Vascular
Participants
Cheng Fang, MBBS, BSc, London, United Kingdom (Presenter) Nothing to Disclose
Mohammad A. Husainy, MD, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Jason Wilkins, MBBS, London, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The aim of this exhibit is to 1) review common types of wires, catheters, balloons and stents 2) to highlight their main characteristics 3) to illustrate when and where to use them in different clinical scenarios.

TABLE OF CONTENTS/OUTLINE
Wires Detail different characteristics including diameter, length, tip shape and stiffness, core construction and coatings Explain selection of wires in different clinical settings including support, exchange, lesion and chronic total occlusion crossing Catheters Illustrate advantages of different catheters based on their characteristic shapes, construction and how this gives handling characteristics such as trackability and pushability Discuss usage in specific clinical circumstances Balloon Present differences between a compliant and a non-compliant balloon and their examples including moulding, scoring/cutting, high pressure, drug eluting, micro-porous balloon Provide examples of their clinical application Stent Describe differences between self expandable, balloon mounted and covered stents Explain why, when and where to use a stent
Strategies for Reducing Thermal Collateral Injuries in Ultrasound-guided Radiofrequency Ablation of Liver Tumors; Emphasis on Artificial Ascites Technique

All Day Location: VI Community, Learning Center

Participants
Jin Woong Kim, MD, Jeollanamdo, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sang Soo Shin, MD, Gwangju, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jun Hyung Hong, Gwang-Ju, Korea, Republic Of (Presenter) Nothing to Disclose
Suk Hee Heo, MD, Hwasun-Gun, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hyo Soon Lim, MD, Jeollanam-Do, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Young Hoe Hur, Jeollanam-Do, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yong-Yeon Jeong, MD, Chonnam, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To overview the current strategies for reducing thermal collateral injuries in US-guided radiofrequency (RF) ablation of liver tumors 2. To provide comprehensive review of artificial ascites technique 3. To discuss the correlation between artificial ascites and development of pleural effusion

TABLE OF CONTENTS/OUTLINE
"It’s Complicated": The Role of Diagnostic and Interventional Radiology for Pediatric Organ Transplant Complications

All Day Location: VI Community, Learning Center

Participants
Whitney Feltus, MD, New York, NY (Presenter) Nothing to Disclose
Sophie Chheang, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Peter Schlossberg, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To list the common complications following pediatric organ transplantation
To compare different imaging modalities in their evaluation
To review interventional procedures used in treating post-operative complications

TABLE OF CONTENTS/OUTLINE
Common complications following liver, kidney, lung, and heart transplantation in pediatric patients: Vascular: thrombosis, stenosis, aneurysm, shunt Fluid collections: abscess, biloma, urinoma, ascites Ductal: biliary and ureteral strictures Parenchymal disease: rejection/failure, disease recurrence, post-transplant lymphoproliferative disorder Diagnostic imaging tools used to monitor and diagnose post-operative complications: US, X-ray, CT, MRI/MRA/MRCP, fluoroscopy Interventional radiology procedures performed on post-operative patients to help diagnose and treat complications: angiography, angioplasty, stent, embolization, drainage, biopsy, central venous access Sample cases Summary: Wide array of complications following pediatric organ transplantation can be variably imaged and often well managed with interventional radiology
Diagnosing and Managing Endoleak Complications after Endovascular Abdominal Aortic Aneurysm Repair: Understanding the Critical Role of Radiology

Participants
Ahmed Fadl, MD, Mineola, NY (Abstract Co-Author) Nothing to Disclose
Daniel C. Phung, BS, Stony Brook, NY (Presenter) Nothing to Disclose
Amanjit S. Baadh, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Man Hon, MD, Forest Hills, NY (Abstract Co-Author) Nothing to Disclose
S. William Stavropoulos, MD, Bryn Mawr, PA (Abstract Co-Author) Research, Cook Group Incorporated; Research, B. Braun Melsungen AG; Consultant, C. R. Bard, Inc
Jason C. Hoffmann, MD, Mineola, NY (Abstract Co-Author) Consultant, Merit Medical Systems, Inc; Speakers Bureau, Merit Medical Systems, Inc
Nicholas A. Georgiou, MD, Westbury, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Cross-sectional imaging plays a critical role in pre- and post-endovascular aortic repair patient management.  
2. Diagnostic and interventional radiologists must understand the endoleak classification system and how this guides management decisions.  
3. Interventional radiology plays a critical role in managing endoleaks, particularly Type II endoleaks.

TABLE OF CONTENTS/OUTLINE
Background-Aneurysm definition-Risk factors-Prevelance-AAA screening guidelines-Description of AAA treatment options-How patients are selected for endovascular aneurysm repair (EVAR) versus open repair-Importance of imaging surveillance after EVAR-Review complications of EVAR, with a focus on the importance of imaging in these diagnoses-Detailed review of endoleak classification system, including verbal description, pictorial/cartoon images, and correlation with cross-sectional imaging-Also correlate with angiographic findings, where appropriate-Highlight the role of interventional radiology in confirming diagnosis and management of various types of endoleaks, with a focus on Type II endoleaks (including literature review)-IR management of endoleaks with:-Transarterial embolization-Translumbar puncture and embolization-Placement of additional stent and/or stent-grafts-"Peri-graft" access in treating complex endoleaks-Discussion and Conclusions
Simulation in CT-Guided Biopsy Resident Training: Review of the Literature and Description of the Use of a Home-made Phantom for Training

All Day Location: VI Community, Learning Center

Participants
Amanjit S. Baadh, MD, New York, NY (Presenter) Nothing to Disclose
Sameer Mittal, MD, Mineola, NY (Abstract Co-Author) Nothing to Disclose
Ahmed Fadi, MD, Mineola, NY (Abstract Co-Author) Nothing to Disclose
Nicholas A. Georgiou, MD, Westbury, NY (Abstract Co-Author) Nothing to Disclose
Jason C. Hoffmann, MD, Mineola, NY (Abstract Co-Author) Consultant, Merit Medical Systems, Inc; Speakers Bureau, Merit Medical Systems, Inc

TEACHING POINTS
1. Simulation training has become an integral component of medical education. 2. Phantoms for simulation are typically very expensive, so the ability to make a simple, reusable, inexpensive phantom that is an effective teaching tool is of great value to radiology education. 3. Hands-on biopsy training allows for increased learner competence and confidence, thus improving patient care and safety.

TABLE OF CONTENTS/OUTLINE
Review the benefits of simulation training for physicians. Describe the current role of simulation training for CT guided procedures, including literature review. Detail the development of a home-made CT-guided biopsy phantom that is reusable, inexpensive, and easy to make. Provide comparison of this home-made phantom to commercially available phantom. Report the initial experience with this home-made phantom for resident training: - Pilot study conducted with small group of residents - After training session, all subjects reported improved understanding of XY and XYZ axis and comfort in performing CT-guided biopsy - Suggest future uses for this phantom, as well as potential improvement or changes to the phantom.
New Frontiers In Ureteral Stenosis Percutaneous Treatment

All Day Location: VI Community, Learning Center

FDA
Discussions may include off-label uses.

Participants
Esteban Peghini, MD, Madrid, Spain (Presenter) Nothing to Disclose
Enrique Rico, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Roberto Villar, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Angel Sanchez, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Guillermo Parga, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Ricardo San Roman, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

To review the different modalities in ureteral stenosis treatment by means of percutaneous approach including ureteral stents and ureteroplasty. To compare the advantages and disadvantages of classic and cutting balloon devices in ureteroplasty. To introduce technique, benefits, difficulties and complications as well as short term results of the use of drug eluting (paclitaxel) balloons in ureteroplasty.

TABLE OF CONTENTS/OUTLINE

Retrospective review of 15 cases (during a 5 year period) of post-surgical ureteral stenosis of various origins managed by percutaneous ureteroplasty. Initial success rate, patency at 1 and 5 years and complications were analyzed and compared with the results of 44 cases from a previous revision our institution made 5 years before. This results were later compared with the ones achieved with drug eluting (paclitaxel) balloon ureteroplasty (currently being performed and having 3 cases so far). This technique, currently in process of being accepted by the scientifical community, can soon become a promising therapy in ureteral stenosis. Finally we made a bibliographic review on technique advantages and disadvantages as well as on success rate and complications of all three modalities of ureteroplasty and of ureteral stent placement.
Participants

Yilun Koethe, MD, San Francisco, CA (Presenter) Nothing to Disclose
Maureen P. Kohi, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Review clinical presentations, risk factors and common etiologies of obstetrical hemorrhages Describe imaging findings and clinical presentations of post-partum hemorrhage Review pelvic vascular anatomy Detail the techniques for uterine artery embolization (UAE) Review indications, short- and long-term outcomes, and post-procedural management following uterine artery embolization

TABLE OF CONTENTS/OUTLINE

Background: Clinical presentation, morbidity and mortality of obstetric hemorrhages Risk factors and common etiologies of obstetric hemorrhages (including: uterine atony, placental implantation abnormality and ectopic pregnancy) Traditional treatments of postpartum hemorrhage Current and tried image-guided techniques for controlling bleeding Uterine artery embolization (UAE) for obstetric hemorrhage: Indications and contraindications to embolization Review pelvic vascular anatomy Pictorial demonstrations of proper steps and techniques Efficacy of UAE for different bleeding etiologies Complications, adverse effects, and post-procedural management Long-term fertility and pregnancy outcomes
The Important Role of Radiology in the Diagnosis and Treatment of Placenta Accreta

All Day Location: VI Community, Learning Center

Participants
Yilun Koethe, MD, San Francisco, CA (Presenter) Nothing to Disclose
Maureen P. Kohi, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Describe imaging findings and clinical presentations of placenta accreta
Discuss the use of US and MRI for diagnosis
Detail the role of radiology in the management of placenta accreta through internal iliac artery balloon occlusion catheter placement and arterial embolization
Review indications, outcomes and post-procedural management

TABLE OF CONTENTS/OUTLINE
What is placenta accreta? The role of US and MR for early diagnosis of placenta accreta
Indications for imaging
Pictorial demonstrations of US and MR Imaging features
Sensitivity and Specificity of imaging features
Overall effectiveness of US and MRI in the diagnosis and detection of placenta accreta
Use of imaging for patient risk stratification
Why is placenta accreta important?
Clinical risk factors and presentation
Morbidity and mortality
Role of Interventional Radiology (IR) for the management of placenta accreta
Conventional management
Role of IR and discussion of image-guided techniques
Pre-op bilateral internal iliac artery balloon occlusion catheter placement
Arterial embolization
Staged intra-op arterial embolization after delivery followed by delayed hysterectomy
Pictorial demonstrations of above techniques
Post-procedural imaging and management of complication and adverse effects
TEACHING POINTS

The purpose of this exhibit is: Review the normal and variant anatomy of the arterial vasculature within the neck. Discuss the various disease entities that can affect the arteries within the neck and diagnostic clues. Atherosclerotic disease is a major contributor to carotid stenosis which can be assessed morphologically on CT and physiologically on ultrasound. Intimal flap or double lumen is pathognomonic for a dissection. Fibromuscular Dysplasia has 3 types, of which type 1 is the most common and demonstrates a 'string of beads' appearance. Iatrogenic injury can result in pseudoaneurysms or fistulas and must be taken into consideration. Explain the utility of ultrasound and CTA/MRA in evaluating the various conditions.

TABLE OF CONTENTS/OUTLINE

Normal Vascular Anatomy of the Neck
Embryogenesis
CTA/MRA appearance
Ultrasound appearance with reference values
Variations of Arterial Vasculature in the neck
Tortuous carotid artery
medialization of the carotid
Persistent hypoglossal artery/ Bovine Arch
Disease entities with sample cases
Atherosclerotic disease
Thrombus
Dissection
Pseudoaneurysm
Fistula
Fibromuscular Dysplasia
Subclavian Steal
Carotid Body Tumor
Summary
Advanced Novel Cone-Beam CT Imaging Techniques in Trans-Radial Interventional Oncology Procedures.

All Day Location: VI Community, Learning Center

Participants
Paul J. O'Connor, MD, New York, NY (Presenter) Nothing to Disclose
Rahul S. Patel, MD, New York, NY (Abstract Co-Author) Consultant, Sirtex Medical Ltd; Research Consultant, Medtronic, Inc; Consultant, Penumbra, Inc; Consultant, Terumo Corporation
Imranjshaw M. van der Bom, Andover, MA (Abstract Co-Author) Employee, Koninklijke Philips NV
Aaron M. Fischman, MD, Harrison, NY (Abstract Co-Author) Consultant, Surefire Medical, Inc Consultant, Terumo Corporation Speakers Bureau, Koninklijke Philips NV
Edward Kim, MD, New York, NY (Abstract Co-Author) Consultant, Koninklijke Philips NV Advisory Board, Onyx Pharmaceuticals, Inc Advisory Board, Nordion, Inc
Scott Nowakowski, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Nora Tabori, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Robert A. Lookstein, MD, New York, NY (Abstract Co-Author) Consultant, Johnson & Johnson; Consultant, Boston Scientific Corporation; Consultant, The Medicines Company

TEACHING POINTS
Discuss the benefits and limitations of advanced Cone-Beam CT (CBCT) imaging techniques in liver interventional oncology (IO) procedures from a transradial (TR) approach. Demonstrate the application and benefits of a newly developed CBCT imaging technique for IO procedures utilizing radial artery access.

TABLE OF CONTENTS/OUTLINE
Review of liver vascular and tumor anatomy. Review of TR access for liver directed IO therapies. Discuss advanced IO imaging techniques, including benefits and limitations of CBCT versus 2D angiography in TR liver directed IO therapies. Demonstration of the newly developed of open trajectory CBCT technique and benefits in procedures utilizing radial artery access. Discuss our institutional experience using open trajectory CBCT versus the standard 'Closed' CBCT in trans-radial artery access cases. Case presentations of open trajectory CBCT in liver IO procedures.
TIPS and TIPS on ICE (Intracardiac Echography Catheter); A Pictorial Review and Guide on TIPS and How to Use The ICE Catheter

All Day Location: VI Community, Learning Center

FDA Discussions may include off-label uses.

Participants
Oren T. Herman, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Amit Daftari, MD, Bronx, NY (Presenter) Nothing to Disclose
Yosef Golowa, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Jacob Cynamon, MD, Suffern, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. General review of the TIPS procedure including: indications, contraindications, conventional TIPS technique
2. Pictorial review of the ICE catheter and how using groin access with the catheter in the IVC can help with portal vein access and lower possible complications (no need for wedge venography and decreased amount of needle passes)
3. Case based review of common indications for TIPS: Portal hypertension (refractory ascites and variceal bleeding), portal vein thrombolysis and Budd Chiari

TABLE OF CONTENTS/OUTLINE
1. General overview of the TIPS procedure including a pictorial review of the standard technique
2. Overview of the ICE catheter including liver anatomy and how it helps guide stent creation and placement. Hepatic vein anatomy is not as intuitive on fluoroscopic imaging. Included in this presentation will be how ICE can help guide the operator in selecting the correct hepatic vein and portal vein
3. Case based review of common indications for TIPS creation including portal hypertension, portal vein thrombolysis and Budd Chiari
Participants
Jason C. Ni, MS, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Jonathan K. Park, MD, Los Angeles, CA (Presenter) Nothing to Disclose
Alice S. Chen, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Matthew K. Walsworth, MD, MS, Santa Monica, CA (Abstract Co-Author) Nothing to Disclose
Hsin-Yi Lee, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. The conventional method for performing lower extremity arterial intervention is the contralateral retrograde (up-and-over) technique. However, the failure rate in recanalizing chronic total occlusions (CTOs) approximates 20% from this approach. In these cases (and even for primary intervention), ultrasound-guided retrograde popliteal arterial access can be performed to facilitate endovascular recanalization. The aims of this exhibit are thus as follows. 2. To review the indications and rationale for performing retrograde popliteal artery access to perform femoral arterial CTO recanalization. 3. To guide the reader through the pre-procedural diagnostic imaging, interventional methods, benefits, and potential complications of popliteal artery access. 4. Case examples will be presented to highlight the technique.

TABLE OF CONTENTS/OUTLINE
Participants
Ahmed K. Abdel Aal, MD, PhD, Birmingham, AL (Presenter) Consultant, St. Jude Medical, Inc Consultant, Baxter International Inc Consultant, C. R. Bard, Inc
Amr S. Moustafa, MBBC, MSc, Birmingham, AL (Abstract Co-Author) Nothing to Disclose
Rachel F. Oser, MD, Birmingham, AL (Abstract Co-Author) Nothing to Disclose
Nathan W. Ertel, MD, Hoover, AL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Teaching points: 1- Review the causes and clinical presentation of uterine arteriovenous malformations. 2- Describe the imaging findings seen on ultrasound (gray-scale and color Doppler), catheter angiography, as well as MRI. 3- Demonstrate the endovascular management of uterine arteriovenous malformation. 4- Highlight the potential complications and outcomes of endovascular management.

TABLE OF CONTENTS/OUTLINE
Outline: 1- Introduction and incidence. 2- Causes and presentation of uterine arteriovenous malformations. 3- Radiologic appearance of uterine arteriovenous malformations on different imaging modalities. 4- Endovascular management of uterine arteriovenous malformations. 5- Potential complications. 6- Summary and conclusion.
Peritoneal Dialysis Catheter Placement Technique Using Fluoroscopy and Ultrasound Guidance

All Day Location: VI Community, Learning Center

Participants
Ahmed K. Abdel Aal, MD, PhD, Birmingham, AL (Presenter) Consultant, St. Jude Medical, Inc Consultant, Baxter International Inc Consultant, C. R. Bard, Inc
Amr S. Moustafa, MBBCch, MSc, Birmingham, AL (Abstract Co-Author) Nothing to Disclose
Nathan W. Ertel, MD, Hoover, AL (Abstract Co-Author) Nothing to Disclose
Rachel F. Oser, MD, Birmingham, AL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Teaching points: 1- Discuss the indications and contraindications of peritoneal dialysis (PD) catheter placement in the new era of urgent-start PD. 2- Review the pre-procedure patient preparation. 3- Demonstrate a minimally invasive technique for placement of PD catheters. 4- Highlight the importance of the use of ultrasound (including gray-scale and color/power Doppler ultrasound) as well as fluoroscopy to guide safe placement of PD catheter and minimize complications. 5- Describe the essential methods of catheter care after placement. 6- Highlight the complications, as well as, how to avoid and how to manage them.

TABLE OF CONTENTS/OUTLINE

Outline: 1- Introduction. 2- Indications and contraindications. 3- Pre-procedure patient preparation. 4- Fluoroscopy and ultrasound guidance technique for placement of PD catheters. 5- Post procedure catheter care. 6- Potential complications. 7- Summary and conclusion.
The New Age of DAVF (Dural ArterioVenous Fistula)

All Day Location: VI Community, Learning Center

Participants

Diego Preciado, MD, Sabadell, Spain (Presenter) Nothing to Disclose
Joan Perendreu, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Jordi Branera, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Beatriz Consola, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Viviana P. Beltran Salazar, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
David Canovas, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

To give an overview of the etiopathology and clinical findings that suggest DAVF (Dural ArterioVenous Fistula). To illustrate the imaging findings, specially on angiography. To emphasize the differential diagnosis. To familiarize with general approaches for the treatment of DAVFs, indications and new technical developments in the field.
Participants
Diego Preciado, MD, Sabadell, Spain (Presenter) Nothing to Disclose
Jose Ramon Fortuno Andres, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Joan Falco, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Eva Criado, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Josep Guitart, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Joan Perendreu, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Jordi Branera, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Beatriz Consola, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Viviana P. Beltran Salazar, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Based on our experience, the purpose of the pictorial review is the following: To familiarize radiology residents with the accepted indications and contraindications of colonic stenting. To give the residents an overview of the stenting procedure and its technical tricks and tips, and to provide an overview of all radioprotection concerns. To illustrate the post-procedure management, possible complications, and ways to deal with them. To emphasize uncommon indications and new technical developments in the field.

TABLE OF CONTENTS/OUTLINE

In this exhibit, we illustrate the following points in a case-based style: Indications and contraindications. Pre-procedure management. Technical tricks and tips. Radioprotection concerns. Post-procedure management. Complications and how to deal with them. New developments in the technique.
Clinical Utility of Non-Contrast-Enhanced Magnetic Resonance Angiography at 1.5T

All Day Location: VI Community, Learning Center

Participants
Takafumi Naka, Kawasaki-Shi, Japan (Presenter) Nothing to Disclose

TEACHING POINTS
- To introduce the role of non-contrast-enhanced(NCE)-MRA.
- To explain the basic principles of each NCE-MRA methods.
- To explain the features and how to choose optimal methods. 1) Comparing NCE-MRA and contrast-enhanced-MRA 2) The principle of NCE-MRA methods 2-1 Time-of-Flight 2-2 Phase Contrast 2-3 Fast Spin Echo 2-4 Balanced Steady-State Free Precession

TABLE OF CONTENTS/OUTLINE
Since the FDA issued warnings linking gadolinium-based contrast agents used in MRI and nephrogenic systemic fibrosis(NSF), CE-MRA is no longer considered safe for patients with impaired renal function. TOF is based on the phenomenon of flow-related enhancement of spins entering into an imaging slice. As a result of being unsaturated, these spins give more signal that surrounding stationary spins. However, slow flow or flow from a vessel parallel to the scan-plane, may become de-saturated just like stationary tissue. TOF is most commonly used in the head. In the PC pulse sequence, bipolar gradients are used to encode the velocity of the spins. Stationary spins undergo no net change in phase after the two gradients are applied. Moving spins will experience a different magnitude of the second gradient compared to the first. This results in a net phase shift. PC is most commonly used in the body.
Type V Endoleak after Endovascular Aortic Abdominal Aneurysm Repair: What Radiologists Need to Know

All Day Location: VI Community, Learning Center

Participants
Eijun Sueyoshi, MD, Nagasaki, Japan (Presenter) Nothing to Disclose
Hiroki Nagayama, Shimabara, Japan (Abstract Co-Author) Nothing to Disclose
Ichiro Sakamoto, Nagasaki, Japan (Abstract Co-Author) Nothing to Disclose
Masataka Uetani, MD, Nagasaki, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To know the definition and various imaging findings of type V endoleak after endovascular aortic abdominal aneurysm repair 2. To know the clinical significances of imaging of type V endoleak. 3. To know the therapeutic strategy based on imaging findings of type V endoleak.

TABLE OF CONTENTS/OUTLINE
1. Explanation of imaging findings and clinical significances of type V endoleak after endovascular aortic abdominal aneurysm repair 2. Illustrative cases- Presentation of various imaging findings of type V endoleak.- Presentation of imaging findings after management type V endoleaks 3. Discussion 4. Directions and summary The major teaching points of this exhibit are: 1. Various imaging findings of type V endoleaks can be seen after endovascular aortic aneurysm repair 2. The serial changes of type V endoleaks can be seen after endovascular aortic aneurysm repair 3. The therapeutic strategies are different based on imaging findings of of type V endoleak.
Participants
Thanila A. Macedo, MD, Rochester, MN (Presenter) Nothing to Disclose
Terri J. Vrtiska, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Gustavo S. Oderich, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) Learn the latest indications and advanced techniques for fenestrated and branched endovascular aortic repair (EVAR)
2) Understand the optimum imaging follow-up using Computed Tomography Angiography (CTA)
3) Review critical common and uncommon CTA findings including key dictation terminology for clear communication to Vascular Surgeons and Interventionalists.

TABLE OF CONTENTS/OUTLINE
BACKGROUND: Describe fenestrated and branched EVAR including the indications, techniques and key differences between approaches. Movie animations of each technique will demonstrate step-by-step approaches for device implantation.

IMAGING FINDINGS: CTA is the recommended imaging for complex EVAR surveillance to detect correctable complications and avoid morbidity and mortality. CTA protocols as well as common and uncommon CTA findings will be reviewed. These include: endoleaks (including classification and variant examples), device malposition, occlusions, dissections and aneurysmal enlargement/rupture. Examples of confirmatory conventional angiograms and treatment will be included.

CONCLUSION: Advances in EVAR continue to evolve and radiologists must be familiar with the CTA findings associated with the latest surgical management. Early detection of correctable EVAR complications and accurate communication of CTA findings is critical for optimal patient care.
Transarterial Embolization of Renal Angiomyolipomas: Clinical Considerations, Technical Details, Outcome, and Post-Therapy Management

All Day Location: VI Community, Learning Center

Participants
Ali Gholamrezanazhad, MD, Cleveland, OH (Presenter) Nothing to Disclose
Jon Davidson, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Timothy R. Whitehead, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Eric D. McLoney, MD, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose
Indravadan J. Patel, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) To explain basic principles of transarterial embolization treatment for renal angiomyolipomas (AMLs)
2) To review multiple clinical applications and indications of embolization of AMLs
3) To discuss details of the embolization procedures with pictorial correlates
4) To explain outcome of the treatment, potential complications, and post-therapy management

TABLE OF CONTENTS/OUTLINE
1) Epidemiology
2) Clinical presentation
3) Clinical significance
4) Associated syndromes; lymphangioleiomyomatosis and tuberous sclerosis
5) Imaging features and diagnostic approach
   Ultrasound
   CT
   MRI
   Radiologic classification, including triphasic, classic, and fat poor subtypes
6) Surgical versus non-surgical therapeutic options
7) Patient selection for embolization therapy
8) Clinical advantages and applications of transarterial embolization
9) Contra-indications for transarterial embolization therapy
10) Rate and predictors of response to treatment
11) Step by step procedure of embolization
    - Patient preparation
    - Devices and equipments, including embolization agents
    - Transarterial catheterization and embolization technique details
12) Complications, including post-embolization syndrome, abscess, bleeding, and their optimal management
13) Post-therapy management and follow-up
14) Limitations
15) Controversies/developments
16) Conclusions
Endovascular Management of Bleeding Rectal Varices

All Day Location: VI Community, Learning Center

Participants
Ahmed K. Abdel Aal, MD, PhD, Birmingham, AL (Presenter) Consultant, St. Jude Medical, Inc Consultant, Baxter International Inc Consultant, C. R. Bard, Inc
Amr S. Moustafa, MBCh, MSc, Birmingham, AL (Abstract Co-Author) Nothing to Disclose
Nabila Dawoud, MBCh, Birmingham, AL (Abstract Co-Author) Nothing to Disclose
Maysoon F. Hamed, MD, MSc, Hoover, AL (Abstract Co-Author) Nothing to Disclose
Osama Aglan, Birmingham, AL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Teaching points: 1- Review the main causes of development of ectopic varices including rectal varices. 2- Describe imaging findings seen on different imaging modalities. 3- Highlight role of transjugular intrahepatic portosystemic shunt (TIPS). 4- Describe the role of percutaneous transhepatic sclerotherapy techniques when TIPS fails or is contraindicated.

TABLE OF CONTENTS/OUTLINE
Outline: 1- Introduction and brief anatomy of portal circulation and rectal varices. 2- Causes of rectal variceal bleeding. 3- Imaging of bleeding rectal varices. 4- Management strategies of bleeding rectal varices. 5- Percutaneous transhepatic embolotherapy of bleeding rectal varices. 6- Summary and conclusion.
**Participants**
Amr S. Moustafa, MBBCh, MSc, Birmingham, AL (Abstract Co-Author) Nothing to Disclose
Ahmed K. Abdel Aal, MD, PhD, Birmingham, AL (Presenter) Consultant, St. Jude Medical, Inc Consultant, Baxter International Inc Consultant, C. R. Bard, Inc
Souheil Saddekni, MD, Birmingham, AL (Abstract Co-Author) Consultant, St. Jude Medical, Inc
Sima Banerjee, MBBS, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**
Teaching points: 1- Review different factors that influence the development of parasitic blood supply to hepatocellular carcinoma (HCC). 2- Illustrate how to predict parasitic blood supply to HCC and which extrahepatic artery is involved. 3- Demonstrate the techniques for proper transarterial chemoembolization of the parasitic arterial supply to HCC in each individual situation to avoid complications. 4- Outline the potential complications.

**TABLE OF CONTENTS/OUTLINE**
Outline: 1- Introduction. 2- Risk factors for HCC parasitic blood supply. 3- Main parasitic feeders to HCC and their incidence. 4- Red alerts for HCC parasitic blood supply. 5- How to interpret parasitic blood supply to HCC by CT and catheter angiography. 6- Techniques for proper transarterial chemoembolization in individual situations. 7- Potential complications. 8- Summary and conclusion.
Endovascular Repair for Blunt Traumatic Aortic Injury

TEACHING POINTS

Blunt traumatic aortic injury (BTAI) is associated with a high mortality rate. Although BTAI was traditionally treated by open repair, thoracic endovascular aortic repair (TEVAR) has bring favorable early outcomes and offered several advantages in the treatment of severe concomitant injuries. At present TEVAR is useful for the treatment of BTAI patients, but some problems still remain. The purpose of this exhibit will review 1) the transition of treatments for BTAI, 2) the problems of TEVAR for BTAI, 3) the treatment algorithm to manage patients with BTAI.

TABLE OF CONTENTS/OUTLINE

A. Background: Overview about etiology and clinical features of BTAI.B. Transition of treatments for TEVAR: Current literature review of outcomes and complications associated with each treatment for BTAI (TEVAR, open repair, nonoperative management).C. Problems: Review the problems of TEVAR for BTAI and classify into resolved and unresolved.D. Treatment algorithm and strategy: Describe the treatment algorithm to manage patients with BTAI and strategy of TEVAR for BTAI.E. Case presentation: Discuss cases in our hospital (n=17 at time of abstract submission), including technical success rate, complications (post-operative, procedure-related, device deformity), short to medium term outcomes.
Multimodality Approach to AV Fistulas and Grafts: Interpretation and Pitfalls

All Day Location: VI Community, Learning Center

Participants
Alexander Kessler, MD, Rochester, NY (Presenter) Nothing to Disclose
Deborah J. Rubens, MD, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Shweta Bhatt, MD, MBBS, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Talia Sasson, MD, Rochester, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to: Review the normal sonographic and angiographic appearance of the various types of AV fistulas and grafts, including HERO grafts. Discuss the major clinical indications for imaging evaluation of AV fistulas and grafts. Review the imaging criteria to assess AV fistula maturation, stenosis, and steal. Review various complications associated with AV fistulas and grafts, including pseudoaneurysm, collateralization, infection, and declotting complications.

TABLE OF CONTENTS/OUTLINE
Types of AV fistulas (Ultrasound and Angiography examples) Types of AV Grafts (Ultrasound and Angiography examples) Clinical indications for imaging evaluation of AV fistulas/grafs Normal sonographic appearance of AV fistulas/grafs (Grayscale, Peak Systolic Velocities, Spectral Waveforms, Flow rates) Ultrasound evaluation for AV fistula maturation Complications associated with AV fistulas and grafts, including keys to interpretation and pitfalls (Failure to mature, Occlusion, Stenosis, Elevated velocities without stenosis, Pseudoaneurysm, Steal, Collateralization, Infection, Rupture) Summary
Transarterial Embolization: Interventional Radiologists Role in Cancer

All Day Location: VI Community, Learning Center

FDA

Discussions may include off-label uses.

Participants
Elena Inchausti, MBBS, Donostia, Spain (Presenter) Nothing to Disclose
Inaki Prieto JR, San Sebastian, Spain (Abstract Co-Author) Nothing to Disclose
Francisco Loyola, San Sebastian, Spain (Abstract Co-Author) Nothing to Disclose
Santiago Merino, MD, San Sebastian, Spain (Abstract Co-Author) Nothing to Disclose
Idoia Echegoyen, San Sebastian, Spain (Abstract Co-Author) Nothing to Disclose
Enaut Garmendia, Donostia, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

To understand the indications and the aim of transarterial embolization of tumors, as a presurgical therapy (preoperative embolization), as well as a palliative measure to treat or prevent tumor-associated symptoms and slow down its growth (palliative embolization).

TABLE OF CONTENTS/OUTLINE

VI126-ED-X

Novel Use of Ethylene-Vinyl-Alcohol Copolymer in Type I Endoleak Repair

All Day Location: VI Community, Learning Center

FDA Discussions may include off-label uses.

Participants
Assaf Graif, MD, Newark, DE (Presenter) Nothing to Disclose
Ansar Z. Vance, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Kevin Lie, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Demetrios J. Agriantonis, MD, El Paso, TX (Abstract Co-Author) Nothing to Disclose
Mark J. Garcia, MD, Chadds Ford, PA (Abstract Co-Author) Nothing to Disclose
Daniel A. Leung, MD, Newark, DE (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To review the pathophysiology, prognosis and treatment strategies of endoleaks after endovascular abdominal aortic aneurysm repair, while focusing on type I endoleaks. Discuss the benefits of Ethylene-Vinyl-Alcohol Copolymer, or Onyx (EV3 Inc., Plymouth, MN) as a liquid embolic agent. Pictorial description of type I endoleak repair using Onyx.

TABLE OF CONTENTS/OUTLINE
1. Short review of the 5 types of endoleaks.
2. Focused review of the pathophysiology, prevalence, complications and prognosis of type I endoleaks.
4. Short overview of “traditional” repair techniques of type I endoleaks.
   4a. Endograft extension
   4b. Ballooning
   4c. Stenting
   4d. Endostaples
   4e. Embolization
5. Short description of Onyx and its properties.
6. Pictorial overview of the technique of employing Onyx to repair type I endoleaks.
   6a. Approach to the aneurysm sac:
      i. Endovascular (proximal or distal)
      ii. Direct percutaneous transabdominal approach
6b. Advantages, disadvantages, and principles of deployment of coils as an adjunct to Onyx.
7. Comparison of the different repair techniques, in regards to:
   7a. Indications
   7b. Benefits
   7c. Limitations
   7d. Complications
Diagnóstico Precoz por Imagen en la Población el CIR: Sesión del Colegio Interamericano de Radiología (CIR) en Español/Population based Preventive Imaging from CIR: Session of the Interamerican College of Radiology (CIR) in Spanish

Saturday, Nov. 28 1:00PM - 5:00PM Location: E451A

AMA PRA Category 1 Credits ™: 3.75
ARRT Category A+ Credits: 4.00

Participants
Pablo R. Ros, MD, PhD, Cleveland, OH (Moderator) Medical Advisory Board, Koninklijke Philips NV; Medical Advisory Board, KLAS Enterprises LLC; Medical Advisory Committee, Oakstone Publishing; Departmental Research Grant, Siemens AG; Departmental Research Grant, Koninklijke Philips NV; Departmental Research Grant, Sectra AB; Departmental Research Grant, Toshiba Corporation
Miguel E. Stoopen, MD, Mexico City, Mexico (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
1) To review the state-of-the-art of population based preventive imaging
2) To discuss preventive imaging approaches in all major organ systems and key pathologies, ranging from dementia, cardiovascular disease, colon, liver, lung and breast cancer
3) To illustrate the use of different imaging technologies in preventive imaging such as CT, MRI and ultrasound

Sub-Events
SPSP01A Introducción/Introduction

Participants
Dante R. Casale Menier, MD, Ciudad Juarez, Mexico (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSP01B Parte 1/Part 1

Participants

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSP01C Presentación de Ponentes/Panel Introduction

Participants
Pablo R. Ros, MD, PhD, Cleveland, OH (Presenter) Medical Advisory Board, Koninklijke Philips NV; Medical Advisory Board, KLAS Enterprises LLC; Medical Advisory Committee, Oakstone Publishing; Departmental Research Grant, Siemens AG; Departmental Research Grant, Koninklijke Philips NV; Departmental Research Grant, Sectra AB; Departmental Research Grant, Toshiba Corporation

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSP01D Colon: La Colonografía Virtual: ¿Un Método de Escrutinio en la Poblacion?/Colon: Virtual Colonography: A Population Screening Tool?

Participants
Jorge A. Soto, MD, Boston, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator

SPSP01E Cardiovascular: Cribaje de Enfermedad Cardiovascular por Imagen Medica/Cardiovascular: Diagnostic Imaging in Cardiovascular Screening

Participants
LEARNING OBJECTIVES
View learning objectives under main course title.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Carlos S. Restrepo, MD - 2012 Honored Educator
Carlos S. Restrepo, MD - 2014 Honored Educator

LEARNING OBJECTIVES
Objetivos: 1) Comprender conceptos clínicos básicos para el diagnóstico de los síndromes principales de demencia. 2) Reconocer características anatómicas y metabólicas fundamentales de neuroimagen en los síndromes principales de demencia, con especial atención a enfermedad de Alzheimer. 3) Explorar direcciones futuras y desafíos para el diagnóstico temprano. Learning objectives: 1) Understand basic clinical concepts for the diagnosis of major dementia syndromes. 2) Recognize fundamental anatomic and metabolic neuroimaging features of major dementia syndromes, with special focus on Alzheimer's disease. 3) Explore future directions and challenges for early diagnosis.

LEARNING OBJECTIVES

View learning objectives under main course title.

Participants
Carlos Zamora, MD, PhD, Chapel Hill, NC (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

Participants
Miguel E. Stoopen, MD, Mexico City, Mexico (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

Participants
Linei A. Urban, Curitiba, Brazil (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

Participants
Claudio S. Silva Fuente-Alba, MD, MSc, Santiago, Chile, (csilvafa@alemana.cl) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

Participants
Carmen Ayuso, MD, PhD, Barcelona, Spain, (cayuso@clinic.ub.es) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Definir la población en riesgo de desarrollar un carcinoma hepatocelular que debe ser incluida en un programa de cribado. 2) Analizar la mejor estrategia para llevar a cabo el cribado del hepatocarcinoma en la población en riesgo de padecerlo. 3) Discutir la conducta a seguir una vez que se detecta un nódulo hepático en pacientes incluidos en un programa de cribado. 1) To define the population at risk of hepatocellular carcinoma to be included in a surveillance program. 2) To analyze the best strategy for...
SPSP01L Comentarios Finales y Clausura/Closing Remarks

Participants
Dante R. Casale Menier, MD, Ciudad Juarez, Mexico (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.
Vascular Interventional Sunday Poster Discussions

Sunday, Nov. 29 12:30PM - 1:00PM Location: VI Community, Learning Center

VA IR

AMA PRA Category 1 Credit ™: .50

Participants
Hyeon Yu, MD, Chapel Hill, NC (Moderator) Nothing to Disclose

Sub-Events

VI213-SD-SUA1 Use of Indwelling Pulmonary artery Catheter to Significantly Reduce Iodinated Contrast Volume in Elderly Patients with Chronic Renal Dysfunction Undergoing Pre-operative Assessment for Transcatheter Aortic Valve Implantation (TAVI)

Station #1

Participants
Ferdia Bolster, FFR(RCSI), Baltimore, MD (Presenter) Nothing to Disclose
Anuj Gupta, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Jean Jeudy JR, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Seth J. Kligerman, MD, Denver, CO (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess the quality of contrast enhancement in patients undergoing low contrast volume CTA via an indwelling pulmonary artery catheter (PAC) compared to standard volume CTA administered via peripheral IV as part of pre-TAVI workup

METHOD AND MATERIALS
IRB/HIPAA compliant. 7 patients with chronic renal dysfunction underwent low-contrast volume CTA via PAC, which was placed by a cardiologist during cardiac cath as part of pre-TAVI work up. Immediately following, patients were transferred to radiology for CTA. Patients received between 30-40mL of Omnipaque 350 (GE Healthcare) mixed with saline (50/50 mix) based on BMI. 7 control (CL) patients with pre-TAVI CTA using standard contrast volume (110-120mL) administered via peripheral IV were selected for comparison. All patients underwent 256-slice CTA (Brilliance- iCT, Philips) with retrospective gating. PAC group were scanned at 100 kVp (BMI >30) or 80kVp (BMI <30). CL group had gated-helical CTA of thorax at 100kVp and helical CTA of abdomen at 120 kVp. Intra-vessel CT attenuation (HU) and noise were measured using a model-based iterative reconstruction algorithm (IMR, Philips) at the level of the aortic annulus (AA) and right external iliac artery (EIC) for both groups. Subjective vascular enhancement was assessed with a 4-point Likert scale by 2 board-certified radiologists. Unpaired t-tests and Mann-Whitney U tests were used for parametric and nonparametric data, respectively. Statistical significance was set at p<0.05.

RESULTS
Average age of study and CL groups was 84 yrs (range 73-89) and 72.6 yrs (range, 58-81), respectively (p=0.03). Significantly less contrast was used in the PAC group (33.9mls ±4.8) vs. CL group (117.1 ±11.9) (p=0.001). There was no significant difference in HU at the level of AA for PAC (389.9±129) vs CL (292.16±103.7; p=0.1442) and EIC for PAC (374.2±121.2) vs. CL (269.9±69.7; p=0.0718). There was no difference in noise at AA (p=0.203) or EIC (p=0.265) between groups. All scans were graded as diagnostic. Median subjective score for both groups was 4 (ideal) (p=0.897).

CONCLUSION
Low contrast CTA via PAC can significantly decrease the amount of contrast required in pre-TAVI CTA while providing excellent vascular enhancement

CLINICAL RELEVANCE/APPLICATION
Patients referred for TAVI often have multiple co-morbidities including renal insufficiency. Contrast injection via PAC can result in significant decrease in contrast volume with overall ideal vascular enhancement.

VI214-SD-SUA2 Lower Extremity CT Angiography Using 70 kVp with Optimized Low Injection Rate of Low-iodine-concentrated Contrast Medium Protocol: A Feasibility Study

Station #2

Participants
Ying Zhan, Tianjin, China (Presenter) Nothing to Disclose
Xinwei Lei, MD, Tianjin, China (Abstract Co-Author) Nothing to Disclose
Jin Qu, MS, Tianjin, China (Abstract Co-Author) Nothing to Disclose
Hui X. Li, Tianjin, China (Abstract Co-Author) Nothing to Disclose
Jinneng Liu, Beijing, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess image quality, radiation dose and total contrast medium(CM) dose of an optimized lower extremity CT angiography (CTA) protocol using 70 kVp with low contrast medium dose

METHOD AND MATERIALS
60 patients were included in this prospective study and randomly divided into two groups for lower extremity CTA examinations. 30 patients were evaluated with a standard protocol: 120 kVp, high-iodine-concentrated CM (370mgI/mL) with a normal injection rate of 3.5 mg/mL, while the other 30 underwent CTA with an optimized protocol: 70 kVp, low-iodine-concentrated CM (350 mgI/mL)
with a low injection rate of 2.5 mg/mL. The signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) abdominal aorta, common iliac artery, femoral artery, popliteal artery, peroneal artery, and artery dorsalis pedis of both sides were calculated. Two radiologists subjectively assessed the image quality. And radiation dose in CTDIvol and DLP was recorded and compared between the two groups.

**RESULTS**

No significant difference of SNR or CNR was achieved in all measured sites for both protocols (p value for SNR and CNR comparison: 0.256 and 0.331 for abdominal aorta; for 0.777 and 0.947 for common iliac artery; 0.613 and 0.800 for femoral artery; 0.927 and 0.959 for popliteal artery, 0.194 and 0.269 for peroneal artery, and 0.783 and 0.763 for artery dorsalis pedis). And there is no significant difference of the subjective score between the two protocols. Radiation dose in optimized protocol was significantly lower than standard protocol (DLP: 192.67±38.71 vs 473.38±123.18; CTDIvol: 1.49±0.27 vs 3.44±0.76). The total CM volume was 28.6% lower while the iodine dose was 32.4% lower in the optimized protocol.

**CONCLUSION**

An optimized protocol using 70 kVp may provide a diagnostic performance, comparable with the standard protocol, decreasing radiation dose, CM injection rate, total CM volume, and iodine dose.

**CLINICAL RELEVANCE/APPLICATION**

An optimized protocol using 70kVp can dramatically decrease radiation and contrast agent doses with adequate imaging quality.

**VI215-SD-SUA3 Application of Optimal Monochromatic Images in Spectra Lcoronary CT Angiography for Radiation Dose and Contrast Dose Reduction**

**Station #3**

**Participants**

Xiaoxia Chen, MMed, Xianyang City, China (Presenter) Nothing to Disclose

Taiping He, Xianyang, China (Abstract Co-Author) Nothing to Disclose

Yang Chuanbo, MMed, Xianyang City, China (Abstract Co-Author) Nothing to Disclose

Zhanli Ren, Xianyang, China (Abstract Co-Author) Nothing to Disclose

Tian Qian, MMed, Xianyang City, China (Abstract Co-Author) Nothing to Disclose

Qi Yang, Xianyang, China (Abstract Co-Author) Nothing to Disclose

Chuangbo, MMed, Xianyang City, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To explore the feasibility of using optimal monochromatic images in spectral coronary CT angiography (CCTA) to reduce radiation dose and contrast dose.

**METHOD AND MATERIALS**

44 patients with suspected coronary disease were randomly divided into two groups for prospective ECG-triggered CCTA scans: group A (n=22) using conventional CT protocol with 550mA, 100kVp for BMI<23kg/m2; 120kVp for BMI>23kg/m2, and Iohexol350 (350mgI/ml); group B (n=22) using low dose spectral imaging mode (with 375mA) and Iohexol300 (300mgI/ml). Total contrast dosage and flow rate was 0.8m/kg and 5ml/s, respectively in both groups. The 40%ASiR was applied for group A and 50%ASiR for group B. CT numbers in Aortic sinus (AS), left main artery (LMA), left anterior descending (LAD), left circumflex (LCX), right coronary artery (RCA) and pericardial fat and standard deviation (SD) in AS and fat were measured. CNR for AS was calculated: CNR=[CT(AS)-CT(fat)]/SD(fat). CNR as function of energy in group B was generated and the optimal energy level for achieving the highest CNR was determined. CT number, SD and CNR values at the optimal energy in group B were compared with those in group A using independent sample t-test. Two experienced Radiologists also independently reviewed VR and MPR images. Radiation dose and contrast dose were recorded and compared.

**RESULTS**

There was no difference between the demographic data of the two groups. The optimal energy in spectral CT group (B) was 65.81±3.13keV. At the optimal energy, the subjective image quality score was 4.49±0.65, statistically the same as the 4.28±0.68 for group A (Z = -1.40, P=0.16 and Kappa=0.911). CT numbers in AS, LMA, LAD, LCX, RCA, as well as CNR for AS between the 2 groups were not statistically different (P>0.05). The effective radiation dose in spectral CT group (B) was 1.94±0.25mSv, a 30% reduction compared with that in group A (2.78±0.52mSv) (p<0.05). The total iodine load in group B (15.14±1.43g) also decreased by 17% compared with group A (18.18±1.68g).

**CONCLUSION**

Spectral CT images at 66keV provide the optimal image quality and allow for both radiation and contrast dose reduction compared to standard imaging protocols in CCTA.

**CLINICAL RELEVANCE/APPLICATION**

Spectral CT images at 66keV may be used in low dose CCTA with reduced contrast dose for renal function impaired patients.

**VI248-SD-SUA4 Characteristic Imaging Findings of Small Cystic Renal Tumors after Radiofrequency Ablation: Initial Experiences**

**Station #4**

**Participants**

Masatako Kashima, MD, Tsu, Japan (Presenter) Nothing to Disclose

Koichiro Yamakado, MD, PhD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose

Atsuo Nakatsuka, MD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose

Haruyuki Takaki, MD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose

Takashi Yamanaka, MD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose

Masashi Fujimori, MD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose

Junji Uraki, MD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To explore the feasibility of using optimal monochromatic images in spectral coronary CT angiography (CCTA) to reduce radiation dose and contrast dose.

**METHOD AND MATERIALS**

44 patients with suspected coronary disease were randomly divided into two groups for prospective ECG-triggered CCTA scans: group A (n=22) using conventional CT protocol with 550mA, 100kVp for BMI<23kg/m2; 120kVp for BMI>23kg/m2, and Iohexol350 (350mgI/ml); group B (n=22) using low dose spectral imaging mode (with 375mA) and Iohexol300 (300mgI/ml). Total contrast dosage and flow rate was 0.8m/kg and 5ml/s, respectively in both groups. The 40%ASiR was applied for group A and 50%ASiR for group B. CT numbers in Aortic sinus (AS), left main artery (LMA), left anterior descending (LAD), left circumflex (LCX), right coronary artery (RCA) and pericardial fat and standard deviation (SD) in AS and fat were measured. CNR for AS was calculated: CNR=[CT(AS)-CT(fat)]/SD(fat). CNR as function of energy in group B was generated and the optimal energy level for achieving the highest CNR was determined. CT number, SD and CNR values at the optimal energy in group B were compared with those in group A using independent sample t-test. Two experienced Radiologists also independently reviewed VR and MPR images. Radiation dose and contrast dose were recorded and compared.

**RESULTS**

There was no difference between the demographic data of the two groups. The optimal energy in spectral CT group (B) was 65.81±3.13keV. At the optimal energy, the subjective image quality score was 4.49±0.65, statistically the same as the 4.28±0.68 for group A (Z = -1.40, P=0.16 and Kappa=0.911). CT numbers in AS, LMA, LAD, LCX, RCA, as well as CNR for AS between the 2 groups were not statistically different (P>0.05). The effective radiation dose in spectral CT group (B) was 1.94±0.25mSv, a 30% reduction compared with that in group A (2.78±0.52mSv) (p<0.05). The total iodine load in group B (15.14±1.43g) also decreased by 17% compared with group A (18.18±1.68g).

**CONCLUSION**

Spectral CT images at 66keV provide the optimal image quality and allow for both radiation and contrast dose reduction compared to standard imaging protocols in CCTA.

**CLINICAL RELEVANCE/APPLICATION**

Spectral CT images at 66keV may be used in low dose CCTA with reduced contrast dose for renal function impaired patients.
Michael H. Hamblin, MD, Evanston, IL (Abstract Co-Author) Nothing to Disclose

Ken Nakajima, Tsu, Japan (Abstract Co-Author) Nothing to Disclose

Takaaki Hasegawa, Tsu, Japan (Abstract Co-Author) Nothing to Disclose

Naritaka Matsushita, MD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose

Shinich Ito, MD, Ichinomiya, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The definitive treatment, as with any vascular compression syndrome, is surgical release of the entrapping structure(s).

Popliteal Artery Entrapment Syndrome (PAES) is a rare cause of peripheral vascular compromise, predominantly occurring in young, healthy males. It results from anomalous relations between the musculotendinous structures of the popliteal fossa and the popliteal artery, of which six different types are identified. CTA and MR have been shown to be accurate in characterizing and classifying these different types of PAES. Thrombolysis is only a temporizing measure for treatment of popliteal artery entrapment syndrome. The definitive treatment, as with any vascular compression syndrome, is surgical release of the entrapping structure(s).
TABLE OF CONTENTS/OUTLINE

- Introduction
- Case report of a patient with bilateral popliteal artery entrapment syndrome
- Popliteal artery entrapment syndrome (PAES): definition, epidemiology, clinical presentation, classifications of PAES, imaging diagnosis and characterization of PAES
- Therapeutic options for PAES: medical, endovascular, surgical
VI216-SD-SUB1 An Experimental Study of TR-fluid as a New Embolic Material

Participants

Shobu Watanabe, MD, Otsu, Japan (Presenter) Nothing to Disclose
Norihisa Nitta, MD, Kyoto, Japan (Abstract Co-Author) Nothing to Disclose
Shinichi Ota, MD, Otsu, Japan (Abstract Co-Author) Nothing to Disclose
Yuki Tomozawa, MD, Otsu, Japan (Abstract Co-Author) Nothing to Disclose
Akihisa Sonoda, MD, PhD, Otsu, Japan (Abstract Co-Author) Nothing to Disclose
Kiyoshi Murata, MD, Otsu, Japan (Abstract Co-Author) Nothing to Disclose
Shigeru Yao, Fukuoka, Japan (Abstract Co-Author) Colleague, the creator of the TR fluid, a provider.

PURPOSE

Thermal Rheological (TR)-fluid developed by Prof. Yao is low viscosity at low temperature (viscosity increases with temperature). In this study, we used TR-fluid as an embolic material for TAE and evaluated the embolic effect, anti-tumor effect, and pathology of embolized arteries in a rabbit model.

METHOD AND MATERIALS

Experiment 1: 12 rabbits were divided into 2 groups and the renal artery was embolized using TR-fluid. Complete embolization of the lobular arteries and filling of the distal parts of the lobar arteries was considered as the end point of embolization. 6 rabbits in each group were sacrificed at 7, and 28 days later and kidneys were extracted. Pathological specimens were constructed in 3-mm intervals by coronal section and changes in arterial walls (wall distension, inflammatory change, and fibrosis) were evaluated. Experiment 2: We divided 6 rabbits with transplanted VX2 liver tumors into 2 groups. They were infused via the proper hepatic artery with cisplatin-TR-fluid suspension or saline as a control and the tumor growth rate was determined on MR images acquired before and 7 days after treatment.

RESULTS

Experiment 1: TR fluid pushed out of the catheter could be confirmed under fluoroscopy without combining with contrast agents. Embolization effect of the renal artery by TR-fluid after 28 days was observed to be the same as that of 7 days later. In microscopic specimens, TR-fluid observed in mold form within the blood vessel and vascular wall, resulting in distension and inflammation. Fibrosis was observed in all cases. Experiment 2: Compared to controls, the tumor growth rate was significantly reduced in the group treated with cisplatin-TR fluid suspension.

CONCLUSION

From this study, TR fluid was estimated to exhibit good embolic effects and anti-tumor effects.

CLINICAL RELEVANCE/APPLICATION

Gelatin sponge or beads are currently used in IVR because embolic area cannot be confirmed only in the distribution of the contrast agent used in the suspension, therefore the embolic effect may become insufficient. Also, it is possible that TR fluid itself is visible under fluoroscopy by using a contrast agent in the manufacturing process. Further studies are necessary, but with the characteristic that viscosity changes by temperature, TR-fluid may become a new material of embolic material.

VI217-SD-SUB2 EVAR Follow-up: Preliminary Validation of Digital Tomosynthesis and CEUS in Detection of Mid and Long Term Complications

Participants

Maria A. Mazzei, MD, Siena, Italy (Presenter) Nothing to Disclose
Susanna Guerini, MD, Siena, Italy (Abstract Co-Author) Nothing to Disclose
Francesco G. Mazzei, MD, Siena, Italy (Abstract Co-Author) Nothing to Disclose
Nevada Cioffi Squitieri, MD, Siena, Italy (Abstract Co-Author) Nothing to Disclose
Giancarlo de Donato, MD, Siena, Italy (Abstract Co-Author) Nothing to Disclose
Giuseppe Galzerano, MD, Siena, Italy (Abstract Co-Author) Nothing to Disclose
Palmiro Sacco, MD, Siena, Italy (Abstract Co-Author) Nothing to Disclose
Luca Volterrani, Siena, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Setacci, MD, Siena, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate the feasibility of digital tomosynthesis of abdomen (DTA) and contrast enhanced ultrasound (CEUS) after EVAR, assuming dual energy computed tomography (DECT) as gold standard.
METHOD AND MATERIALS

From June 2013 to December 2014, 53 patients scheduled for CT examination during EVAR follow-up, previously underwent DTA and CEUS. The DECT examination were obtained using a 64-detector row configuration. On the basis of DTA and CEUS examinations, patients were divided in three groups: A) expected complications; B) suspected complications, C) not expected complications. All examinations were evaluated by a vascular team (a radiologist and a vascular surgeon skilled in vascular images and endovascular therapies). Sensitivity, specificity and accuracy for combined DTA and CEUS and separately were calculated.

RESULTS

According to DTA and CEUS examinations, 2 patients were in group A (1 expected graft fracture and 1 dislocation), 11 in group B (4 suspected stenosis, 2 dislocations, 2 fractures and 3 graft migrations) and 40 in group C. DECT evaluation confirmed the diagnosis in all patients in group A and in 39 patients in group C, while 2 suspected stenosis, 2 dislocation, 1 fracture and 3 migrations were confirmed in group B. Sensitivity, specificity and accuracy for combined DTA and CEUS were 91%, 93% and 92% respectively.

CONCLUSION

By combining DTA and CEUS data, the accuracy in detecting EVAR failure could be improved, reserving CT examination only for expected and strongly suspected complications with a significant reduction of dose-exposure and risk of contrast induced nephropathy.

CLINICAL RELEVANCE/APPLICATION

The primary aim of this project is to find a new way to perform the EVAR follow-up, tailoring the imaging protocol per single patient, with a significant reduction of dose-exposure and risk of CIN.

V2118-SD-SUB3 Chest Port-related Infection According to Medical History: Are There Any High Risk Groups?

Participants
Katsuhiro Kobayashi, MD, Syracuse, NY (Presenter) Nothing to Disclose
Jayminkumar Patel, Syracuse, NY (Abstract Co-Author) Nothing to Disclose
Masoud Faridnia, BS, Syracuse, NY (Abstract Co-Author) Nothing to Disclose
Mohammed Jawed, MD, Syracuse, NY (Abstract Co-Author) Nothing to Disclose
Mitchell I. Karmel, MD, Syracuse, NY (Abstract Co-Author) Nothing to Disclose
Dianbo Zhang, MD, Syracuse, NY (Abstract Co-Author) Nothing to Disclose
Cole F. Mendenhall, MD, Long Branch, NJ (Abstract Co-Author) Nothing to Disclose

PURPOSE

To retrospectively investigate the incidence of chest port-related infection according to medical history and to determine high risk groups.

METHOD AND MATERIALS

Between July, 2012 and May, 2014, a total of 924 chest ports were placed in 897 patients. Of these, 53 ports were placed in 48 patients with chronic medical disease (CMD) (Male/Female: 21/27, mean age: 37). 5 patients had a port placed twice because of complications. 871 ports were placed in 849 patients with cancer (Male/Female: 437/412, mean age: 57). 22 patients had a port placed twice because of tumor recurrence or complications. Chronic medical disease included sickle cell disease (SCD) (n=13 ports), cystic fibrosis (n=12), and others 27. Cancer type included Gastrointestinal (GI) (n=193), lung (n=154), breast (n=134), and hematologic (n=133), Head and Neck (HandN) (n=97), and others (n=160) Retrospective review of the medical records of all the patients was conducted to identify chest port-related infection (local and systemic) requiring port removal. The incidence of infection according to medical history was calculated and compared to that of each comparison group.

RESULTS

The infection rate of patients with CMD was 22.6% (12/52) or 2.2 infections/1000 catheter-days, which was significantly higher than that of patients with cancer (5.7% (50/871), 0.24/1000 catheter days) (p<0.05). Among patients with CMD, patients with SCD were at a higher risk for infection (38.5%, 1.11 infections/1000 catheter days). Among patients with cancer, patients with hematologic cancer had a highest chest port-related infection rate (9.02%, 0.40/1000 catheter-days), followed by lung cancer (7.79%, 0.396/1000 catheter-days) and HandN cancer (6.19%, 0.258/1000 catheter days). However, the infection rates were not statistically higher than those with the comparison groups (non-hematologic, non-lung and non-HandN, P=0.11, 0.26, 0.88, respectively).

CONCLUSION

Incidence of chest port-related infection in patients with CMD was significantly higher than that in patients with cancer. Patients with SCD were at a higher risk and patients with hematologic cancer were at marginally higher risk for infection.

CLINICAL RELEVANCE/APPLICATION

Proper handing with strict aseptic techniques and close monitoring of a chest port are mandatory in patients with CMD especially those with SCD because of the high incidence of chest port-related infection.

V2149-SD-SUB4 CT-Guided Percutaneous Renal Cryoablation: A Large Series with Long-Term Follow-Up and Low Morbidity

Participants
Hussein D. Aoun, MD, Dearborn, MI (Presenter) Nothing to Disclose
Peter J. Littrup, MD, Providence, RI (Abstract Co-Author) Founder, CryoMedix, LLC; Research Grant, Galil Medical Ltd; Research Grant, Endo Health Solutions Inc; Consultant, Delphinus Medical Technologies, Inc
Barbara A. Adam, MSN, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Evan N. Fletcher, MS, BA, Detroit, MI (Abstract Co-Author) Nothing to Disclose

PURPOSE

The primary aim of this project is to find a new way to perform the EVAR follow-up, tailoring the imaging protocol per single patient, with a significant reduction of dose-exposure and risk of CIN.

METHOD AND MATERIALS

Between July, 2012 and May, 2014, a total of 924 chest ports were placed in 897 patients. Of these, 53 ports were placed in 48 patients with chronic medical disease (CMD) (Male/Female: 21/27, mean age: 37). 5 patients had a port placed twice because of complications. 871 ports were placed in 849 patients with cancer (Male/Female: 437/412, mean age: 57). 22 patients had a port placed twice because of tumor recurrence or complications. Chronic medical disease included sickle cell disease (SCD) (n=13 ports), cystic fibrosis (n=12), and others 27. Cancer type included Gastrointestinal (GI) (n=193), lung (n=154), breast (n=134), and hematologic (n=133), Head and Neck (HandN) (n=97), and others (n=160) Retrospective review of the medical records of all the patients was conducted to identify chest port-related infection (local and systemic) requiring port removal. The incidence of infection according to medical history was calculated and compared to that of each comparison group.

RESULTS

The infection rate of patients with CMD was 22.6% (12/52) or 2.2 infections/1000 catheter-days, which was significantly higher than that of patients with cancer (5.7% (50/871), 0.24/1000 catheter days) (p<0.05). Among patients with CMD, patients with SCD were at a higher risk for infection (38.5%, 1.11 infections/1000 catheter days). Among patients with cancer, patients with hematologic cancer had a highest chest port-related infection rate (9.02%, 0.40/1000 catheter-days), followed by lung cancer (7.79%, 0.396/1000 catheter-days) and HandN cancer (6.19%, 0.258/1000 catheter days). However, the infection rates were not statistically higher than those with the comparison groups (non-hematologic, non-lung and non-HandN, P=0.11, 0.26, 0.88, respectively).

CONCLUSION

Incidence of chest port-related infection in patients with CMD was significantly higher than that in patients with cancer. Patients with SCD were at a higher risk and patients with hematologic cancer were at marginally higher risk for infection.

CLINICAL RELEVANCE/APPLICATION

Proper handing with strict aseptic techniques and close monitoring of a chest port are mandatory in patients with CMD especially those with SCD because of the high incidence of chest port-related infection.

V2118-SD-SUB4 CT-Guided Percutaneous Renal Cryoablation: A Large Series with Long-Term Follow-Up and Low Morbidity

Participants
Hussein D. Aoun, MD, Dearborn, MI (Presenter) Nothing to Disclose
Peter J. Littrup, MD, Providence, RI (Abstract Co-Author) Founder, CryoMedix, LLC; Research Grant, Galil Medical Ltd; Research Grant, Endo Health Solutions Inc; Consultant, Delphinus Medical Technologies, Inc
Barbara A. Adam, MSN, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Evan N. Fletcher, MS, BA, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Vascular Complications Following Liver Transplant: Diagnosis and Intervention

ABSTRACT

Purpose

Vascular complications following liver transplantation are relatively common and can significantly impact patient outcomes. The aim of this study was to review the diagnostic and interventional strategies used to manage these complications.

Methods

This study included a retrospective analysis of 328 liver transplant cases from a single center over a 5-year period. Vascular complications were classified into arterial and venous categories. Diagnostic imaging, including Doppler ultrasound, CT angiography, and MR angiography, was used to identify the cause of complications. Interventional procedures such as angioplasty and stent placement were performed as needed.

Results

Arterial complications were noted in 20% of cases, predominantly due to narrowing at the arterial anastomosis. Venous complications occurred in 40% of cases, with stenosis at the venous anastomosis being the most common. Imaging findings such as stenosis, thrombosis, and pseudoaneurysms were successfully treated using interventional techniques.

Conclusions

These findings emphasize the importance of thorough pre-transplant evaluation and vigilant post-transplant monitoring. Specialized training and a multidisciplinary approach are crucial to manage vascular complications effectively.

Participants

Ankaj Khosla, MD, Dallas, TX (Presenter) Nothing to Disclose
David T. Fetzner, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Stephen P. Reis, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Patrick D. Sutphin, MD, PhD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Clayton K. Trimmer, DO, Irving, TX (Abstract Co-Author) Nothing to Disclose
Sanjeeva P. Kalva, MD, Dallas, TX (Abstract Co-Author) Consultant, CeloNova BioSciences, Inc

TEACHING POINTS

1. Vascular complications are relatively common following liver transplantation and are associated with a significant risk of allograft dysfunction and patient morbidity and mortality.
2. It is important for the radiologist to understand the range of vascular anastomatic variants and the range of complications including stenosis and thrombosis.
3. Imaging modalities such as Doppler ultrasound, CT, and MR angiography, and traditional catheter angiography each play a critical role in the diagnosis of vascular complication.
4. A number of image-guided interventions can be utilized for these complications and can be suggested from diagnostic imaging.

TABLE OF CONTENTS/OUTLINE

Review of whole- vs partial-liver transplantation

Typical anatomy following liver transplant

Arterial anastomosis and variants

Portal venous anastomosis

Hepatic venous anastomosis

Complications involving the hepatic artery

Percutaneous interventions

Angioplasty
Thrombolysis Complications involving the portal vein Treatment options Complications involving the IVC and hepatic veins Treatment options
Imaging and Endografts (An Interactive Session)

Sunday, Nov. 29 2:00PM - 3:30PM Location: S103AB

VA IR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC112A   TEVAR Indications and Outcomes

Participants
Michael D. Dake, MD, Stanford, CA (Presenter) Scientific Advisory Board, W. L. Gore & Associates; Scientific Advisory Board, Abbott Laboratories; Research Consultant, Cook Group Incorporated; Research Consultant, TriVascular, Inc; Research Consultant, Medtronic, Inc; Research Consultant, Intact Vascular, Inc; Research Consultant, Novate Medical; Research support, Cook Group Incorporated; Research support, Medtronic, Inc; Research support, W. L. Gore & Associates, Inc;

LEARNING OBJECTIVES
1) Understand the current applications of thoracic endografts for management of thoracic aortic pathologies. 2) Recognize the benefits and existing limitations of current endograft technologies for treatment of different aortic lesions. 3) Identify the complications and failure modes of TEVAR. 4) Know the current outcome metrics typically evaluated after TEVAR treatment of thoracic aneurysms and aortic dissections. 5) List the important imaging findings and criteria currently used to assess the suitability of aortic anatomy for TEVAR.

RC112B   New Endografts for Complex AAA

Participants
Constantino S. Pena, MD, Miami, FL (Presenter) Speakers Bureau, Cook Group Incorporated; Advisory Board, C. R. Bard, Inc; Advisory Board, Boston Scientific Corporation; Advisory Board, General Electric Company;

LEARNING OBJECTIVES
1) Discuss the status of established AAA endografts. 2) Discuss new endografts for the treatment of AAA. Particularly discuss areas of improvement over established endografts. 3) Present data on novel endografts being developed.

RC112C   Old Endografts with New Complications

Participants
Elliot K. Fishman, MD, Owings Mills, MD (Presenter) Research support, Siemens AG Advisory Board, Siemens AG Research support, General Electric Company Advisory Board, General Electric Company Co-founder, HipGraphics, Inc

LEARNING OBJECTIVES
1) Understand the spectrum of complications which may be seen in patients with endografts that have been in place for several years and the significance of these complications. 2) Develop a strategy for the evaluation of endovascular stents with specific scanning protocols and the role of post processing of the data into 3D. 3) Understand the complexities of complications including involvement of bowel and adjacent organs and the CT findings that can suggest these complications.

ABSTRACT

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Elliot K. Fishman, MD - 2012 Honored Educator
Elliot K. Fishman, MD - 2014 Honored Educator
ABSTRACT

Biomarkers have been embraced by both the scientific and regulatory communities as surrogates end points for clinical trials, paving the way for their widespread use in medicine. The field of imaging biomarkers has exploded, and the their integration into clinical practice relies on and intersects with the field of bioinformatics. Once specific biomarkers are show to have value, easily integrating them into the digital environment of the radiologist and communicating them to the health care providers and or directly to patients efficiently and seamlessly is important for their value and impact on health to be realized. Culturally, it is taking radiologists from the era of description and largely qualitative reporting, into a quantitative future state, and leveraging informatics to extract information from imaging alone or together with data available in the electronic medical record is essential for future success in this new world. To get there, understanding the impact of this approach as a value of our services, and standardization of imaging techniques along the lines of what the RSNA QIBA initiative is designing, are essential, so that imaging biomarkers are robust, accurate and reproducible. Embracing this approach enables and facilitates new approaches, relationships of imaging and IT researchers, vendors and consumers, to fully realize the possibilities. This course will discuss and describe the overall constructs, and use tangible exams of using this in practice today and for the future.

LEARNING OBJECTIVES

1) To learn what the term precision medicine means. 2) To understand how informatics intersects with clinical radiology to enable precision medicine in practice. 3) To learn through concrete examples how informatics based radiology precision medicine impacts health

The era of personalized/precision medicine offers the potential to utilize patient and lesion specific data to personalize screening and diagnostic work-up, diagnosis, and treatment selection to a particular patient to optimize effectiveness. Although recently, the emphasis has been on utilization of genomic data in personalized medicine, there is a ‘gold mine’ of useful data in previously conducted clinical trials as well as patient medical electronic records that has, until now, gone largely untapped. The purpose of this presentation is to describe how the screening, diagnosis, and treatment of lung nodules can be personalized utilizing data from the NLST and PLCO clinical trials and how the Fleischner Guidelines and screening criteria for lung cancer can be modified according to the characteristics of an individual patient and individual nodule. The presentation will also include ways in which a facility can collect local data on their own patients to supplement these reference databases with experience from their own patient population.
LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Cardiovascular diseases (CVD) develop over an individual's lifetime. CVD is the number one cause of death and morbidity worldwide. Integrated application of genomics, quantitative imaging and "big data" has the potential to positively transform cardiovascular prevention and care and reduce the health and economic consequence of CVD. In this talk we will review how easily obtainable imaging biomarkers, already available, can power this change. Measures of cardiac and vascular structure and function as well as body composition provide great insight into and individual's risk of CVD, level of physical activity, diet, vascular health and general well-being.
RC212A  
**TAVR: The Surgeon’s Perspective**

Participants  
Dominik Fleischmann, MD, Palo Alto, CA  
*Moderator*  
Research support, Siemens AG;

Sub-Events  

**RC212A**  
TAVR: The Surgeon’s Perspective

Participants  
Michael Fischbein, Stanford, CA  
*Presenter*  
Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the epidemiology, surgical and novel transcatheter treatment options for aortic stenosis.  
2) Be able to analyze current evidence for the effectiveness of TAVR in different risk groups.  
3) Comprehend the elements of a successful TAVR program implementation.

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RC212B  
**CTA for TAVR Planning: Current Evidence**

Participants  
Jonathon A. Leipsic, MD, Vancouver, BC  
*Presenter*  
Speakers Bureau, General Electric Company;  
Speakers Bureau, Edwards Lifesciences Corporation;  
Consultant, Heartflow, Inc;  
Consultant, Circle Cardiovascular Imaging Inc

**LEARNING OBJECTIVES**

1) Review the recent advancements in the field of TAVR.  
2) Review the published literature defining the role of MDCT for device selection and annular sizing.  
3) Discuss the other ancillary roles of MDCT in TAVR planning.

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Honored Educators  

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at:  
https://www.rsna.org/Honored-Educator-Award/

Jonathon A. Leipsic, MD - 2015 Honored Educator

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RC212C  
**Measurements, Workflow, Training and Q/A**

Participants  
Shannon Walters, Stanford, CA  
*Presenter*  
(shannon.walters@stanford.edu)  
Nothing to Disclose

**LEARNING OBJECTIVES**

1) Define elements of an effective TAVR image analysis workflow.  
2) Discuss the variety and applicability of measurement/imaging tools.  
3) Develop training plans to improve inter observer agreement.  
4) Improve efficiency and reliability through quality assurance.
**Interventional Series: Venous Disease**

Monday, Nov. 30 8:30AM - 12:00PM Location: S404CD

VA IR

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 4.00

FDA Discussions may include off-label uses.

**Participants**
Marcelo Guimaraes, Charleston, SC (Moderator) Consultant, Cook Group Incorporated; Consultant, Baylis Medical Company; Consultant, Terumo Corporation; Patent holder, Cook Group Incorporated
Wael E. Saad, MBBCch, Ann Arbor, MI (Moderator) Research Grant, Siemens AG; Consultant, Siemens AG; Consultant, Boston Scientific Corporation; Consultant, Medronic, Inc; Consultant, Getinge AB; Consultant, Merit Medical Systems, Inc;

**LEARNING OBJECTIVES**
1) Describe the use of radio frequency wire in central venous occlusion. 2) List rationale for venous thrombolysis. 3) Describe the indications for balloon retrograde transvenous occlusion (BRTO). 4) Discuss one approach to establishing a PE response team.

**ABSTRACT**

**Sub-Events**

**RC214-01 PE I: Diagnosis and Triage of Pulmonary Embolism**

Monday, Nov. 30 8:30AM - 8:55AM Location: S404CD

Participants
Akhilesh K. Sista, MD, New York, NY, (aks9010@med.cornell.edu) (Presenter) Nothing to Disclose

**RC214-02 Additional Catheter-Directed Thrombolysis for Proximal Deep Vein Thrombosis: 5 Year Results of a Randomized Controlled Trial (The Cavent Study)**

Monday, Nov. 30 8:55AM - 9:05AM Location: S404CD

Participants
Ylva Haig, MD, PhD, Oslo, Norway (Abstract Co-Author) Nothing to Disclose
Ole Jorgen J. Grotta, MD, Oslo, Norway (Presenter) Nothing to Disclose
Tone R. Enden, MD, PhD, Oslo, Norway (Abstract Co-Author) Nothing to Disclose
Per M. Sandset, MD, PhD, Oslo, Norway (Abstract Co-Author) Nothing to Disclose
Carl-Erik Slagsvold, MD, Oslo, Norway (Abstract Co-Author) Nothing to Disclose
Gunnar Sandbek, MD, PhD, Oslo, Norway (Abstract Co-Author) Nothing to Disclose
Lars O. Holmen, MD, Krakeroy, Norway (Abstract Co-Author) Nothing to Disclose
Geir Hafshafi, MD, Billingstad, Norway (Abstract Co-Author) Nothing to Disclose
Nils-Einar Klow, MD, PhD, Oslo, Norway (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To examine whether additional catheter-directed thrombolysis (CDT) had a persistent benefit in reducing post-thrombotic syndrome (PTS), and if CDT increased patency and reduced reflux 5 years following a high proximal deep vein thrombosis (DVT)

**METHOD AND MATERIALS**
Patients with a first-time objectively verified DVT affecting the upper femoral vein and/or iliac vein were randomized to receive conventional therapy alone or to additional CDT. PTS was assessed using the Villalta scale and the venous system was examined by duplex ultrasound and air plethysmography to define the presence of patency and/or reflux.

**CONCLUSION**
Follow-up after 5 years showed an additional benefit of CDT in reducing PTS, which supports "the open vein hypothesis" and underpins the importance of early clot removal to prevent PTS.

**CLINICAL RELEVANCE/APPLICATION**
The results of this first randomized controlled trial to evaluate the effect of additional CDT for deep vein thrombosis supports the use of CDT in selected patients.

**RC214-03 When are Advanced Inferior Cava Filter Retrieval Techniques Necessary? An Analysis in 724 Procedures**

Monday, Nov. 30 9:05AM - 9:15AM Location: S404CD

Participants
Kush R. Desai, MD, Chicago, IL (Presenter) Nothing to Disclose
James L. Laws, BS, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Samdeep Mouli, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Jennifer Karp, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Robert K. Ryu, MD, Chicago, IL (Abstract Co-Author) Consultant, Cook Group Incorporated Stockholder, EndoVention Inc
Consultant, IORAD
Robert J. Lewandowski, MD, Chicago, IL (Abstract Co-Author) Advisory Board, BTG International Ltd; Advisory Board, Boston Scientific Corporation; Consultant, Cook Group Incorporated; Consultant, ABK Medical Inc

PURPOSE
Retrievable inferior vena cava filters (rIVCF) with prolonged dwell time often cannot be removed with standard techniques. Advanced retrieval techniques, which are increasingly necessary with prolonged rIVCF dwell time, have positively impacted overall retrieval rates. We aim to derive a dwell time at which the use of advanced techniques becomes necessary to achieve retrieval success.

METHOD AND MATERIALS
All rIVCF retrieval procedures from 1/2009-2/2015 were identified from a prospectively acquired database. We assessed patient age/sex, filter dwell time, technical success, fluoroscopy time, adverse events, and advanced retrieval technique (loop wire, balloon disruption, directional sheath, endobronchial forceps, and Excimer laser sheath) use. The data were analyzed with binomial regression analysis to calculate a dwell time in months at which advanced techniques were necessary. Statistical significance was accepted at p<0.05.

RESULTS
724 retrieval procedures were performed during the study period, with an overall technical success rate of 97%. Filters encountered in the study period include devices manufactured by Cook, Cordis, Bard, Argon, Volcano, and ALN. After 3.1 months (95% CI 2.8-3.4, p<0.01), the likelihood of requiring advanced techniques to achieve retrieval success increased significantly.

CONCLUSION
At approximately 3 months rIVCF dwell time, the likelihood of requiring advanced techniques to maintain retrieval technical success increases significantly. In patients with rIVCFs in place beyond this time point, referral to centers with expertise in advanced filter retrieval techniques may facilitate their successful retrieval.

CLINICAL RELEVANCE/APPLICATION
Retrieval of prolonged dwell rIVCFs is not uniformly attempted and is often not successful due to lack of widespread expertise in advanced retrieval techniques. These devices with prolonged implantation time are prone to increased rates of complication. In accordance with a 2010 FDA safety communication, we strongly believe that rIVCFs that are no longer indicated should be removed. Identifying a time when advanced techniques will likely be necessary may improve overall retrieval of these devices.

RC214-04 Microbubble Augmented Ultrasound Thrombolysis of Deep Vein Thrombosis in an In-vitro Model

Monday, Nov. 30 9:15AM - 9:25AM Location: S404CD

Participants
Brahman Dhamarajah, MBBS, MRCS, London, United Kingdom (Presenter) Nothing to Disclose
Tom McKinnon, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Christina Keravnou, Nicosia, Cyprus (Abstract Co-Author) Nothing to Disclose
Michalakis A. Averkiou, PhD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Alun Davies, FRCR, London, United Kingdom (Abstract Co-Author) Nothing to Disclose

PURPOSE
Acute thrombus removal is recommended for extensive deep vein thrombosis (DVT) to prevent the long term sequelae of post thrombptic syndrome. However, catheter-directed thrombolysis confers a haemorrhage risk of up to 20%. Sonothrombolysis is the combination of high mechanical index ultrasound (US) and ultrasound contrast microbubbles (MBs) to achieve thrombus dissolution.

METHOD AND MATERIALS
Under venous shear stress, parallel plate flow chambers coated with tissue factor were used to create a DVT specific in-vitro clot model. Therapy groups included: control, US only and US and MBs (each n=8). US was applied via a Philips iU-22 platform with a C5-1 transducer using a custom bubble destruction sequence producing a triggered mechanical index pulse of 1.31 every 1500 milliseconds. SonoVue MBs were infused at 0.2% concentration. Fluoroscopically tagged fibrin captured via video microscopy provided validated blinded offline image quantification of clot surface area coverage with statistical analysis performed using a one-way ANOVA.

RESULTS
Mean surface area coverage of the clot ± SD after treatment was 85.8 ± 5.6% in the control group, 52.7 ± 7.6% in the US only group and 10.7 ± 12.37% in the US and MBs group. A significant difference of US alone over control was identified (P<0.05), however, a further significant effect was displayed by US and MBs (P<0.0001). Qualitative video microscopy clot analysis revealed maintenance of the fibrin scaffold with areas of porosity with US only whilst complete dissolution of the fibrin structure with restoration of flow was observed with US and MBs.

CONCLUSION
This pilot study using commercially available MBs and US platform identifies sonothrombolysis as a feasible non-invasive, non-irradiating technique for the dissolution of DVT. Further translational research assessing both safety and efficacy of this novel technique is warranted before it can rival current thrombus removal strategies.

CLINICAL RELEVANCE/APPLICATION
Microbubble augmented ultrasound thrombolysis is feasible and may confer less risk of haemorrhage and irradiation than current thrombus removal strategies.

**RC214-05 PE II: Treatment Options for the IR and the PE Response Team**

Monday, Nov. 30 9:25AM - 9:50AM Location: S404CD

Participants
Robert A. Lookstein, MD, New York, NY (Presenter) Consultant, Johnson & Johnson; Consultant, Boston Scientific Corporation; Consultant, The Medicines Company

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**RC214-06 Unknown Case of the Session**

Monday, Nov. 30 9:50AM - 10:15AM Location: S404CD

Participants
Wael E. Saad, MBChB, Ann Arbor, MI (Presenter) Research Grant, Siemens AG; Consultant, Siemens AG; Consultant, Boston Scientific Corporation; Consultant, Medtronic, Inc; Consultant, Getinge AB; Consultant, Merit Medical Systems, Inc;

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**RC214-07 Efficacy of TIPS/Embolization for Gastric Varices**

Monday, Nov. 30 10:15AM - 10:25AM Location: S404CD

Participants
Janesh Lakhoo, BS, Chicago, IL (Presenter) Nothing to Disclose
Ron C. Gaba, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Gastric varices (GVs)-which occur in 5-35% of liver cirrhosis patients-may lead to severe bleeding and mortality rates ~25% at 2-years. Transjugular intrahepatic portosystemic shunt (TIPS) creation with/without variceal embolization serves to decompress and occlude varices in cases refractory to medical management. However, GVs may be difficult to treat with TIPS/embolization due to distance from TIPS shunt ("proximity" theory), large size resulting in competitive outflow with TIPS ("throughput" theory), and canalization of new feeders after embolization ("recruitment" theory). This study evaluated the efficacy of TIPS with or without embolization in decompressing or occluding GVs.

**METHOD AND MATERIALS**

In this single center, retrospective observational study, 79 patients with GV bleeding were selected from a cohort of 303 patients who underwent TIPS from 1999-2014. Individuals with bare metal stent TIPS and patients who lacked post-TIPS imaging/endoscopic follow-up were excluded. Chart and imaging review were used to assess variceal types, feeders, and post-procedure cross-sectional imaging or endoscopic patency. The primary study outcome measure was imaging and/or endoscopic GV patency rate as a surrogate for clinical efficacy of TIPS/embolization.

**RESULTS**

The final cohort consisted of 26 patients (M:F 16:10, median age 54 years, median MELD 16). GVs included GEV1 (10), GEV2 (2), IGV1 (3), IGV2 (2), and unspecified (9). TIPS were hemodynamically successful in 24/26 (92%) patients with median final portosystemic pressure gradient of 7 mm Hg. Multiple GV feeders (left/posterior/short gastric veins) were present in 62% (16/26) cases. embolization was performed in 75% (18/24). 13, 3, and 10 patients had imaging, endoscopic, or both imaging/endoscopic follow-up. The incidence of GV patency on post-TIPS follow-up was 77% (20/26) (78%/75% with/without embolization) at 129 days median follow-up time. The post-TIPS rebleeding incidence was 27% (7/26), and the 90-day mortality rate was 15% (4/26).

**CONCLUSION**

In this study, most GVs showed persistent patency despite TIPS decompression and variceal occlusion, and rebleeding incidence was high. The findings suggest suboptimal efficacy for GV therapy, and indicate need for study of alternative/adjunctive approaches to GV treatment, such as balloon-occluded antegrade or retrograde obliteration.

**CLINICAL RELEVANCE/APPLICATION**

TIPS/coil embolization may not optimally decompress or occlude gastric varices.

**RC214-08 Comparison of Balloon-occluded Retrograde Transvenous Obliteration (BRTO) using Ethanolamine Olate Iopamidol (EOI), BRTO Using Sodium Tetradecyl Sulfate (STS) Foam and Modified BRTO (mBRTO)**

Monday, Nov. 30 10:25AM - 10:35AM Location: S404CD

Participants
Young Hwan Kim, MD, Daeug, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Young Hwan Kim, Daeug, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jung Hee Hong, Daeug, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Byoung Je Kim, Daeug, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hye Min Son, Daeug, Korea, Republic Of (Presenter) Nothing to Disclose

**PURPOSE**
To compare the clinical outcomes of BRTO using EOI, BRTO using STS foam and mBRTO.

**METHOD AND MATERIALS**

From April 2004 to February 2015, Eighty-three patients underwent retrograde transvenous obliteration for gastric varices were analyzed retrospectively. BRTO with EOI was performed in 38 patients, BRTO with STS foam in 25 and mBRTO in 20. Among them, we obtained follow-up data in 66 patients. Recurrence of gastric varices was evaluated by follow-up endoscopy or CT. Medical records were reviewed for the clinical and technical efficacy. Statistical analyses were performed by Chi-square test, Fisher's exact test, Kruskal-Wallis test and Mann-Whitney U test.

**RESULTS**

Technical and clinical success was achieved in 79 patients (95.2%). As major complications, hemoglobinuria occurred in one patient with BRTO using EOI. Recurrence of gastric varices occurred more frequently in BRTO group (P<0.05). Recurrence of gastric varices occurred in 1 patient in BRTO using EOI group and 4 patients in mBRTO group with 3.3% and 22.2% of each expected one-year recurrence rates. There was no recurrence of gastric varices in all patients underwent BRTO using STS foam. Abdominal pain occurred more frequently in BRTO using EOI than BRTO using STS foam and mBRTO (P<0.05). Procedure time of mBRTO was shorter than the other two conventional BRTO groups(P<0.05).

**CONCLUSION**

Both BRTO using STS foam and mBRTO are better than BRTO using EOI for treatment of gastric varices in terms of complication and procedure time. However, mBRTO showed frequent recurrence of gastric varices during the long-term F/U rather than conventional BRTO.

**CLINICAL RELEVANCE/APPLICATION**

Modified BRTO is a time-saving procedure, but mBRTO has more recurrence rate. This article makes paying attention to perform mBRTO which has more recurrence rate of gastric varices.

**RC214-09 Prediction for Improvement of Liver Function after B-RTO for Gastric Varices by Transient Elastography -To Manage Portosystemic Shunt Syndrome**

**Participants**

Akira Yamamoto, Osaka, Japan (Presenter) Nothing to Disclose
Norifumi Nishida, MD, PhD, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Hiroyasu Morikawa, MD, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Atsushi Jogo, MD, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Ken Kageyama, MD, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Etsuji Sohgawa, MD, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Shinichi Haramoto, MD, PhD, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Tohru Takeshita, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Yukimasa Sakai, MD, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Yukio Mihi, MD, PhD, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Norifumi Kawada, Osaka, Japan (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To investigate the predictive factors including transient elastography (TE) using Fibroscan® for improvement in liver function after B-RTO for GV.

**METHOD AND MATERIALS**

We retrospectively analyzed 47 consecutive patients who were followed up for more than 3 months after B-RTO and who had undergone TE before B-RTO between January 2011 and December 2013. The correlation between change in liver function (total bilirubin, albumin, and prothrombin time) and baseline liver function values and the liver stiffness measurement (LSM) by TE using FibroScan® was evaluated by Pearson’s correlation test. Receiver operating characteristic (ROC) curves were used to determine the cut-off values with the best sensitivity and specificity in discriminating between patients who experienced improved liver function and those who did not. To clarify the cut-off level, time interval from B-RTO to aggravation of esophageal varix (EV) was also analyzed.

**RESULTS**

Of the 47 enrolled patients, B-RTO was successfully performed in all patients (100%). The serum albumin was significantly improved at 3 months after B-RTO (3.60 vs. 3.80, p=0.001). There was a significant negative correlation between the change in serum albumin and the baseline LSM (r = -0.51, p=0.0001). The best cut-off point for LSM was 22.9 kilopascals (kPa) with a sensitivity and specificity of 76.5% and 69.2%, respectively, and an area under the curve of 0.79 for predicting which patients would experience improved albumin after B-RTO. In the patient with ≤ 22.9 kPa LSM, serum albumin levels improved significantly from before to 3 months after B-RTO (3.60 ± 0.46 vs. 3.90 ± 0.45 g/dl, p<0.0001). In the patient with ≥ 22.9 kPa LSM, serum albumin did not improve significantly from before to 3 months after B-RTO (3.50 ± 0.36 vs. 3.50 ± 0.40 g/dl, p=0.75). One year aggravation rate of EV after B-RTO was 9.5% in the patient with ≤ 22.9 kPa LSM, while 69.5% in the patient with > 22.9 kPa LSM.

**CONCLUSION**

The predictive factor for improvement in liver function after B-RTO was lower LSM (≤ 22.9 kPa) using TE. In the patients with ≤ 22.9 kPa LSM, aggravation rate of esophageal varices was very low.

**CLINICAL RELEVANCE/APPLICATION**

Predictor for improvement of liver function after B-RTO for gastric varices was identified by Transient Elastography.
Participants
Wael E. Saad, MBBCh, Ann Arbor, MI (Presenter) Research Grant, Siemens AG; Consultant, Siemens AG; Consultant, Boston Scientific Corporation; Consultant, Medtronic, Inc; Consultant, Getinge AB; Consultant, Merit Medical Systems, Inc;

LEARNING OBJECTIVES
View learning objectives under main course title.

RC214-11 Chronic Venous Occlusions Treated with RFA
Monday, Nov. 30 11:10AM - 11:35AM Location: S404CD

Participants
Marcelo Guimaraes, Charleston, SC (Presenter) Consultant, Cook Group Incorporated; Consultant, Baylis Medical Company; Consultant, Terumo Corporation; Patent holder, Cook Group Incorporated

LEARNING OBJECTIVES
View learning objectives under main course title.

RC214-12 Wrap Up and Discussion
Monday, Nov. 30 11:35AM - 12:00PM Location: S404CD

Participants
Cardiac CT Mentored Case Review: Part II (In Conjunction with the North American Society for Cardiac Imaging) (An Interactive Session)

Monday, Nov. 30 10:30AM - 12:15PM Location: S406A

AMAPRA Category 1 Credits ™: 1.75
ARRT Category A+ Credits: 2.00

Participants
Pamela K. Woodard, MD, Saint Louis, MO (Director) Research Consultant, Bristol-Myers Squibb Company; Research Grant, Astellas Group; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Bayer AG; Research agreement, Siemens AG; Research Grant, Actelion Ltd; Research Grant, Guerbet SA; ;
Geoffrey D. Rubin, MD, Durham, NC (Moderator) Consultant, Fovia, Inc; Consultant, Informatics in Context, Inc; Research Consultant, General Electric Company; Arthur E. Stillman, MD, PhD, Atlanta, GA (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify cardiac and coronary artery anatomy. 2) Recognize cardiac disease processes, including coronary atherosclerosis, as diagnosed on CT. 3) Understand methods of cardiac CT and coronary CT angiography post-processing.

Sub-Events

MSMC22A  Coronary Atherosclerosis I

Participants
Geoffrey D. Rubin, MD, Durham, NC (Presenter) Consultant, Fovia, Inc; Consultant, Informatics in Context, Inc; Research Consultant, General Electric Company;

LEARNING OBJECTIVES
View learning objectives under main course title.

MSMC22B  Coronary Atherosclerosis II

Participants
Smita Patel, MBBS, Ann Arbor, MI (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

ABSTRACT

MSMC22C  Valves and Cardiac Function

Participants
Andrew J. Bierhals, MD, Saint Louis, MO (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

ABSTRACT
Cardiac CT can provide information on valves and function when retrospective ECG gating is used in the acquisition. These studies require extensive image post-processing to accurately depict the moving structures. This presentation will highlight basic image acquisition as well as the evaluation of normal and abnormal patients.
**Vascular Interventional Monday Poster Discussions**

**Monday, Nov. 30 12:15PM - 12:45PM Location: VI Community, Learning Center**

**VI220-SD-MOA1**

Quantitative Analysis of the Flow Dynamics in Percutaneous Isolated Pancreatic Perfusion Therapy using CT during Arteriography

Station #1

Participants
Gretchen M. Foltz, MD, Saint Louis, MO (Moderator) Nothing to Disclose

**Sub-Events**

**VI221-SD-MOA2**

Percutaneous Endobiliary Radiofrequency Ablation with Stent Implantation for Malignant Biliary Obstruction: A Preliminary Study on Two-Step Method

Station #2

Participants
Hongyuan Liang, MD, Shenyang City, China (Presenter) Nothing to Disclose

Zaiming Lu, MD, Shenyang, China (Abstract Co-Author) Nothing to Disclose

Qiyong Guo, MD, Shenyang, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To analyze pancreatic flow dynamics during percutaneous isolated pancreatic perfusion (PIPP).

**METHOD AND MATERIALS**

All experiments were approved by our institution’s Animal Experiment Ethics Committee. Fifteen pigs were divided into 5 groups, and PIPP was performed. Contrast media was circulated in an extracorporeal circuit through the pancreas at infusion rates of 12, 24, and 36 mL/min (groups 1, 2 and 3, respectively) in order to quantitatively evaluate pancreatic enhancement with computed tomography (CT) during arteriography. PIPP was performed in 2 additional groups at infusion rates of 12 and 24 mL/min without and with balloon occlusion of the anterior mesenteric artery (AMA) (groups 4 and 5, respectively). CT was performed before and during PIPP without AMA occlusion and during PIPP with AMA occlusion. The enhanced area was measured on CT axial images and summed to calculate the enhancement volume. The percentage of enhancement volume, relative to the volume of the whole pancreas, was compared in each case.

**RESULTS**

Without AMA occlusion, higher infusion rates significantly increased the enhancement volume of the pancreas (P = 0.039, Kruskal-Wallis test). The mean percentage of enhancement volume (groups 1, 2, and 3) was 60.3%, 72.6%, and 91.3%, respectively. Each enhancement area of the pancreases with AMA occlusion was significantly larger than the corresponding area without AMA occlusion (P = 0.031, Wilcoxon signed-rank test). The mean percentage with AMA occlusion (groups 4 and 5) was 92.7% and 95.9%, respectively.

**CONCLUSION**

Higher infusion rates, or infusion rates with AMA occlusion are suitable for pancreatic perfusion.

**CLINICAL RELEVANCE/APPLICATION**

High infusion rate and AMA occlusion will optimize the distribution of drugs to the pancreatic parenchyma in percutaneous isolated pancreatic perfusion therapy.
RESULTS

All the 12 patients tolerated well a total of 16 RFA procedures with 17 self-expandable metal stents placed. 5 patients suffered with hilar obstruction, the others with distal lesions. The reasons for biliary obstruction are cholangiocarcinoma(8/12), pancreatic cancer(3/12) and metastasis(1/12). The main postablation complication was pain which could be controlled by analgesics. One patient suffered fever and biliary infection, cured by antibiotics. Stent patency was 198 days (106-405). Median survival was 265 days (78-625) from the time of the first RFA in each patient.

CONCLUSION

With the utility of PET-MR, two-step method of Percutaneous intraluminal RFA combined with biliary stenting may be more feasible and effective therapeutic option for unresectable extrahepatic malignant biliary obstruction.

CLINICAL RELEVANCE/APPLICATION

(deal with endobiliary RFA for biliary obstruction) two-step method of Percutaneous intraluminal RFA sequential treatment of with biliary stenting may be more feasible and effective therapeutic option for unresectable extrahepatic malignant biliary obstruction.

VII22-SD-MOA3 Non-ECG-Gated and Non-Enhanced MR Angiography in Arrhythmia with Flow-Sensitive Black Blood Technique

Participants
Jun Isogai, MD, Asahi, Japan (Presenter) Nothing to Disclose
Takashi Yamada, Hasuda, Japan (Abstract Co-Author) Nothing to Disclose
Jun Kaneko, Hasuda, Japan (Abstract Co-Author) Nothing to Disclose
Kenji Yodo, Saitama, Japan (Abstract Co-Author) Employee, Toshiba Corporation
Mitsue Miyazaki, PhD, Vernon Hills, IL (Abstract Co-Author) Employee, Toshiba Corporation
Soichiro Iimori, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Tomoko Miyata, Saitama, Japan (Abstract Co-Author) Employee, Toshiba Corporation

PURPOSE

To selectively visualize the lower extremity arteries of arrhythmia patients without contrast media by the use of a free-ECG-gating Flow-Sensitive Black Blood (FSBB) technique.

METHOD AND MATERIALS

A principle of FSBB technique of the peripheral vascular imaging is a subtraction process between two images with subtle different b values. A protocol optimization was performed on the lower extremity of 10 healthy volunteers. Subsequently, the revised FSBB protocol parameters were applied to 40 chronic kidney disease (CKD) patients with arrhythmia, who complain intermittent claudication or have symptoms of lower limb ischemia. All the studies were performed on a 1.5T MRI system (EXCELART Vantage XGV Toshiba) equipped with a SPEEDER torso coil. FSBB imaging was performed as follows; T2*-weighted 3D gradient echo sequence, b value; difference between 0 and 0.1-0.4, and typical scan time=2-3min. The performance of FSBB on the lower extremity artery was assessed for the image contrast, as compared with unenhanced MRA techniques including time-of-flight (TOF) and Fresh Blood Imaging (FBI) using ECG-gated half-Fourier FSE MRA.

RESULTS

FSBB provided excellent anatomical depiction in arrhythmia at the lower limb arterial trees, especially in slow-flow and tortuous arterial branches. Selective visualization of the arterial stenosis or occlusion in the lower extremity was successfully achieved in all CKD patients with arrhythmia. The scan time of FSBB was almost reduced by half than that of FBI or TOF using ECG-gating technique.

CONCLUSION

FSBB technique is independent of ECG-gating and consequently shortens examination time so that it may provide a valuable procedure for diagnosis of peripheral vascular imaging. Selective visualization of the lower extremity artery in arrhythmia patients without contrast media is of increasing significance for an interventional procedure in our aging population.

CLINICAL RELEVANCE/APPLICATION

Visualization of the lower limb artery of arrhythmia patients without contrast material is quite difficult using conventional unenhanced MR angiography. FSBB imaging is a new clinical tool with the use of MR susceptibility difference between tissue and vessels. It has been proven to be useful for brain imaging. In this study, we extended the application of FSBB to the lower extremity to investigate if FSBB could provide an additional benefit outside the brain.

VII25-SD-MOA4 The Effect of Bridging Locoregional Therapy on Recurrence in HCC OLT Patients: UNOS Population Study

Participants
Minzhi Xing, MD, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Hayley Olgane, DO, Pittsburgh, PA (Presenter) Nothing to Disclose
Hyun S. Kim, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

PURPOSE

To compare the incidence of hepatocellular carcinoma (HCC) recurrence after orthotopic liver transplant (OLT) in patients treated with bridging locoregional therapy (LRT) vs. best supportive care and to identify factors which predict recurrence in a national
population study.

**METHOD AND MATERIALS**

The United Network for Organ Sharing (UNOS) database was used to identify patients with HCC who were listed for OLT between 2002 and 2013. Patients within Milan Criteria for whom an HCC Model for End-Stage Liver Disease (MELD) exception was approved were included. Tumor histopathological characteristics from available explant data were assessed. Chi square tests were used to compare categorical variables and t-tests to compare continuous variables. Kaplan-Meier estimation was used for survival analysis with log-rank test and Cox proportional hazard models to assess independent prognostic factors for OS.

**RESULTS**

Of 17291 patients with HCC who were listed for OLT, 14511 received OLT, mean age 57.4 years, 76.8% male; 3889 (26.8%) received bridging LRT. The overall incidence of post-OLT HCC recurrence was 6.7%; it was 3.6% (140/3889) in the bridging LRT group and 7.65% (813/10622) in those who did not receive LRT (p=0.11). Of the 14511 patients, 2794 had complete explant data available. Of these, 11.4% had microvascular invasion on explant pathology. The incidence of recurrence in patients with microvascular invasion was 29.4% (92/313), and in patients without microvascular invasion it was 11.9% (295/2581) (p=0.001). On multivariate analysis, HCC recurrence was found to be an independent and significant prognostic factor of post-transplant survival, p=0.001; HR=3.2 (1.6-14.2).

**CONCLUSION**

In a large-scale population study, the rate of post-transplant recurrence of HCC in OLT patients who received bridging LRT was significantly lower than in those who did not receive bridging LRT. Presence of microvascular invasion on explant pathology was found to predict incidence of HCC recurrence, and recurrence was an independent prognostic factor for prolonged post-OLT survival.

**CLINICAL RELEVANCE/APPLICATION**

In HCC OLT patients, microvascular invasion on explant predicts HCC recurrence, which is an independent prognostic factor for post-OLT survival.

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**Assessment of the Reliability of 4D DSA Temporal Data**

**Station #5**

**Participants**

Jimmy Xu, BS, Madison, WI (**Presenter**) Nothing to Disclose

Sebastian Schafer, Madison, WI (**Abstract Co-Author**) Consultant, Siemens AG

Gabe Shaughnessy, PhD, Madison, WI (**Abstract Co-Author**) Nothing to Disclose

Kevin Royalty, PhD, MBA, Hoffman Estates, IL (**Abstract Co-Author**) Employee, Siemens AG

Pengfei Yang, Beijing, China (**Abstract Co-Author**) Nothing to Disclose

Carolina Sandoval-Garcia, Madison, WI (**Abstract Co-Author**) Nothing to Disclose

Charles M. Strother, MD, Madison, WI (**Abstract Co-Author**) Research Consultant, Siemens AG Research support, Siemens AG

License agreement, Siemens AG

**PURPOSE**

4D DSA generates time-resolved 3D vascular volumes using current angiographic systems. Factors that may invalidate the temporal information have not been adequately evaluated. The two goals of this project were to determine the association between contrast reflux and physiologic waveforms, and to identify other factors that may corrupt physiologic waveforms.

**METHOD AND MATERIALS**

From an internal database, 34 studies from 17 patients, including normal exams (n=4), AVMs (n=15), and aneurysms (n=15), were selected based on available clinical correlates. Projections for 4D DSA reconstructions were evaluated for reflux (defined as either retrograde contrast flow in the artery injected or retrograde flow into arteries proximal to the injection site). 4D DSA volumes were reviewed using prototype software. Starting 3 arterial diameters distal to the injection site, flow waveforms were analyzed and categorized as either physiologic or corrupted. Physiologic waveforms were defined as having a regular interval between time to peaks, an equal full width/half max width, and at least 3 adjacent curves. Fisher's Exact test was used to determine an association between physiologic waveforms and reflux.

**RESULTS**

Of the 34 cases, 23 (68%) had reflux and 11 (32%) did not. Of those with reflux, 17 (74%) had physiologic waveforms. There was no association between waveform characteristics and reflux (p= 1). Of the 6 cases with reflux and corrupted waveforms, visual inspection showed that catheters were located ~1 cm proximal to a stenotic or tortuous segment, or near the carotid siphon or external/internal carotid artery bifurcation. Injection rates that drove contrast into the contralateral vertebral artery also had corrupted waveforms.

**CONCLUSION**

The presence or absence of physiologic waveforms was not associated with reflux. Catheter position and injection rate are two factors that can corrupt physiologic waveforms. These findings suggest that contrast reflux did not invalidate 4D reconstruction temporal information, and therefore quantitative analysis can often be made even with reflux, as flow waveforms remain physiologic.

**CLINICAL RELEVANCE/APPLICATION**

Measurement of blood flow based on 4D DSA seems to be feasible. The ability to obtain and recognize physiologic temporal information is a critical component of this process.
Minimally Invasive Treatment Options for Management of Angiomyolipoma

Participants
Amr S. Moustafa, MBBCh, MSc, Birmingham, AL (Abstract Co-Author) Nothing to Disclose
Ahmed K. Abdel Aal, MD, PhD, Birmingham, AL (Presenter) Consultant, St. Jude Medical, Inc Consultant, Baxter International Inc Consultant, C. R. Bard, Inc
Jonathan R. Hinshelwood, MD, Homewood, AL (Abstract Co-Author) Nothing to Disclose
William A. Barret, MD, Birmingham, AL (Abstract Co-Author) Nothing to Disclose
Nathan W. Ertel, MD, Hoover, AL (Abstract Co-Author) Nothing to Disclose
Rachel F. Oser, MD, Birmingham, AL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Teaching points: 1- Review the incidence, presentation and complications of angiomyolipoma (AML). 2- Discuss the different imaging modalities used for the diagnosis AML including techniques used for the diagnosis of poor fat containing AML. 3- Discuss the endovascular management of AML. 4- Discuss the percutaneous ablation of AML. 5- Highlight the advantages of the interventional radiology based management for AML. 6- Highlight the outcomes and potential complications of the treatment of AML.

HIGH-RESOLUTION MAGNETIC RESONANCE ANGIOGRAPHY AS AN ASSESSMENT TOOL FOR VASCULARIZED LYMPH NODE TRANSFER

Participants
Alexander C. Kagen, MD, New York, NY (Abstract Co-Author) Speakers Bureau, Bayer AG
Joseph Dayan, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Erez Dayan, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Nishi Talati, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Jody Shen, MD, New York, NY (Presenter) Nothing to Disclose
Omid Khalilzadeh, MD, MPH, Boston, MA (Abstract Co-Author) Nothing to Disclose
Mark Smith, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To educate the reader regarding primary and secondary lymphedema, and the current and evolving therapies for this disease, including vascularized lymph node transfer. To discuss the magnetic resonance angiography (MRA) protocol for imaging donor and recipient soft tissue and vascular anatomy, highlighting pertinent findings. To illustrate expected imaging findings in the pre and post-operative settings, as well as complications and common pitfalls relevant to the surgeon.

TABLE OF CONTENTS/OUTLINE
Lymphedema Etiology/pathophysiology Epidemiology Medical and non-surgical treatments Surgical management of lymphedema Indications and Procedure Imaging assessment Role of MRA MRA protocol Pre-operative approach Lymph nodes Soft tissue anatomy and limb volumes Venous and arterial anatomy Lymphatic anatomy Post-operative approach Flap viability Lymph node assessment Soft tissue anatomy and limb volumes Venous and arterial anatomy
**Bowel Interposition is No Longer an Obstacle in MR-guided High-intensity Focused Ultrasound Ablation of the Uterus**

**Station #1**

**Participants**

Young-Sun Kim, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose  
Hyo Keun Lim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose  
Hyunchul Rhim, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To know the influences of bowel interposition on procedure feasibility and to evaluate the effectiveness of bowel manipulation technique in MR-guided high-intensity focused ultrasound (MR-HIFU) ablation of the uterus.

**METHOD AND MATERIALS**

A total of 375 screening MR exams and 206 MR-HIFU ablations for uterine fibroid and/or adenomyosis performed from August 2010 to March 2015 were retrospectively analyzed. Influences of bowel interposition on procedure feasibility were assessed by comparing pass rates of overall/bowel-interposed cases before and after adopting bowel manipulation technique that consisted of sequential bladder filling, rectal gel filling and bladder emptying (ie, BRB maneuver). In cases where BRB maneuver were adopted, success rate and details of the technique were reviewed. Risk factors for technical failure were also assessed (age, BMI, disease type, uterine size, uterine configuration, GnRH pretreatment; logistic regression analysis).

**RESULTS**

Overall pass rates of pre-BRB and post-BRB periods were 59.0% (98/166) and 71.7% (150/209) (P=0.001), and corresponding rates in bowel-interposed cases were 5.4% (2/37) and 72.9% (43/59; failures due to other reasons) (P<0.001), respectively. BRB maneuver was adopted in 60 cases and successfully established safe acoustic windows in 95.0% (57/60). Bladder filling/emptying was repeated 1.7±1.0 (1-5) times and the amount of gel used was 180±86.5 (100-400)mL. Additional time taken for BRB maneuver was 12.7min in average. In 3 cases, manual compression of the upper bladder margin during bladder emptying was necessary, and bladder re-filling and through-the-bladder sonication was performed in 8 cases. Regarding through-the-bladder sonication as technical failure (ie, technical success rate=81.7%), a small uterine size turned out to be the only independent risk factor for BRB failure (B=0.093, P=0.021). Uterine sizes of success and failure cases were 101.8±15.2mm and 84.6±10.9mm, respectively (P=0.001).

**CONCLUSION**

Owing to high effectiveness of the bowel manipulation technique, bowel interposition may have little influence on the procedure feasibility of MR-HIFU ablation of the uterus. However, the cases with small uterus should be screened with caution.

**CLINICAL RELEVANCE/APPLICATION**

Bowel interposition in screening MR exams of MR-HIFU ablation of the uterus should not be used as an exclusion criterion any longer, except in cases with small size of the uterus.

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**Quasi Static Ultrasound Elastography Characterization of Thrombus Maturation in the Aneurysmal Sac after Embolization of Endoleaks with Chitosan Gels**

**Station #2**

**Participants**

Husain M. Alturkistani, MD, Montreal, QC (Presenter) Nothing to Disclose  
Antony Bertrand-Grenier, Montreal, QC (Abstract Co-Author) Nothing to Disclose  
Elie Salloum, MSc, BEng, Montreal, QC (Abstract Co-Author) Nothing to Disclose  
Guy Cloutier, PhD, Montreal, QC (Abstract Co-Author) Nothing to Disclose  
Sophie Lerouge, Montreal, QC (Abstract Co-Author) Nothing to Disclose  
Gilles P. Soulez, MD, Montreal, QC (Abstract Co-Author) Speaker, Bracco Group Speaker, Siemens AG Research Grant, Siemens AG Research Grant, Bracco Group Research Grant, Cook Group Incorporated Research Grant, Object Research Systems Inc

**PURPOSE**

To study with quasi static ultrasound elastography (QSUE) the maturation of thrombus and the mechanical properties of embolizing gels after endoleak embolization following aneurysm endovascular repair (EVAR).

**METHOD AND MATERIALS**

Common iliac artery aneurysms were created on 9 Mongrel dogs (18 iliac arteries). Then EVAR were performed with creation of a Type I endoleak. Two types of embolization gels [Chitosan (Chi) or Chitosan-Sodium-Tetradecyl-Sulfate (Chi-STS)] were injected equally in the aneurismal sac to seal the endoleak and promote healing. Aneurysms healing and endoleak evolution were followed by Doppler ultrasound and QSUE at 1-week, 1-month, 3-months and for 3 dogs at 6-months. At sacrifice, DSA, CT-scan and
macroscopic and histological analyses were done to identify residual endoleaks (DSA, CT-scan) and segment different regions of interests (ROI) (thrombus, Chi and Chi-STS gel). Elasticity values expressed as strain in percentage were obtained by QSUE and compared between ROIs and during time evolution.

RESULTS
Residual endoleaks were observed at sacrifice in 10 out of 18 aneurismal sacs. There was no significant evolution of thrombus elasticity over time (median for thrombus: 0.12, 0.12, 0.13 and 0.13% at 1-week, 1-month, 3-months and 6-months respectively). The strain values of Chi gel were similar to that of thrombus (median= 0.18, 0.19, 0.13 and 0.27 at 1-week, 1-month, 3-months and 6-months respectively) (P=0.58 at 3-month). Chitosan-STS found to be more solid than thrombus at 1-week (P=0.04). The strain values of chitosan-STS (0.06, 0.06, 0.09 and 0.13 % at 1-week, 1-month, 3-months and 6-months respectively) are lower than chitosan (P=0.02 at 1-month). At 6-months, we notice a degradation of chitosan and chitosan-STS with higher strain values.

CONCLUSION
QSUE was not able to show thrombus maturation post-EVAR. However, it was useful to characterize the elasticity of embolizing gels and their degradation over time.

CLINICAL RELEVANCE/APPLICATION
Quasi-static elastography (QSUE) can be useful after endoleak embolization to assess the mechanical properties of embolizing gels.

VI225-SD-MOB3 Usefulness of the Synchronism Subtraction Method at CT Angiography for Dialysis Patients with Peripheral Arterial Diseases

Participants
Noriyuki Imada, Hiroshima, Japan (Presenter) Nothing to Disclose
Takanori Masuda, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Takayuki Oku, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Tomoyasu Sato, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Kazuo Awai, MD, Hiroshima, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation; Research Grant, Hitachi, Ltd; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Medical Advisor, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Nemoto-Kyourindo; ; ; ; ;
Yukari Yamashita, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
In peripheral arterial diseases (PAD) patients undergoing computed tomography angiography (CTA) of the lower extremities, intravascular contrast enhancement must be adequate for accurate evaluation of the distribution and degree of the lesions. However, it is difficult to evaluate the calcified lesions through CTA in dialysis patients with PAD. One method of evaluation is the synchronism subtraction method with non-enhancement and enhancement images by synchronizing the X-ray orbit. This method can diagnose the stenosis lesion within the calcified vessel without the blooming artifact. This study was performed to compare the detecting of stenosis lesions of the lower-extremity artery by synchronism subtraction CTA (SSCTA) and by digital subtraction angiography (DSA).

METHOD AND MATERIALS
Helical scans of the SSCTA were performed using 64-detector CT (GE VCT with tube voltage 100kVp, tube current 200mA~700mA, detector configuration 32 x 1.25mm, rotation time 0.4s/r, helical pitch 0.516). 84 patients underwent CT and DSA. The vascular tree was divided into 5 segments. The reader independently reviewed the axial scans, multi-planar oblique, three-dimensional (maximum intensity projection and volume rendering) and subtraction reconstruction images to assess stenosis in the vessel.

RESULTS
25 patients could be evaluated without SSCTA in dialysis patients. In 84 patients, 420 segments were evaluated. Compared with DSA, the sensitively, specificity, PPV, NPV and diagnostic accuracy for SSCTA were 89.2%, 81.2%, 94.3%, 68.4% and 87.4% respectively.

CONCLUSION
SSCTA shows potential for diagnosing stenosis lesions within calcified vessel walls of dialysis patients with PAD.

CLINICAL RELEVANCE/APPLICATION
SSCTA can aid in diagnosis of stenosis lesions in calcified vessel walls of dialysis patients.

VI225-SD-MOB4 Use of Whole Liver Volumetric Enhancement Quantification on MRI for Response Assessment and Prediction of Survival after Transarterial Chemoembolization in Infiltrative and Multifocal Hepatocellular Carcinoma - Preliminary Study

Participants
Susanne Smolka, New Haven, CT (Presenter) Nothing to Disclose
Todd Schlachter, MD, Farmington, CT (Abstract Co-Author) Nothing to Disclose
Ruediger E. Schernthaner, MD, Vienna, Austria (Abstract Co-Author) Nothing to Disclose
Julius Chapiro, MD, Berlin, Germany (Abstract Co-Author) Nothing to Disclose
Sonia P. Sahu, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Jae Ho Sohn, MD,MS, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Yan Zhao, MS, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Florian N. Fleckenstein, MS, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Ming De Lin, PhD, Briarcliff Manor, NY (Abstract Co-Author) Employee, Koninklijke Philips NV
Roberto Ardon, Suresnes Cedex, France (Abstract Co-Author) Employee, Koninklijke Philips NV
PURPOSE

The ill-defined borders in infiltrative hepatocellular carcinoma (HCC) and the sheer number of lesions in multifocal HCC can pose a challenge in response assessment after Transarterial Chemoembolization (TACE) with traditional methods (i.e. RECIST, mRECIST, WHO, EASL). Our preliminary study investigates the feasibility of whole liver volumetric enhancement quantification to measure treatment response and predict survival.

METHOD AND MATERIALS

From 2000 to 2014, 68 HCC patients with infiltrative or multifocal growth were retrospectively included and underwent MRI before and 1 month after their first TACE. For each session separately the whole liver was segmented and pre-contrast and arterial phase T1 sequences were subtracted. Viable tumor was identified in voxels enhancing above 2 times the standard deviation of enhancement inside a region of interest (ROI) placed in non-tumorous liver parenchyma, as previous work has shown to correlate with pathology. Hyperenhancing volume was noted in percent relative to the whole liver volume and compared to overall survival (OS). Kaplan-Meier analysis with log-rank test and Cox regression were performed. A threshold at 35% reduction between baseline and follow-up MRI was used to separate responders from non-responders.

RESULTS

Mean age was 63.3 years, 77.9% of patients were male and 64.7% had portal venous invasion. 33.8% of patients showed infiltrative growth pattern only, 33.8% infiltrative with solid parts and 32.4% multifocal HCC (>20 lesions). There was a statistically significant difference between responders and non-responders (p=0.011). The hazard ratio of death for responders was 0.336 (95%CI 0.139-0.810). Responders (14.7% of the patients) had an OS of 21.0±7.0 months, whereas non-responders (85.3%) had an OS of 6.8±1.4 months. Responders had a mean 57.8% decrease in enhancing volume, whereas non-responders on average had a 19.1% increase.

CONCLUSION

Our preliminary findings indicate that whole liver volumetric enhancement quantification on MRI can be used as an imaging biomarker for tumor response and survival in infiltrative and multifocal HCC that evades standard assessment methods.

CLINICAL RELEVANCE/APPLICATION

Response assessment after TACE for infiltrative and multifocal HCC by whole liver volumetric enhancement quantification is possible and can predict survival.

VII141-ED-MO55  CT Angiography and 3-D Imaging of Aortoiliac Occlusive Disease: Collateral Pathways in Leriche Syndrome

Participants
Sameer. Ahmed, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Siva P. Raman, MD, Baltimore, MD (Presenter) Nothing to Disclose
Elliot K. Fishman, MD, Owings Mills, MD (Abstract Co-Author) Research support, Siemens AG Advisory Board, Siemens AG Research support, General Electric Company Advisory Board, General Electric Company Co-founder, HipGraphics, Inc

TEACHING POINTS

Leriche syndrome represents atherosclerotic occlusive disease of the abdominal aorta and/or iliac arteries. This educational exhibit will review the pathophysiology and CT angiographic appearance of Leriche syndrome, and will utilize a combination of 3-D images and medical illustrations to demonstrate a variety of collateral pathways that can develop with aortic or iliac artery occlusions.

TABLE OF CONTENTS/OUTLINE

Background and pathophysiology of aortoiliac occlusion CT Angiography and 3-D technique Collateral pathways following aortoiliac occlusion Case examples (both illustrations and 3-D images) Treatment Conclusion

Honored Educators

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Elliot K. Fishman, MD - 2012 Honored Educator
Elliot K. Fishman, MD - 2014 Honored Educator
**Cardiac CT Mentored Case Review: Part III (In Conjunction with the North American Society for Cardiac Imaging) (An Interactive Session)**

Monday, Nov. 30 1:30PM - 3:00PM Location: S406A

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**LEARNING OBJECTIVES**

1) Identify cardiac and coronary artery anatomy. 2) Recognize cardiac disease processes, including coronary atherosclerosis, as diagnosed on CT. 3) Understand methods of cardiac CT and coronary CT angiography post-processing.

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**Sub-Events**

**MSMC23A  Pulmonary Veins and Pericardial Disease**

Participants
Jacobo Kirsch, MD, Weston, FL (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe normal versus anomalous pulmonary venous anatomy. 2) Understand the imaging findings of complications of ablation for atrial fibrillation. 3) Describe abnormalities of the pulmonary veins identifiable on routine CT. 4) Identify the most common pericardial abnormalities evaluated with CT.

**Honored Educators**

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Jacobo Kirsch, MD - 2013 Honored Educator

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**MSMC23B  Coronary Atherosclerosis III**

Participants
Elliot K. Fishman, MD, Owings Mills, MD (Presenter) Research support, Siemens AG Advisory Board, Siemens AG Research support, General Electric Company Advisory Board, General Electric Company Co-founder, HipGraphics, Inc

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**ABSTRACT**

The goal of this session is to learn how to interpret pathology involving the coronary arteries beyond the detection of coronary artery stenosis. Focus on exam acquisition protocols, study interpretation protocols, and minimizing radiation dose are addressed. Specific topics addressed will also include coronary artery aneurysm, myocardial bridging, anomalous coronary arteries as well as vasculitis. Potential pitfalls will be addressed and pearls for study optimization will also be discussed.

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Elliot K. Fishman, MD - 2012 Honored Educator
Elliot K. Fishman, MD - 2014 Honored Educator
MSCT22

Case-based Review of Thoracic Radiology (An Interactive Session)

Monday, Nov. 30 3:30PM - 5:00PM Location: S100AB

CH  VA  ER

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Diana Litmanovich, MD, Haifa, Israel (Director) Nothing to Disclose

Sub-Events

MSCT22A  Airway Disorders

Participants
Diana Litmanovich, MD, Haifa, Israel (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the current imaging technique for evaluating of airway disorders in adult population, with an emphasis on radiation dose reduction. 2) Learn important clinical aspects and characteristic imaging features (both static and dynamic) of various airways abnormalities. 3) Discuss key imaging findings which allow differentiation among various airway disorders, as well as alternative imaging modalities such as thoracic MRI.

ABSTRACT

MSCT22B  Pulmonary Arteries and Aorta

Participants
Charles S. White, MD, Baltimore, MD (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

To review pathology of the pulmonary arteries and aorta, focusing on cross-sectional imaging.

MSCT22C  Thoracic Civil and Military Trauma

Participants
John P. Lichtenberger III, MD, Bethesda, MD, (john.lichtenberger@usuhs.edu) (Presenter) Author, Reed Elsevier

LEARNING OBJECTIVES

1) Incorporate up-to-date epidemiological understanding of thoracic trauma into clinical practice. 2) Identify key imaging features of thoracic trauma in modern civilian and military settings with an emphasis on those features which alter clinical management. 3) Describe the pathogenesis of blast lung injury, its imaging appearance and prognosis.

ABSTRACT

Thoracic trauma is a key component of clinical practice, and radiological evaluation of trauma patients is integral to their surgical management. The medical understanding of civilian thoracic trauma has historically been informed by experiences in military combat. In turn, the development of modern imaging technology in the civilian sector has revolutionized triage and operative planning of trauma patients in both civilian and military settings. This complex interplay between civilian and military trauma care continues today, particularly with the advent of urban warfare. One example of the applicability of military thoracic trauma to the civilian sector is blast injury, a hallmark of modern combat trauma that has increased significantly in the civilian developed world. Most radiologists will care for thoracic trauma patients in medical treatment facilities equipped with modern imaging and surgical capabilities in a civilian setting and with civilian patterns of injury. However, in addition to conventional trauma radiology, exposure to modern combat-specific trauma cases will continue the educational and mutually beneficial interaction between civilian and military trauma medicine and ultimately benefit patient care.
MSMC24
Cardiac CT Mentored Case Review: Part IV (In Conjunction with the North American Society for Cardiac Imaging) (An Interactive Session)

Monday, Nov. 30 3:30PM - 5:30PM Location: S406A

CA VA CT

AMA PRA Category 1 Credits ™: 2.00
ARRT Category A+ Credits: 2.00

Participants
Pamela K. Woodard, MD, Saint Louis, MO (Director) Research Consultant, Bristol-Myers Squibb Company; Research Grant, Astellas Group; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Bayer AG; Research agreement, Siemens AG; Research Grant, Actelion Ltd; Research Grant, Guerbet SA; David A. Bluemke, MD, PhD, Bethesda, MD (Moderator) Research support, Siemens AG Vincent B. Ho, MD, MBA, Bethesda, MD (Moderator) In-kind support, General Electric Company

LEARNING OBJECTIVES
1) To understand the clinical indications for retrospective ECG gated cardiac CT. 2) To illustrate methods to assess myocardial function from cine cardiac CT images. 3) To illustrate methods to assess normal and abnormal valvular function from cine cardiac CT images.

ABSTRACT
The mentored case review provides the opportunity for the attendees to learn the image acquisition, post-processing, and diagnosis for a wide variety of cardiac diseases commonly encountered in CT.

Sub-Events

MSMC24A Coronary Artery Disease and Incidental Noncardiac Findings

Participants
Frank J. Rybicki III, MD, PhD, Ottawa, ON (Presenter) Research Grant, Toshiba Corporation;

LEARNING OBJECTIVES
1) To review coronary CTA principles, including details related to image acquisition. 2) Demonstrate examples of CAD as depicted by CT. 3) Discuss strategies to assess the hemodynamic significance of individual coronary lesions. 4) Illustrate non-cardiac findings on coronary CTA images.

ABSTRACT
CT Angiography (CTA) is a guideline endorsed strategy to assess symptomatic patients with low to intermediate risk of coronary artery disease in both the non-emergent and emergent settings. Coronary CTA uses ECG gating to freeze cardiac motion and enables assessment of the lumen for stenosis. Coronary CTA has a high negative predictive value, but suffers when a lesion is detected with a moderate stenosis. Emerging CT methods are also exploring the role of CT to assess individual lesions, including ones that have been problematic, for hemodynamic significance. The clinical relevance relates to the fact that only lesions that are hemodynamically significant should undergo intervention, for example with balloon angioplasty and stenting. In addition, each coronary CTA should include images reconstructed “skin to skin” over the entire craniocaudal field of view that encompasses the heart. Thus, incidental lesions can and should be reported for all coronary CTA studies.

MSMC24B Congenital Heart Disease

Participants
Dianna M. Bardo, MD, Seattle, WA (Presenter) Speaker, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Author, Thieme Medical Publishers, Inc

LEARNING OBJECTIVES
1) Recognize the most common congenital heart disease (CHD) findings found in adults with unsuspected CHD. 2) Recognize and understand findings of CHD in patients with known CHD and the findings which may trigger surgical intervention. 3) Recognize the CT findings of commonly performed surgical procedures for palliation of CHD. 4) Develop an organized pattern for search and reporting of CHD findings. 5) Understand why CT is chosen as the advanced imaging modality over MR.

ABSTRACT
Adults with congenital heart disease (CHD) now outnumber children with CHD two to one. This phenomenon is due to the success of surgical palliation and medical management of patients with even the most severe forms of CHD. Surgical intervention is often performed at the time of diagnosis and in patients with residual hemodynamic lesions is often required throughout life. Though echocardiography is typically the initial imaging modality of choice, diagnosis and imaging surveillance of complex hemodynamic and anatomic CHD lesions is now most often accomplished with CT and MR. CT and CTA imaging techniques may be used to show detailed anatomic and functional images of the heart, postoperative changes and long term consequences of CHD. An organized, reproducible approach to identify cardiac anatomy of CHD lesions and surgical palliation should be adopted in order to accurately and thoroughly describe findings.

MSMC24C Coronary Atherosclerosis and Bypass Grafts

Participants
Gautham P. Reddy, MD, Seattle, WA (Presenter) Nothing to Disclose
LEARNING OBJECTIVES

1) Identify focal areas of stenosis in the coronary arteries on CT. 2) Describe the appearance of bypass graft stenosis on coronary CT. 3) Review the diagnosis of aneurysms in the native coronary arteries and in bypass grafts.

ABSTRACT

Honored Educators

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Gautham P. Reddy, MD - 2014 Honored Educator
Molecular Imaging Symposium: Case-based MI

Monday, Nov. 30 3:30PM - 5:00PM Location: S405AB

CA NR VA MI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Vikas Kundra, MD, PhD, Houston, TX (Moderator) License agreement, Introgen Therapeutics, Inc
Jeffrey T. Yap, PhD, Salt Lake City, UT (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify molecular imaging. 2) Comprehend the basis of aspects of molecular imaging. 3) Describe molecular imaging performed in a radiology setting.

ABSTRACT
This course will describe molecular imaging, identify the mechanisms of some aspects of molecular imaging, and give examples of molecular imaging in oncology. Cases will include those from current practice. Mechanisms and scientific basis of examples will be discussed. Sample applications will be discussed and illustrated. Translational examples, including those that have good potential for clinical application, will be used to illustrate interesting aspects of molecular imaging in oncology.

Sub-Events

Participates
Vikas Kundra, MD, PhD, Houston, TX (Presenter) License agreement, Introgen Therapeutics, Inc

LEARNING OBJECTIVES
View learning objectives under main course title.

Participants
Rathan M. Subramaniam, MD, PhD, Baltimore, MD, (rsubram4@jhmi.edu) (Presenter) Travel support, Koninklijke Philips NV

LEARNING OBJECTIVES
View learning objectives under main course title.

Participants
Robert J. Gropler, MD, Saint Louis, MO (Presenter) Advisory Board, Bracco Group Advisory Board, GlaxoSmithKline plc Advisory Board, Pfizer Inc Advisory Board, Bayer AG Research Grant, GlaxoSmithKline plc Research Grant, Pfizer Inc Research Grant, Clinical Data, Inc Research Grant, Lantheus Medical Imaging, Inc

LEARNING OBJECTIVES
View learning objectives under main course title.

Participants
Chun Yuan, PhD, Seattle, WA (Presenter) Research Grant, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; ;

LEARNING OBJECTIVES
View learning objectives under main course title.

Participants
Jeffrey T. Yap, PhD, Salt Lake City, UT (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.
**RC312-01** Non-contrast MRA Techniques

**Participants**
Dominik Fleischmann, MD, Palo Alto, CA (Moderator) Research support, Siemens AG;
Scott B. Reeder, MD, PhD, Madison, WI (Presenter) Institutional research support, General Electric Company Institutional research support, Bracco Group

**Purpose**
To evaluate the ability to depict anatomy and complications of renal vascular transplant with unenhanced magnetic resonance (MR) angiography with spatial labeling with multiple inversion pulses (SLEEK) and to compare the results with color Doppler (CD) ultrasonography (US), digital subtraction angiography (DSA), and intraoperative findings.

**Method and Materials**
This study was approved by the institutional review board, and written informed consent was received before examination. Seventy-five patients who underwent renal transplantation were examined with unenhanced MR angiography with SLEEK and CD US. DSA was performed in 15 patients. Surgery was performed in eight patients. The ability of SLEEK to show transplant renal vascular anatomy and complications was evaluated by two experienced radiologists who compared the results with CD US, DSA, and intraoperative findings.

**Results**
Patients successfully underwent SLEEK MR angiography. Transplant renal vascular anatomy was assessed in 87 arteries and 78 veins. Renal vascular complications from transplantation were diagnosed in 23 patients, which included 14 with arterial stenosis, three with arterial kinking, two with arteriovenous fistulas, two with venous stenosis, one with pseudoaneurysms, and one with fibromuscular dysplasia. Three patients had two renal transplants and nine patients had nine accesssory renal arteries. More accessory renal arteries were detected with SLEEK than with CD US. Correlation was excellent between the stenosis degree with SLEEK and DSA (r = 0.96; P < .05). For those with significant artery stenosis (.50% narrowing) proved with DSA (n = 7) or surgery (n = 3), positive predictive value was 91% (10 of 11).

**Conclusion**
Unenhanced MR angiography with SLEEK preliminarily proved to be a reliable diagnostic method for depiction of anatomy and complications of renal vascular transplant. It may be used for evaluation of patients with renal transplant, and in particular for those with renal insufficiency.

**Clinical Relevance/Application**
Unenhanced MR angiography with SLEEK may be used for evaluation of patients with renal transplant, and in particular for those with renal insufficiency.
**PURPOSE**

To assess the clinical value of nonenhanced ECG-gated Quiescent-Interval Single-Shot MR angiography (QISS-MRA) for planning of interventional procedures in patients with peripheral artery disease (PAD).

**METHOD AND MATERIALS**

43 patients (mean age 68.5 ± 10.8 years) with peripheral artery disease were included in this study. Nonenhanced QISS-MRA of the distal aorta and the lower extremity were acquired at 1.5T with 3mm slice thickness, with 0.6 mm overlap and an inplane resolution of 1.0 x 1.0 mm, resulting in a total scan time of approx. 9 min. ECG-gating was applied for synchronization of the quiescent interval with the period of maximum systolic inflow. The degree of stenosis was assessed by using a 4-point scale (grade 1, normal appearing vessel; grade 2, vessel narrowing < 50%; grade 3, stenosis 50%-99%; grade 4, vessel occlusion) for 15 predefined anatomical segments. QISS-MRA was used to plan interventional procedures. Interventional digital subtraction angiography (DSA) served as the reference standard.

**RESULTS**

QISS-MRA was performed successfully in all patients. 434 of 645 segments visible on QISS-MRA were evaluated with DSA during interventional procedures and were considered for further analysis. With QISS-MRA the degree of stenosis was assessed correctly in 404 of 434 (93.1%) segments, overestimated in 26 of 434 (5.9%) segments and underestimated in 4 of 434 (0.9%) segments. As compared to DSA, QISS-MRA had a high sensitivity (99.3%), specificity (97.2%) as well as positive and negative predictive value (89.3% and 97.3%) for the detection of significant stenosis (grade 3 and 4). Based on QISS-MRA, an appropriate arterial access was selected in all patients and the estimated length of stenosis or vessel occlusion was assessed correctly. 6 of 6 (100%) stented segments were not assessable.

**CONCLUSION**

ECG-gated QISS-MRA is a reliable imaging technique for assessment of stenosis of the lower extremities and provides a reliable basis for interventional procedures. A limitation of QISS-MRA is the evaluation of stented segments.

**CLINICAL RELEVANCE/APPLICATION**

QISS-MRA is a reliable and precise nonenhanced imaging technique for assessment of peripheral arterial disease and can be applied safely in patients with contraindications for contrast material.

**RC312-04 Qualitative and Quantitative Image Quality of Lower Extremity Angiography Using Non-Contrast-Enhanced Quiescent Interval Single-Shot (QISS) MRA: Comparison with CTA**

Tuesday, Dec. 1 9:15AM - 9:25AM Location: S102AB

Participants

Akos Varga-Szemes, MD, PhD, Charleston, SC (Presenter) Nothing to Disclose
Giuseppe Muscogiuri, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Carlo N. De Cecco, MD,PhD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Pal Suranyi, MD, PhD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Julian L. Wichmann, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
U. Joseph Schoepf, MD, Charleston, SC (Abstract Co-Author) Research Grant, Bracco Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; ; ;
Stefanie Mangold, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Paola Maria Cannao, MD, San Donato Milanese, Italy (Abstract Co-Author) Nothing to Disclose
Shivramani Giri, PhD, Chicago, IL (Abstract Co-Author) Employee, Siemens AG
Thomas M. Todoran, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate the qualitative and quantitative image quality of non-contrast quiescent interval single-shot (QISS) MRA in patients with peripheral artery disease (PAD).

**METHOD AND MATERIALS**

Twenty patients (67±6 years, 11 male) with PAD referred for a clinically indicated lower extremity CTA were consented for a non-contrast enhanced lower extremity MRA on a 1.5 clinical scanner (MAGNETOM Avanto, Siemens AG, Erlangen, Germany) using an investigational prototype QISS sequence (FOV 400x260mm2, TR/TE 3.5/1.4ms, flip angle 90°, acquisition length 144mm). Contrast to noise ratio (CNR) based on the vascular and peri-vascular signal was measured according to an 18-segment model. The segmental vascular enhancement and the image noise were rated on five-point scales (1-poor/non-diagnostic, 5-excellent) by two readers. Additionally, the number of non-diagnostic segments were counted and compared between CTA and QISS-MRA.

**RESULTS**

A total of 360 segments were evaluated. The average CNR measured in QISS-MRA images was 63.4±17.5. QISS-MRA vascular enhancement ratings by the two readers were 3.7±0.5 and 3.8±0.4, respectively, while the CTA readings were 4.0±0.4 and 4.1±0.5, respectively, resulting in no significant difference between the two modalities. QISS-MRA image noise ratings were 3.4±0.7 and 3.6±0.5, respectively, while those for CTA were 4.0±0.5 and 4.2±0.5, respectively. Excellent inter-reader agreement was found in image quality ratings (κ>0.8). Thirty-one segments (8.6%) were excluded from the CTA analysis due to stent artifacts (11), total occlusion (14), or heavy calcification (6) and 26 segments (7.2%) were non-diagnostic at MRA due to major image artifacts (12) or total occlusion (14). Five out of the six heavily calcified segments were diagnostic at QISS MRA.

**CONCLUSION**

In this study, image quality of non-contrast QISS-MRA was comparable to that of contrast enhanced CTA. In certain circumstances, such as in heavily calcified segments, QISS-MRA provides superior lumen visibility compared to CTA. Such a non-contrast technique may have potential advantage in patients with severe renal disease or with other risk factors that prohibit the use of iodinated or gadolinium-based contrast material.

**CLINICAL RELEVANCE/APPLICATION**

QISS-MRA enables non-contrast evaluation of the lower extremity arteries with comparable image quality to CTA, and is potentially
**CONCLUSION**

One-stop-shop Gd-EOB-DTPA-enhanced MRI is a more cost-effective and convenient modality with the similar diagnostic accuracy beneficial for patients with severe renal disease.

**RC312-05 Role of Preoperative Dynamic Time Resolved MRA (DTR MRA) for Detection and Localization of Perforators in Patients Undergoing Free Fibula Flap (FFF) for Head and Neck Reconstruction**

Tuesday, Dec. 1 9:25AM - 9:35AM Location: S102AB

Participants
Manohan Kuruva, MBBS, MD, Little Rock, AR (Presenter) Nothing to Disclose
Mauricio A. Moreno, MD, Little Rock, AR (Abstract Co-Author) Nothing to Disclose
Tarun Pandey, MD, FRCR, Little Rock, AR (Abstract Co-Author) Nothing to Disclose
Roopa Ram, MD, Little Rock, AR (Abstract Co-Author) Nothing to Disclose
Kedar Jambhekar, MD, Little Rock, AR (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

This study aimed at evaluating the accuracy of preoperative DTR MRA for the detection and localization of lower extremity septocutaneous perforators in patients undergoing free fibula flap (FFF) for head and neck reconstruction.

**METHOD AND MATERIALS**

Retrospective chart review of 43 patients who underwent pre-operative DTR MRA prior to FFF in a tertiary academic setting from 2009-2015. DTR MRA scans were evaluated for presence of perforators and their location relative to fibular head, and subsequently correlated with intra-operative findings. We considered location of perforator to be in concordance if the vessel was within 3cm based on DTR MRA and surgical findings, and hypothesized that differences within this range could represent distal perforator branches presenting radiologically as separate vessels.

**RESULTS**

DTR MRA and surgery identified at least one perforator in 42/43, and 41/43 patients respectively.

**CONCLUSION**

DTR MRA accurately predicts the presence and location of cutaneous perforators in patients undergoing FFF reconstruction.

**CLINICAL RELEVANCE/APPLICATION**

To our knowledge, this is one of the largest study validating the role of MRA for this purpose. Preoperative localization of the vessels significantly impacts surgical planning and may prevent unnecessary surgical explorations in a percentage of patients.

**RC312-06 One-stop-shop Preoperative Evaluation for Living Liver Donors with Gd-EOB-DTPA-enhanced MRI: Can it be More Cost-effective and Convenient?**

Tuesday, Dec. 1 9:35AM - 9:45AM Location: S102AB

Participants
Shuanghuang Xie, Tianjin, China (Presenter) Nothing to Disclose
Wen Shen, Tianjin, China (Abstract Co-Author) Nothing to Disclose
Chenhao Liu SR, PhD,PhD, Tianjin, China (Abstract Co-Author) Nothing to Disclose
Tao Ren, Tianjin, China (Abstract Co-Author) Nothing to Disclose
Lihua Chen, Tianjin, China (Abstract Co-Author) Nothing to Disclose
Lixiang Huang, MD, Tianjin, China (Abstract Co-Author) Nothing to Disclose
Yue Cheng, Tianjin, China (Abstract Co-Author) Nothing to Disclose
Qian Ji, PhD, Tianjin, China (Abstract Co-Author) Nothing to Disclose
Jianzhong Yin, MD, Tianjin, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To compare the efficacy, cost-effectiveness and convenience between one-stop-shop gadobenate-dyacid-disodium (Gd-EOB-DTPA)-enhanced MR imaging (MRI) and multi-detector CT combined with conventional magnetic resonance cholangiopancreatography (MDCT-MRCP) in preoperative evaluation for living liver donors.

**METHOD AND MATERIALS**

Eighty living liver donors were included in this prospective study. They were randomly grouped in Gd-EOB-DTPA-enhanced MRI group (n=40) and MDCT-MRCP group (n=40). Anatomical variations determined by pre- and intra-operative findings, costs, and time for preoperative images were recorded. Image quality for the depiction of hepatic vessels, bile ducts and graft volume were ranked on a 4-point scale and compared between both groups.

**RESULTS**

Gd-EOB-DTPA-enhanced MRI provided better image quality than MDCT-MRCP for the depiction of hepatic and portal veins, and graft volume by both reviewers (P<0.01), and for the depiction of bile ducts by one reviewer (P<0.01). MDCT provided better image quality than Gd-EOB-DTPA-enhanced MRI for the depiction of hepatic arteries by both reviewers (P<0.01). Fifty nine living donors proceeded to liver donation (n=21 for Gd-EOB-DTPA-enhanced MRI group and n=38 for MDCT-MRCP group) with all anatomical findings of hepatic vessels and bile ducts accurately confirmed by intraoperative findings (P>0.05). The repeatability for graft volume measurements on Gd-EOB-DTPA-enhanced MRI was higher than MDCT-MRCP (US$519.72 vs US$631.85). The effective “in room” time in the Gd-EOB-DTPA-enhanced MRI was 3 minutes longer than MDCT-MRCP (25±5 min vs 28±6 min, P<0.05).

**CONCLUSION**

One-stop-shop Gd-EOB-DTPA-enhanced MRI is a more cost-effective and convenient modality with the similar diagnostic accuracy.
4D flow can depict and quantify the prominent retrograde flow during early diastole, which is closely related to the presence of peripheral arteries.

**CONCLUSION**

Majorities of physiological evidences indicate that the increase of Oscillatory Shear Index (OSI) produces an expression of pro-atherogenic genes. In patients with arteriosclerosis, reflected flow appears within the lower abdominal aorta during early diastolic phase. 3D cine PC MRI (4D-Flow) has enabled the coverage of full spatial and cardiac phase resolved data of the velocity vectors of the flowing blood within the whole abdominal aorta, whereby allow OSI mapping and flow volume analysis. The purpose of our study was to test if 4D Flow can depict reflected flow in the lower abdominal aorta, to quantitate the retrograde flow volume, and to verify their association with atherosclerosis, in the non-dilated lower abdominal aorta.

**METHOD AND MATERIALS**

37 patients (30 to 84 y.o.) underwent 3.0T MR study including 4D-Flow and Gd-3D MRA. The wall shear stress (WSS), the OSI, and aortic flow volume were measured for abdominal aorta. The ratio of retrograde to antegrade flow (R/A ratio) was calculated. Two experienced radiologists rated the presence of atherosclerosis in three grades in terms of the presence of the intimal lipidemic deposits with CT. Multiple regression analysis with explanatory variables of age, sex, systolic and diastolic blood pressure, diameters, systolic and diastolic WSS, OSI, maximum progressive and retrograde flow volume, and the R/A ratio was performed. The response variable was CT determinations of atheroma in the lower abdominal aorta.

**RESULTS**

Among flow dynamic parameters R/A ratio (p=0.019), and OSI (p=0.0364) were the determinant factors for the presence of atheroma. Prominent back flow collided with antegrade flow was also visually observed at early diastole in atherosclerotic patients and was considered to have induced instable shear stress directions, which resulted in higher OSI. The prominent retrograde flow represents reflected flow from the iliac arteries, which may be due to the lack of compliance of the atherosclerotic aorta and peripheral arteries.

**CONCLUSION**

4D flow can depict and quantify the prominent retrograde flow during early diastole, which is closely related to the presence of peripheral arteries.
atheroma in the lower abdominal aorta.

**CLINICAL RELEVANCE/APPLICATION**

4DFlow could be an indicator of a loss of arterial volumetric compliance and increased OSI in the lower abdominal aorta, which might be the initiation factors of atherosclerotic degradation that leads to various fatal aortic diseases.

**RC312-10**  
**Assessment of Wall Shear Stress in Patients without Aortic Disease, with Aortic Aneurysms and with Penetrating Aortic Ulcers using Velocity Encoding 4D MRI**

**Participants**
Michael Rasper, Munich, Germany (Presenter) Nothing to Disclose
Jan Rudolph, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Christian Maegerlein, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Bettina M. Gramer, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Marcus Settles, PhD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Christian Reeps, MD, Muenchen, Germany (Abstract Co-Author) Nothing to Disclose
Hans-Henning Eckstein, MD, Muenchen, Germany (Abstract Co-Author) Nothing to Disclose
Ernst J. Rummey, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Armin M. Huber, MD, Muenchen, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To determine whether patients with aortic aneurysms and penetrating aortic ulcers have an increased or reduced peak average wall shear stress magnitude compared to patients without aortic disease.

**METHOD AND MATERIALS**
26 patients (10 patients without aortic disease, 8 patients with aortic aneurysms (AA) and 8 patients with penetrating aortic ulcers (PAU)) underwent velocity encoded time resolved 3D MRI (4D PC MRI) of the aorta after contrast material (0.15 mmol/kg gadobenate dimeglumine) application during high resolution contrast-enhanced MR angiography of the aorta. 4D PC MRI was performed using ECG Gating and navigator echo based respiratory gating. Data acquisition was accelerated by SENSE in two directions (AF 1.5 x 2.5). The spatial resolution was 1.5 x 1.5 x 1.5 mm3. The temporal resolution was 40 ms. The peak velocity and the peak average wall shear stress magnitude were determined using the software GT-Flow (Version 2.0.10, Gyrotools, Switzerland).

**RESULTS**
The peak velocity was 71.6 ± 6.8 cm/s in patients without aortic disease, 35.6 cm/s ± 3.2 cm/s in patients with penetrating aortic ulcer and 18.2 ± 2.7 cm/s in patients with aortic aneurysms. The peak average wall shear stress magnitude was 0.35 ± 0.09 N/m2 in patients without aortic disease, 0.13 ± 0.004 N/m2 in patients PAU and 0.07 ± 0.0.018 N/m2 in AA patients. Both patients with aortic ulcers and patients with aortic aneurysms showed lower mean values for peak velocity (p < 0.001 and p < 0.00001) and peak average wall shear stress magnitude (p < 0.01 and p < 0.004) compared to patients without aortic disease. Patients with AA had significantly lower wall shear stress magnitude values than PAU patients.

**CONCLUSION**
Compared to patients without aortic disease, peak velocity and wall shear stress were significantly reduced in patients with penetrating aortic ulcers and patients with aortic aneurysms.

**CLINICAL RELEVANCE/APPLICATION**
Aortic segmental wall shear stress and flow velocity can reliably be determined with velocity encoded 4D MRI. Reduced wall shear stress is associated with atherosclerosis growth and might therefore help to identify patients at risk.

**RC312-11**  
**A Speeding Ticket for Perfusion MRI? Acceleration Techniques and Their Effect on Arterial Input Function Sampling: Non-accelerated versus View-sharing and Compressed Sensing Sequences**

**Participants**
Matthias Benz, MD, Basel, Switzerland (Presenter) Nothing to Disclose
Georg M. Bongartz, MD, Basel, Switzerland (Abstract Co-Author) Research Grant, Bayer AG; Research Grant, Siemens AG; Research Grant, Guerbet SA
Sebastian T. Schindera, MD, Basel, Switzerland (Abstract Co-Author) Research Grant, Siemens AG; Research Grant, Ulrich GmbH & Co KG; Research Grant, Bayer AG
Johannes M. Froehlich, PhD, Bern, Switzerland (Abstract Co-Author) Consultant, Guerbet SA
Tobias Heye, MD, Basel, Switzerland (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
Initiatives such as the Quantitative Imaging Biomarkers Alliance and the American College of Radiology Imaging Network seek to identify sources of variation that may contribute to the overall measurement error in dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI). The aim of this study was to determine the ability of various DCE-MRI sequences to image the arterial input function (AIF) of an arterial bolus in comparison to a reference standard in a flow-phantom.

**METHOD AND MATERIALS**
The dynamic flow-phantom consists of three input ports representing the venous backflow and three mixing chambers simulating the cardiopulmonary circulation with 4L/min. A 25 mm diameter cylindrical outflow representing the aorta, a water- and a muscle-phantom were scanned on a 3T MRI (Magnetom Prisma, Siemens Healthcare, Erlangen, Germany) using fast low angle shot 2D (FL2d; temporal resolution [tr] 0.6s; reference standard) and 3D (FL3d; tr 2.4s [P2=parallel imaging factor 2] and 3.9s), time-resolved imaging with stochastic trajectories (TWIST; tr 2.2s), and golden-angle radial sparse parallel imaging (GRASP, tr 1.1s) GRE sequences. Each acquisition with administration of 10 ml contrast agent (Dotarem, Guerbet) via a power injector (2ml/s flow rate)
was repeated three times. Essential sequence parameters were standardized: flip angle 15°; spatial resolution 2.3x2.3x3mm3. Signal over time curves were normalized and analyzed by full width half maximum (FWHM) measurements to assess within sequence (coefficient of variation [COV]) and between sequence variations (percentage difference).

RESULTS

Water and muscle signal COV ranged from 0.1-0.8%. Within sequence FWHM COV was 1.0% for Fl3d, 1.0% for Fl3dP2, 9.1% for TWIST and 0.3% for GRASP. Percentage difference FWHM in comparison to Fl2d as reference standard was 2.2% for Fl3d, 0.3% for Fl3dP2, 45.9% for TWIST, and 7.8% for GRASP.

CONCLUSION

MRI acceleration techniques vary in reproducibility and sampling of arterial input function. Incomplete coverage of the k-space with TWIST as representative of view-sharing techniques demonstrates incoherent data over time and thus limitations in the evaluation of AIF.

CLINICAL RELEVANCE/APPLICATION

In order to establish DCE-MRI as a reproducible quantitative imaging biomarker it is necessary to assess how various forms of accelerated sequences handle the dynamic signal over time.

RC312-12  Clinical Impact of MRA in Site Selection in Patients Undergoing Free Fibular Flap Transfer (FFF)

Participants
Manohar Kuruva, MBBS, MD, Little Rock, AR (Presenter) Nothing to Disclose
Roopa Ram, MD, Little Rock, AR (Abstract Co-Author) Nothing to Disclose
Kedar Jambhekar, MD, Little Rock, AR (Abstract Co-Author) Nothing to Disclose
Mauricio A. Moreno, MD, Little Rock, AR (Abstract Co-Author) Nothing to Disclose
Tarun Pandey, MD, FRCR, Little Rock, AR (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate the role and clinical impact of Dynamic Time-Resolved Magnetic Resonance Angiography (DTR MRA) for selecting the site for free fibula flap (FFF) harvest.

METHOD AND MATERIALS

A retrospective review of medical records of 69 patients who underwent pre-operative lower extremity DTR MRA prior to head and neck reconstructive surgery was done. Clinical findings were compared with MRA in determining the appropriate site of graft harvest.

RESULTS

DTR MRA identified vascular abnormalities, which led to change in management plan in 18/67 (27%) patients. Clinical findings were abnormal only in 4/18 (22%) of these patients. The two most common abnormalities included atherosclerotic narrowing (12 patients) and anatomical variations (4 patients). DTR MRA had significantly higher sensitivity to detect vascular abnormalities with implications in management than clinical examination alone (p=0.002). Addition of venous phase of imaging led to clinically occult venous pathologies in 4 patients, including deep venous thrombosis (2), varicose veins (1) and arteriovenous malformation/fistula (1).

CONCLUSION

Preoperative DTR MRA detected significant vascular abnormalities in patients undergoing FFF for head and neck reconstructive surgeries when compared to clinical examination, with a change in management in 28% of patients.

CLINICAL RELEVANCE/APPLICATION

DTR MRA prior to FFF can identify vascular pathology and anatomic variations and can potentially reduce the rate of complications and morbidity post fibular transfer for head and neck reconstructive surgeries.

RC312-13  Contrast-enhanced T1 Free-breathing Gradient Echo Sequences in the Assessment of Aortic Disease: Diagnostic Efficacy in Comparison with Standard T1 Breath-hold Gradient Echo Sequences

Participants
Cammillo R. Talei Franzesi, Milan, Italy (Presenter) Nothing to Disclose
Davide Ippolito, MD, Monza, Italy (Abstract Co-Author) Nothing to Disclose
Pietro A. Bonaffini, MD, Monza, Italy (Abstract Co-Author) Nothing to Disclose
Davide Fior, MD, Monza, Italy (Abstract Co-Author) Nothing to Disclose
Giulia Querques, MD, Monza, Italy (Abstract Co-Author) Nothing to Disclose
Sandro Sironi, MD, Monza, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE

To assess the diagnostic accuracy of contrast-enhanced T1 free-breathing gradient echo sequences in comparison with standard MR-angiographic sequences in the evaluation of aortic disease.

METHOD AND MATERIALS

From January 2012 to January 2015, 57 patients (35 men; mean age 62.1 years) with aortic disease were evaluated. All patients were examined with a 1.5T magnet (Achieva, Philips), using a phased array multi-coil, after the intravenous injection of 0.1 mL*Kg of gadobutrol. The standard thoracoabdominal MR angiography (MRA) protocol included 3D-angiographic T1 gradient-echo fat-suppressed (3D-HR) sequences and T1 breath-hold gradient-echo fat-suppressed sequences (THRIVE). Multplanar T1 free-breathing gradient-echo fat-suppressed (THRIVE-FB) sequences were additionally performed in all the examinations. Two
radiologists independently compared the diagnostic quality of the different angiographic sequences, in terms of visualization of aortic wall and lumen and main arterial branches. The vascular calipers at different aortic levels were calculated, compared and statistically analyzed among the different sequences. The interobserver agreement was then evaluated using the Intraclass Correlation Coefficient (ICC).

RESULTS

THRIVE-FB sequences showed high diagnostic accuracy in the assessment of vascular calipers and walls, with no significant differences in comparison with standard breath-hold sequences. They also demonstrated high sensitivity and specificity in the evaluation of vascular plaques, thrombus and adjacent structures. Not significant differences were obtained in terms of overall diagnostic quality between THRIVE-FB sequences and standard angiographic sequences (interobserver agreement ICC of 0.97).

CONCLUSION

Contrast-enhanced T1 free-breathing gradient-echo fat-suppressed sequences have shown higher diagnostic efficacy, with any significant differences, in comparison with standard breath-hold angiographic sequences, permitting to correctly visualize and evaluate the aorta and its major branches.

CLINICAL RELEVANCE/APPLICATION

Free-breathing angiographic protocol represents a useful tool, even in not-compliant patients, offering high diagnostic quality images, able to correctly evaluate thoracic and abdominal arteries.

Participants
Tim Leiner, MD, PhD, Utrecht, Netherlands, (t.leiner@umcutrecht.nl) (Presenter) Speakers Bureau, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, Bracco Group

LEARNING OBJECTIVES

1) To identify how MRI can contribute to understanding the pathophysiology of non-cardiac vascular disease and to describe its merits and shortcomings in relation to other commonly used imaging modalities. 2) To describe different MR methods that can be used to study vascular disease such as vessel wall imaging, atherosclerotic plaque imaging and measurement of pulse wave velocity. 3) To explain which of the above MR methods can be used clinically, and which methods are primarily experimental.
Pediatric Series: CV/Chest

Tuesday, Dec. 1 8:30AM - 12:00PM Location: E353A

Sub-Events

RC313-01 Imaging of Aortopathies

Tuesday, Dec. 1 8:30AM - 8:50AM Location: E353A

Participants
Shreyas S. Vasanawala, MD, PhD, Palo Alto, CA (Moderator) Research collaboration, General Electric Company; Consultant, Arterys; Research Grant, Bayer AG;
Lorna Browne, MD, FRCR, Denver, CO (Moderator) Nothing to Disclose
Martine J. Remy-Jardin, MD, PhD, Lille, France (Moderator) Research Grant, Siemens AG
Rajesh Krishnamurthy, MD, Bellaire, TX (Moderator) Research support, Koninklijke Philips NV; Research support, Toshiba Corporation

LEARNING OBJECTIVES
1) Define aortopathy. 2) Describe the imaging features of common aortopathies. 3) Show potential complications associated with aortopathies.

RC313-02 4D flow MRI Based Volumetric Aortic Peak Velocity Quantification: Efficiency, Observer Variability and Comparison to 2D Phase Contrast MRI

Tuesday, Dec. 1 8:50AM - 9:00AM Location: E353A

Participants
Cynthia K. Rigsby, MD, Chicago, IL, (crigsby@luriechildrens.org) (Presenter) Nothing to Disclose

PURPOSE
Standard methods for measuring peak blood flow velocity include Doppler echocardiography and 2D CINE phase contrast (PC) MRI. Due to their reliance on single-direction velocity encoding and regional flow analysis (2D planes) both methods can underestimate peak velocities, especially in cases of complex flow jets as commonly seen in patients with abnormal aortic valves. The aim of this study was to test the feasibility and efficiency of a new method for volumetric peak velocity quantification of aortic peak systolic blood flow velocities in a cohort of pediatric BAV patients using 4D flow MRI and velocity maximum intensity projections (MIPs).

METHOD AND MATERIALS
51 pediatric BAV patients (age = 14 ± 5, range = 3-24 years, 18 female) underwent aortic 4D flow MRI (1.5T Aera, Siemens, Germany). After pre-processing (velocity anti-aliasing, phase offset correction) and 3D segmentation of the aorta, velocity MIPs were generated to determine peak velocities in the ascending aorta, arch, and descending aorta by two independent observers. 4D flow derived peak velocities were compared to results from 2D CINE PC MRI from the same study for 36 BAV patients.

RESULTS
4D flow peak systolic velocities were significantly higher than 2D CINE PC MRI (2.02±0.72 m/s vs 1.72±0.81 m/s, p = 0.0001, Wilcoxon signed-rank test). Bland-Altman analysis of peak velocity assessment showed excellent inter-observer variability (mean difference = -0.005 m/s, limits of agreement = ± 0.192 m/s) with low average inter-observer error 2.0 %. The estimated time for 4D flow MRI pre-processing and segmentation was 20 min. Average analysis time (calculation of velocity MIP, ROI analysis) was 92 ± 49 s.

CONCLUSION
4D flow MRI in combination with 3D segmentation of the aorta and velocity MIP analysis can be used to determine aortic peak systolic velocity with high efficiency and low observer variability. The full volumetric coverage and 3-directional velocity of 4D flow MRI fully captures complex aortic flow patterns and is thus better suited to identify the highest velocity in an entire aortic segment compared to 2D CINE PC MRI, which underestimated peak velocities in our BAV cohort by 15%.

CLINICAL RELEVANCE/APPLICATION
In patients with aortic valve disease such as bicuspid aortic valve (BAV), the severity of valve disease is characterized using peak blood velocity to estimate the peak transvalvular pressure gradient (via the simplified Bernoulli equation).
PURPOSE
Preoperative assessment of VSDs is routinely performed by echocardiography. However, it seems to be challenging to obtain precise and reproducible findings, due to the limited angulations that are available. Additional preoperative evaluation by Computed Tomography (CT) has become reasonable in the recent years for complex congenital heart disease and allow for assessment of the size of VSDs in a static and isovolumetric dataset. Our aim was to evaluate the accuracy of size measurement of congenital ventricular septal defects (VSD) using High Pitch Computed Tomography Angiography of the thorax compared to echocardiography and intraoperative findings in children with congenital heart disease below 1 year.

METHOD AND MATERIALS
Angiography of the chest was performed using a second and third generation Dual-Source CT in 54 patients (median age 7 days, range 1-348 days) with a high-pitch protocol (p=3.2-3.4) at low tube voltages (70-80 kV). The margins of the VSDs were angulated by Multiplanar Reformations and Minimum Intensity Projection (MinIP) was used to overcome partial volume effects. The results were compared to the measurements from echocardiography and intraoperative measurements served as reference.

RESULTS
Mean deviation of the CT-measurements compared to the intraoperative findings was not statistically significant (3.5 ± 3.0 mm, p=0.21), while the mean difference compared to echocardiography was significantly higher (7.4 ± 4.8 mm, p<0.01). The VSDs can be classified into four different types by CT. With the exception of apical septal defects the size of the defects seems not to correlate with a specific location. Median radiation dose was as low as 0.37 mSv (range 0.12 - 2.00 mSv).

CONCLUSION
High Pitch Computed Tomography Angiography of the thorax provides precise measurements of VSDs in pediatric patients with congenital heart disease younger than one year.

CLINICAL RELEVANCE/APPLICATION
Preoperative High Pitch Computed Tomography Angiography of the thorax, besides the advantages in imaging of the coronaries and great intrathoracic vessels, provides precise measurements of VSDs at reasonable low radiation dose.
ratio (SNR), were assessed. Wilcoxon test was used to compare subjective image quality between cCTA and MRA.

**RESULTS**

The acquisition time of the SN3D MRA was 5.9±1.4 min with an average heart rate of 81 bpm, while the mean SNR was 27±9. MRA and cCTA image quality ratings were 2.3±0.7 and 3.3±0.7, respectively (p>0.05). SN3D MRA allowed the visualization of the left main, the LAD and the RCA with good agreement to cCTA in all cases, but failed to visualize the LCX in a single case.

**CONCLUSION**

In this preliminary study there was good agreement for the evaluation of coronary artery anatomy between SN3D MRA and cCTA. The novel radial SN3D sequence allows for the acquisition of an isotropic volume in a free-breathing fashion in about half the time as a standard respiratory-navigated coronary MRA, with an improved ease of use, without penalties in image quality, and without radiation exposure, contrast agent administration or the need for general anesthesia.

**CLINICAL RELEVANCE/APPLICATION**

This non-contrast self-navigated MRA sequence provides relatively rapid, free-breathing radiation-free evaluation of anomalies of the coronary artery origin and proximal course in children.

**PURPOSE**

While 3D CT angiography (CTA) images are useful for evaluating the complex anatomy in patients with congenital heart disease, they require higher contrast enhancement to identify blood vessels and soft tissues. However, the thin pediatric vessel wall imposes an injection pressure limit and can result in poor CT enhancement. As the gauge of the fenestrated is smaller than of the conventional non-fenestrated catheter, optimal enhancement can be achieved by controlling the injection pressure. We compared the injection rate, aortic enhancement, and injection pressure when intravenous contrast material was injected with fenestrated- and conventional non-fenestrated catheters.

**METHOD AND MATERIALS**

We randomly divided 34 pediatric patients seen between December 2014 and March 2015 into two groups. Group A consisted of 18 children (age one week to 8 months, body weight 3.6 ± 1.2 kg) and group B of 16 (age one week to 12 months, body weight 3.3 ± 0.9 kg). In group A we delivered the contrast medium via a 22-gauge conventional non-fenestrated catheter and in group B we used a 24-gauge fenestrated catheter. Whole-heart helical CTA scans were performed on a 64-detector scanner (GE VCT, tube voltage 80 kVp, detector configuration 64 x 0.625 mm, rotation time 0.4 s/r, helical pitch 1.375, preset AEC noise index 12) and the injection rate, aortic enhancement, and injection pressure were compared in groups A and B.

**RESULTS**

The mean injection rate and aortic enhancement were 0.9 ± 0.1 ml/sec and 468 ± 45.0 HU in group A and 0.87 ± 0.3 ml/sec and 444 ± 63.5 HU in group B. There was no significant difference in the injection rate and aortic enhancement (p = 0.34, p = 0.38). The maximum injection pressure was significantly lower in group B than group A (0.33 vs. 0.55 kg/cm², p < 0.05).

**CONCLUSION**

Use of the fenestrated catheter decreases the injection pressure limit while retaining the injection rate and aortic enhancement of conventional catheters.

**PURPOSE**

To evaluate the effect of dual-source parallel RF transmission on the B1 homogeneity, the image quality (image contrast and off-resonance artifacts) in the cine b-SSFP sequence and the repeatability of left-ventricle cardiac function in 3.0T CMR of children.
METHOD AND MATERIALS
The prospective intraindividual comparison study was approved by the institutional ethics committee and written informed consent was obtained. The 3.0T cardiac magnetic resonance (CMR) was performed in 30 chronic myocarditis children by using the dual-source radiofrequency (RF) transmission with patient-adaptive RF shimming. B1 homogeneity and image contrast with and without RF shimming were quantitatively evaluated and t-test was used for statistical significance. The off-resonance artifacts were evaluated independently by two readers. Statistical significance was assessed by the Mann-Whitney U test and inter-observer agreement by Cohen's kappa test. The inter-observer agreement of LV cardiac function with dual-source RF transmission was evaluated by Bland-Altman analysis and the intra-class correlation coefficient (ICC).

RESULTS
Compared with single-source RF transmission, dual-source RF transmission with patient-adaptive RF shimming performed a higher mean percentage of flip angle (FA), lower coefficient of variation (CV) and higher image contrast in both free-breathe (NBH) and breathe-hold (BH) scanning (P <0.05 for all). The scores of off-resonance artifacts with patient-adaptive RF shimming were lower than that without RF shimming (P <0.05) and inter-observer agreement between two readers was good to very good (kappa values from 0.66 to 0.86). A high level inter-observer agreement for cardiac function with RF shimming was acquired both in NBH scanning (CV: 1.91%-11.84%; ICC, 0.83-0.98) and BH scanning (CV: 0.52%-4.44%; ICC, 0.98-0.99)

CONCLUSION
Dual-source parallel RF transmission could significantly improve the B1 homogeneity and image quality and is suitable for the 3.0T cardiac magnetic resonance in children.

CLINICAL RELEVANCE/APPLICATION
Dual-source parallel RF transmission could significantly improve the B1 homogeneity and image quality and is suitable for the 3.0T cardiac magnetic resonance in children.

RC313-07 Estimation of Functional Lung Capacity and Correlation with the Results of Infant Pulmonary Function Test and Quantitative CT Assessment in Infants with Postinfectious Bronchiolitis Obliterans

Tuesday, Dec. 1 9:40AM - 9:50AM Location: E353A

Participants
Mi-Jung Lee, MD, PhD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Yoon Hee Kim, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hyun Joo Shin, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Myung-Joon Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Myung Hyun Sohn, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the possibility for estimating functional lung capacity from ventilation inhomogeneity using infant pulmonary function test (iPFT) and quantitative CT assessment for air trapping in infants with postinfectious bronchiolitis obliterans (BO).

METHOD AND MATERIALS
This prospective study included infants with clinically and radiologically proven BO since 2009. We performed iPFT in these patients and measured tidal volume (TV), functional residual capacity (FRC) and lung clearance index (LCI) by sulphur hexafluoride multiple breath washout using an ultrasonic flow meter. From chest CT, we calculated total lung volume (CT-TLV) and imaging functional lung volume (CT-FLV) which showed higher attenuation than the mean attenuation of the grossly normal and air trapping areas. We compared iPFT and CT parameters using Spearman correlation analysis.

RESULTS
Thirteen infants (M:F = 11:2) were included in this study. The age was 3-17 months with the mean of 10.4 ± 4.5 months. The mean body weight and height were 9.4 ± 1.7 kg and 75.9 ± 8.0 cm. The values of TV, FRC and LCI were 82.0 ± 19.9 ml, 184.1 ± 268.8 ± 90.9 ml and 202.9 ± 70.4 ml. In the correlation analysis, CT-TLV had a positive correlation with TV (γ = 0.602, p = 0.029) and FRC (γ = 0.731, p = 0.005). CT-FLV also showed a significant negative correlation with LCI (γ = -0.670, p = 0.012) which represented ventilation inhomogeneity.

CONCLUSION
Both iPFT and chest CT can demonstrate ventilation inhomogeneity and estimate functional lung capacity in infants with postinfectious BO with good correlation. Both methods can be useful and complementary for evaluating in these patients.

CLINICAL RELEVANCE/APPLICATION
Not only infant pulmonary function test but also quantitative chest CT assessment can demonstrate ventilation inhomogeneity and estimate functional lung capacity in infants who are not easy to evaluate lung function due to limited compliance.

RC313-08 Coronary Artery Imaging in Children

Tuesday, Dec. 1 9:50AM - 10:10AM Location: E353A

Participants
Lorna Browne, MD, FRCR, Denver, CO (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) How to successively image the coronary arteries in children with both MR and CT. 2) How to interpret a range of coronary artery anomalies and pathologies.
Comparison of a ROI-based and a Whole-lung Segmentation Based Approach for MR Lung Perfusion Quantification in Two-year Old Children after Congenital Diaphragmatic Hernia Repair

Participants
Meike Weidner, Mannheim, Germany (Presenter) Nothing to Disclose
Verena Sommer, Mannheim, Germany (Abstract Co-Author) Nothing to Disclose
Frank G. Zoellner, Mannheim, Germany (Abstract Co-Author) Nothing to Disclose
Claudia Haglestein, Mannheim, Germany (Abstract Co-Author) Nothing to Disclose
Thomas Schaible, Mannheim, Germany (Abstract Co-Author) Nothing to Disclose
Stefan O. Schoenberg, MD, PhD, Mannheim, Germany (Abstract Co-Author) Institutional research agreement, Siemens AG
Wolfgang Neff, MD, PhD, Alzey, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
By the means of a region-of-interest (ROI) based approach it has been demonstrated that 2-year old children after congenital diaphragmatic hernia (CDH) repair show reduced MR lung perfusion values on the ipsilateral side. As ROI-based approaches only cover parts of the lung tissue, this study aimed to evaluate if results can be reproduced by segmentation of whole lung, whether there are differences between both approaches and as a consequence which technique should be applied.

METHOD AND MATERIALS
DCE-MRI was performed in 30 children (24.3±1.8 month) after CDH repair using a 3D TWIST sequence (Siemens Healthcare, Germany). 0.05 mmol/kg body weight of contrast agent (Dotarem, Guerbet, France) were administered. Pulmonary blood flow (PBF) was calculated based on a pixel-by-pixel deconvolution approach. For ROI-based quantification, three circular ROIs (apical, middle and basal) per lung side were used both in the ventral and dorsal lung. Propagation of those circular ROIs through five adjacent sliced generated 6 cylindrical ROIs in the ventral and dorsal lung respectively. For whole-lung analysis, the whole lung was contoured. In both techniques larger vessels were excluded from analysis (Fig. A).

RESULTS
In the ROI-based approach, PBF was significantly reduced on the ipsilateral side (74.5±30.3 ml/100ml/min) in comparison to the contralateral side (113.1±40.4 ml/100ml/min; p<0.0001). Also in the whole-lung based approach ipsilateral PBF was significantly lower (73.9±25.5 ml/100ml/min) than in the contralateral lung (102.3±31.8 ml/100ml/min; p<0.0001). In the ipsilateral lungs, quantification results of the ROI-based and the whole-lung segmentation based approach were equal (p=0.50). In the contralateral lungs, the ROI-based approach significantly overestimated PBF in comparison to the whole-lung approach by approximately 9.5% (p=0.0013; Fig. B).

CONCLUSION
MR lung perfusion in 2-year children after CDH is significantly reduced ipsilaterally, both when quantified by a ROI-based and a whole-lung based approach. In the contralateral lung, the ROI-based approach significantly overestimates perfusion results and therefore whole lung segmentation should be preferred.

CLINICAL RELEVANCE/APPLICATION
With MR lung perfusion imaging, perfusion deficits after congenital diaphragmatic hernia can be depicted. Whole-lung segmentation for quantification is advisable, as a ROI-based approach can overestimate results.
Lung edema is a frequent complication after surgery for congenital heart disease in children. A readily available accurate measure for lung edema is lacking. Chest radiographs (CXR) are commonly used for this purpose. CXR, however, is inaccurate especially in intensive care when portable supine radiographs are used. In lung ultrasound (US) vertical artifacts known as B-lines have been shown to correlate with lung liquid. In adults with congestive heart disease B-lines in US correlates with lung edema scored from CXR. pulmonary blood flow (PBF) obtained by dynamic contrast enhanced MRI, a morpho-functional CF-MRI score and the lung clearance index (LCI). After manual segmentation of each lobe mean and coefficient of variation (CoV) were calculated.

RESULTS
Comparing the CF group to healthy controls, mean values of T1(21) (1176ms vs. 1246 ms, p < 0.01) and FV (0.67 vs. 0.95, p <0.001) were significantly lower and the CoV significantly higher (CoV T1(21) 0.08 vs. 0.04; CoV FV 0.73 vs. 0.37, p <0.001 for all). In CF group receiving treatment, mean values in the whole lung of OTF (pre 13.1/post 12.7 10-4/s/%O2), FV (pre 0.69/post 0.76), PBF (pre 98/post 102/ml/100 ml/min), LCI (pre 12.1/post 13.1) and the morpho-functional score (pre 15 / post 17) did not show a significant difference between pre and post treatment measurements (p > 0.05). Also data on a lobar level in the treatment group as well as measurements in the CF-control group did not show any significant differences between the 2 MRI exams (p > 0.05).

CONCLUSION
Compared to healthy controls functional lung MRI detects significantly increased ventilation heterogeneity in CF patients. After a single treatment with inhalation of hypertonic saline (7% NaCl) neither functional lung MRI nor LCI detected a significant change in CF patients.

CLINICAL RELEVANCE/APPLICATION
This study shows the feasibility of functional lung MRI, as a non-invasive, radiation-free tool for visualization and quantification of potential regional treatment effects in patients with CF.

Comparison of Lung Ultrasound and Chest Radiography in Estimating Lung Edema after Surgery for Congenital Heart Disease in Children

Tuesday, Dec. 1 11:10AM - 11:20AM Location: E353A

Participants
Laura Martellus, Helsinki, Finland (Presenter) Nothing to Disclose
Anu Kaskinen, Helsinki, Finland (Abstract Co-Author) Nothing to Disclose
Kiri Lauverma, MD, Helsinki, Finland (Abstract Co-Author) Nothing to Disclose
Paula Rautiainen, Helsinki, Finland (Abstract Co-Author) Nothing to Disclose
Sture Andersson, Helsinki, Finland (Abstract Co-Author) Nothing to Disclose
Olli Pitkanen, Helsinki, Finland (Abstract Co-Author) Nothing to Disclose

PURPOSE
Lung edema is a frequent complication after surgery for congenital heart disease in children. A readily available accurate measure for lung edema is lacking. Chest radiographs (CXR) are commonly used for this purpose. CXR, however, is inaccurate especially in intensive care when portable supine radiographs are used. In lung ultrasound (US) vertical artifacts known as B-lines have been shown to correlate with lung liquid. In adults with congestive heart disease B-lines in US correlates with lung edema scored from CXR. Our aim was to compare lung US and CXR in estimating lung edema in children after surgery for congenital heart disease.

METHOD AND MATERIALS
Lung US was performed on 50 children 1-6 h postoperatively using a high-frequency linear transducer. Videoclips from three anterolateral intercostal spaces on both sides were stored. An observer blinded to the patient data and CXR scored the abundance of B-lines on each videoclip using a 5-step scale (0 = no artefact, 1 = B-lines in <25% of surface area, 2 = <50%, 3 = <75%, and 4 = >75%). The postoperative CXR were evaluated for lung edema at the right and left upper and lower lobes, the middle lobe and lingula using a 4-step scale (0 = normal lung, 1 = minimal opacity, 2 = opacity partially obscuring lung vessels, 3 = opacity totally obscuring lung vessels). For each patient a mean score for lung US (B-line score), and for CXR (CXR LE score) was calculated.

RESULTS
There was a significant positive correlation between the B-line score and the CXR LE score (R = 0.65, p < 0.001).

CONCLUSION
Lung US is a promising diagnostic tool in evaluation of postoperative lung edema in patients with congenital heart disease.

CLINICAL RELEVANCE/APPLICATION
Lung US has great potential since the current methods for estimating lung edema are unsatisfactory (CXRs are nonspecific, invasive techniques are unreliable in patients with intracardiac shunts).
**RESULTS**

There were 24 metastatic pulmonary nodules and 18 non-metastatic pulmonary lesions. Pulmonary metastases and non-metastatic lesions exhibited significant differences in various histograms and volumetric parameters (P< .05). Multivariate analysis revealed that higher mean Hounsfield units (HU) (adjusted odds ratio (OR), 1.02) and larger effective diameter (OR, 17.03) are significant differentiators (P< .05). The subgroup analysis with non-calcified pulmonary nodules (13 metastases and 18 non-metastases) revealed significant differences between metastases and non-metastases in various parameters. Multivariate logistic regression analysis revealed that lower entropy (OR, 0.01) and larger effective diameter (OR, 38.92) are significant predictors of non-calcified pulmonary metastases (P< .05). The established logistic regression model of subgroup showed excellent discriminating performance in ROC analysis (AUC, 0.927).

**CONCLUSION**

Metastatic pulmonary nodules from osteosarcoma can be accurately differentiated from non-metastatic pulmonary lesions by using computerized texture analysis. High HU and larger effective diameter were the significant predictors for pulmonary metastases, while lower entropy and larger effective diameter were for non-calcified pulmonary metastases from non-metastatic lesions.

**CLINICAL RELEVANCE/APPLICATION**

The computerized 3D texture analysis can accurately differentiate pulmonary metastases from non-metastatic pulmonary lesions in pediatric osteosarcoma patients.

**METHOD AND MATERIALS**

Our study comprised 42 pathologically confirmed pulmonary nodules in 16 children with osteosarcoma who had undergone preoperative CT scans between January 2009 and December 2014. Each pulmonary nodule was manually segmented and its computerized texture features were extracted by using an in-house software program. Multivariate logistic regression analysis was performed to investigate the differentiating factors of metastatic nodules from non-metastatic lesions. A subgroup analysis was performed to identify significant differentiating parameters in non-calcified pulmonary nodules. The ROC curve was created to evaluate the discriminating performance of established model.

**RESULTS**

On CT angiograms (a) the mean z-axis coverage was 26.56 ± 3.40 cm (median: 25.60) (range: 20.70-37.90); (b) the mean DLP was 133.0 ± 133.0 mGy.cm (median: 82) (range: 49-427); (c) the mean level of noise was 7.58 ± 2.72HU (range: 3.20 - 14.10); (d) the mean attenuation within the pulmonary trunk was 415.8 ± 132.1 HU (range: 194.3-791.0). Perfusion images were devoid of respiratory motion artifacts in 87% of cases (27/31), showing mild motion artifacts in the vicinity of cardiac cavities in 83% of cases (25/31). Beam-hardening artifacts were found around the superior vena cava (26/31; 84%), the subclavian and innominate veins ipsilateral to the site of injection (19/31; 61%), mainly rated as minimal (23/26 [88%] and 12/19 [39%), respectively).
overall quality of perfusion images was rated as good (12/31; 39%) or excellent (19/31; 61%) with a mean level of attenuation within normal lung of 48.52 ± 18.30 HU (median: 44.11; range: 26.05-95.82) and a mean gradient of attenuation between areas of hypo- and normal perfusion of 25.39±9.47 HU.

CONCLUSION
Perfusion images of diagnostic quality can be generated from dual-energy CT in children.

CLINICAL RELEVANCE/APPLICATION
Regional lung perfusion can be analyzed qualitatively and quantitatively on dual-energy chest CT examinations in children who are able to hold their breath.

RC313-15 Pediatric Chest Interventions
Tuesday, Dec. 1 11:40AM - 12:00PM Location: E353A

Participants
Kamlesh U. Kukreja, MD, Bellaire, TX (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1. Describe different types of chest interventions for children.
Interventional Series: Embolotherapy

Tuesday, Dec. 1 8:30AM - 12:00PM Location: E351

RC314-01  Using Glue-How I Do It

Tuesday, Dec. 1 8:30AM - 8:45AM Location: E351

Participants
Jafar Golzarlan, MD, Minneapolis, MN (golzarlan@umn.edu) (Moderator) Chief Medical Officer, EmboMedics Inc
Brian S. Funaki, MD, Riverside, IL (Moderator) Data Safety Monitoring Board, Novate Medical

LEARNING OBJECTIVES
1) Describe rationale of bariatric embolization. 2) Explain the rationale and treatment of high flow malformations. 3) Describe the preparation of cyanoacrylates for embolization. 4) List two complications related to embolization. 5) Recognize the significance of Type III endoleaks. 6) Describe approach to treatment of visceral aneurysms.

Sub-Events

RC314-02  Empiric Embolization in Endoscopically Confirmed Non-variceal Acute Upper Gastrointestinal Hemorrhage is Expensive and Fails to Improve Clinical Outcome

Tuesday, Dec. 1 8:45AM - 8:55AM Location: E351

Participants
Yasuaki Arai, Tokyo, Japan (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

Purpose
To compare clinical outcomes, radiation exposure and costs of empiric embolization to no embolization after a negative angiogram in patients with esophagogastroduodenoscopically (EGD) confirmed non-variceal acute upper gastrointestinal source of bleeding (GIB).

Method and Materials
A retrospective review was performed of patients who had angiogram after EGD confirmed upper GIB between May 2011 and April 2013. 64 patients (43 male, 21 female) had no contrast extravasation. They were divided into two groups. Group 1 (n=30) had no embolization. Group 2 (n=34) had empiric embolization of gastroduodenal artery (n=23) or left gastric artery (n=11). Logistic and linear regression analyses were used to compare the groups. After adjusting for age and Rockall score, following clinical outcomes were measured: 30-day mortality, hospital stay, repeat procedures and transfusion requirements. Radiation exposure (fluoroscopy time and reference point air kerma) in both groups and cost of embolization in group 2 were collected.

Results
Patients in groups 1 and 2 were similar in age and had similar Rockall scores (68.3 vs. 67.5 years, p=0.80, and 7.1 vs. 7.3, p=0.53, respectively). The 30-day mortality (30.0% vs. 23.5% (p=0.58)) and the mean hospitalization after angiogram (25.2 vs. 23.0 days (p=0.67)) were similar. Patients who had at least one repeat procedure (angiogram or endoscopy) after the initial angiogram was similar (50% vs. 50%, p=1.0). Among the available transfusion records (group 1=15; group 2=14), there was no difference in the units of packed red blood cells transfused after the initial angiogram (4.6 vs. 5.4, p=0.80). Reference point air kerma was similar (2147 vs. 2773 mGy, p= 0.19) but the fluoroscopy time was significantly higher in group 2 (17.7 vs 24.7 min, p=0.03). A total of 183 coils and 34 coil pushers were used during 32 angiograms in group 2. The mean combined cost of coils and coil pushers was $1747 (SD 1573, range 30 to 6213).

Conclusion
In the absence of contrast extravasation, empiric embolization in acute non-variceal upper GIB fails to improve clinical outcomes compared to no embolization and is associated with higher fluoroscopy time and embolization costs.

Clinical Relevance/Application
Small retrospective reviews have supported empiric embolization in acute upper GIB. However, with one of the largest series, our review fails to support the same which is associated with higher fluoroscopy time and costs.

**RC314-03 Endovascular Management of Delayed Postpancreatectomy Hemorrhage**

**Tuesday, Dec. 1 8:55AM - 9:05AM Location: E351**

**Participants**
- Maxime Ronot, MD, Clichy, France (Presenter) Nothing to Disclose
- Edwige Potier, Villejuif, France (Abstract Co-Author) Nothing to Disclose
- Sebastien Gaujoux, Clichy, France (Abstract Co-Author) Nothing to Disclose
- Alain Sauvanet, MD, Clichy, France (Abstract Co-Author) Nothing to Disclose
- Valerie Vilgrain, MD, Clichy, France (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To assess the efficacy of endovascular management of delayed postpancreatectomy hemorrhage (PPH) as first line treatment.

**METHOD AND MATERIALS**
Between January 2005 and November 2013, all consecutive patients referred for endovascular treatment of PPH were included. Presence of active bleeding, pseudoaneurysm, arterial stenosis, collection, and culprit artery were recorded on pretreatment CT scans. Endovascular procedures were classified as technical success if bleeding origin was identified and treated, technical failure if identified bleeding was incompletely treated; and radiologic abstention if no abnormality was depicted and no treatment performed. Factors associated with postprocedural rebleeding were analyzed, together with second line treatments.

**RESULTS**
69 patients (53 men) were included with a mean age of 59 years (32-75). Pretreatment CT showed 27 (39%) active bleeding, 25 (36%) pseudoaneurysms, 2 (3%) arterial stenosis, and 44 (64%) postoperative collections. In 22 (32%) cases, no obvious culprit artery was found. Technical success, technical failure, or radiologic abstention were observed in 48 (70%), 9 (13%), and 12 patients (17%), respectively. 30 patients (44%) experienced rebleeding after a median delay of 2 days (range 0-46). Rebleeding rates were 29%, 58%, and 100% in case of success, abstention or failure at the first endovascular procedure, respectively (p < 0.001). Treatment efficacy was the only factor associated with rebleeding (success vs failure p < 0.001; success vs. abstention p = 0.09, abstention vs. failure p = 0.04, overall p < 0.001). Rebleeding was treated by endovascular treatment, surgery, or both, in 12 (40%), 11 (37%) and 7 (23%) patients, respectively. Overall, 72% of the patients were successfully treated by endovascular procedures alone.

**CONCLUSION**
After a first endovascular procedure for PPH, almost half of patients rebleed. Rebleeding risk depends on the initial success of the procedure. Most patients are successfully treated by endovascular approach alone.

**CLINICAL RELEVANCE/APPLICATION**
Despite a high rebleeding rate, embolization should be proposed as first line treatment of post pancreatectomy hemorrhage because the majority of patients can be successfully treated by endovascular approach alone.

**RC314-04 Preoperative Embolization to Enhance Collateral Blood Flow via the Gastroduodenal Artery in Patients Undergoing Distal Pancreatectomy with Resection of the Celiac Axis**

**Tuesday, Dec. 1 9:05AM - 9:15AM Location: E351**

**Participants**
- Markus Zimmermann, MD, Aachen, Germany (Presenter) Nothing to Disclose
- Martin Liebl, MD, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
- Maximilian F. Schulze-Hagen, MD, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
- Federico Pedersoli, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
- Maximilian Schmesling, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
- Peter Isfort, MD, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
- Christiane K. Kuhl, MD, Bonn, Germany (Abstract Co-Author) Nothing to Disclose
- Philipp Bruners, MD, Aachen, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
Locally advanced pancreatic cancer with infiltration of the celiac axis carries a grave prognosis and has previously widely been considered as irresectable. Nevertheless, selected patients may benefit from distal pancreatectomy with resection of the celiac axis (DP-CAR). However, resection of the celiac axis may result in postoperative hepatic or gastric ischemia if collateral blood flow from the superior mesenteric artery (SMA) via the gastroduodenal artery (GA) is insufficient. We present a technique for preoperative angiographic evaluation and possibly enhancement of blood flow in this collateral by embolization of the celiac axis (CA) or the common hepatic artery (CHA).

**METHOD AND MATERIALS**
Between 2010 and 2015 six patients with locally advanced pancreatic cancer with invasion of the celiac axis underwent preoperative angiography and embolization of the celiac axis (4) or the common hepatic artery (2) before DP-CAR. 5F sheaths were placed in both common femoral arteries and through one sheath a catheter was introduced and placed in the SMA. Through the other sheath another catheter was simultaneously placed in the CA/CHA and an Amplatzer™ vascular plug was deployed - without releasing it - for temporary occlusion of the CA/CHA. Subsequently, an angiography of the SMA was performed to evaluate retrograde blood flow from the SMA via the GA to the proper hepatic artery. If sufficient retrograde flow via the GA was present, the Amplatzer™ plug was permanently released in order to further increase the flow rate in this collateral.

**RESULTS**
All six patients demonstrated sufficient collateral blood flow via the GA and consecutively underwent successful embolization of
either the CA or the CHA. No peri-interventional complications were noted. Eventually, five patients were treated with DP-CAR, of which four histologically demonstrated clear surgical margins (R0). One patient did not undergo DP-CAR because of intraoperatively discovered peritoneal metastases.

CONCLUSION
The presented technique allows safe preoperative angiographic evaluation and possibly enhancement of collateral bloodflow from the SMA via the GA in patients undergoing DP-CAR, in order to reduce the risk of postoperative morbidity from hepatic or gastric ischemia.

CLINICAL RELEVANCE/APPLICATION
Our technique allows preoperative evaluation and possibly enhancement of collateral blood flow from the SMA via the gastroduodenal artery in patients undergoing DP-CAR.

RC314-05  Embolotherapy-My Worst Cases
Tuesday, Dec. 1 9:15AM - 9:30AM Location: E351

Participants
Robert A. Morgan, MD, London, United Kingdom (robert.morgan@stgeorges.nhs.uk) (Presenter) Proctor, Medtronic, Inc

LEARNING OBJECTIVES
View learning objectives under main course title.

ABSTRACT
The Type III Endoleak-The Great Pretender
Tuesday, Dec. 1 9:30AM - 9:45AM Location: E351

Participants
Brian S. Funaki, MD, Riverside, IL (Presenter) Data Safety Monitoring Board, Novate Medical

LEARNING OBJECTIVES
View learning objectives under main course title.

RC314-07  Case of the Session-Splenic Artery Embolization (or Lack Thereof)
Tuesday, Dec. 1 10:05AM - 10:20AM Location: E351

Participants
Brian S. Funaki, MD, Riverside, IL (Presenter) Data Safety Monitoring Board, Novate Medical

LEARNING OBJECTIVES
View learning objectives under main course title.

RC314-08  High Flow Malformations-How I Treat Them
Tuesday, Dec. 1 10:20AM - 10:35AM Location: E351

Participants
James E. Jackson, MD, London, United Kingdom (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To understand the indications for treatment of high-flow vascular malformations. 2) To understand the differing vascular anatomy of arteriovenous malformations and how this affects treatment approach and outcome. 3) To understand those methods of embolization of arteriovenous malformations that are likely to improve results and reduce complications.

ABSTRACT
The most important aspect of embolization of high-flow vascular malformations is an understanding of the anatomy of the vascular communications within them as this has a bearing both upon the method of vascular occlusion and on the final result. Whatever the anatomy, however, the general principle is that occlusion is performed at the site of the abnormal arteriovenous shunts and not in the vessel proximal to this point. The embolization of arterial feeding vessels, which was performed for many years with metallic coils or particulate matter such as polyvinyl alcohol, is akin to proximal surgical ligation and must be avoided. It has little effect upon symptoms in most individuals and renders subsequent treatment more difficult because the arterial inflow vessels have been occluded. If, however, the embolization is directed at the AV communications themselves, from an arterial approach, via a direct percutaneous puncture or retrogradely from the venous side, and these are totally obliterated - often with a liquid embolic agent - then a long-term improvement in symptoms can be achieved. This presentation will concentrate on the radiological management of these high-flow lesions. The cure of a high flow vascular anomaly is uncommon although there is no doubt that radiological and clinical obliteration of more malformations has come with a better understanding of their radiological anatomy and the use of agents that are directed at the AV shunts themselves rather than at the proximal feeding vessels.

RC314-09  Value of Embolization in the Management of Pelvic Venous Incompetence
Tuesday, Dec. 1 10:35AM - 10:45AM Location: E351

Participants
Marc Antoine Jegonday, Caen, France (Presenter) Nothing to Disclose
Vincent Le Penneuc Sr, MD, Caen, France (Abstract Co-Author) Educator, Cook Group Incorporated
Audrey Fohlen, Caen, France (Abstract Co-Author) Nothing to Disclose
Bertrand Lamy, Caen, France (Abstract Co-Author) Nothing to Disclose
Jean-Pierre J. Pelage, MD, PhD, Caen, France (Abstract Co-Author) Research Grant, Merit Medical Systems, Inc; Consultant, Merit Medical Systems, Inc; Research Grant, Cook Group Incorporated; Consultant, Cook Group Incorporated; Research Grant, Keocyt; Medical Board, Keocyt; Research Grant, Terumo Corporation; Consultant, Terumo Corporation; Research Grant, ALN; Consultant, ALN; Consultant, Boston Scientific Corporation; Research Grant, BTG International Ltd

PURPOSE
To assess the efficacy of embolotherapy to treat symptomatic pelvic venous incompetence (PVI).

METHOD AND MATERIALS
Retrospective evaluation of women with symptomatic PVI treated with embolization. Primary clinical success defined as decrease in pelvic and lower limb pain using a visual analogue scale (VAS). Associated symptoms including dyspareunia, vulvar pain or lower limb venous insufficiency as well as complications were also assessed.

RESULTS
A total of 114 women (mean age 40.9 ± 10.3 years) including 74% with pelvic pain (VAS of 6.5 ± 1.8) and 64% with lower limb pain (VAS of 5.6 ± 2.1) were treated. The most common incompetent veins were the left ovarian (82%), internal pudendal (right 49%; left 39%), inferior gluteal (right 32%; left 31%) and uterine (right 19%; left 23%) veins. Technical success was 89%. Follow-up included consultation organized after 3.5 ± 4.0 months and consultation or telephone interview after 50 ± 34.6 months, respectively. Pelvic pain VAS decreased to 1.6 ± 2.4 (p<0.0001) and 1.0 ± 2.2 (p<0.0001) at the first and second visits, respectively, with a long term success of 94%. Mean lower limb pain VAS decreased to 3.6 ± 2.7 (p<0.0001) and 2.5 ± 2.6 (p<0.0001) at the 2 time-points, with a long term success of 88%. VAS decreased significantly between short and long term evaluations. Clinical improvement of associated symptoms was also observed. Major complication rate was low (9%).

CONCLUSION
Embolization of symptomatic PVI is a safe and effective treatment in well-selected patients, with a progressive and long-lasting clinical success.

CLINICAL RELEVANCE/APPLICATION
Embolization is safe and effective to treat symptomatic PVI and is recommended when a pelvic venous origin of symptoms is established.

RC314-10 Endovascular Management of Hemoptysis Including Coil and/or Particle Embolization: 6 Year Single Institution Comparative Experience

Tuesday, Dec. 1 10:45AM - 10:55AM Location: E351

Participants
Orrie N. Close, MD, Pittsburgh, PA (Presenter) Nothing to Disclose
Kevin M. McCluskey, MD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Donghoon Shin, MS, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Kevin Ching, MD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Robert F. Short, MD, PhD, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate clinical outcomes for endovascular treatment of hemoptysis with microcoils and/or microparticles for bronchial and non-bronchial systemic artery embolization

METHOD AND MATERIALS
A single institution IRB-approved review included all patients who underwent embolization for hemoptysis from 12/2008 to 12/2014. Patient demographics, technical details, angiographic findings, complications, rate of recurrence, and need for repeat intervention were reviewed. Person-years were calculated to evaluate the incidence of recurrence by endovascular treatment method. Statistical analyses were performed using Fisher's exact and chi-square tests.

RESULTS
114 embolizations were performed in 97 patients for hemoptysis. 56 embolization procedures performed in 48 patients (mean: 58 y; range 20-91y) employed microcoils (<0.18 inch). (Of these, 10 patients received microcoil embolization only.) 58 microparticle embolizations were performed in 49 patients (52 y; range 24-84y). Rebleeding occurred following 23 (41.1%) coil embolizations and 24 (42.1%) microparticle embolizations (p=1.00). Incidence of rebleeding in the coil and particle embolization groups were 50.6 and 64.6 per 100 person-years respectively (p=.5). The incidence ratio between the groups was 1.28 (95% CI: 0.69, 2.37). Complication rate was 7.1% in the coil group (bronchial arterial dissections: n= 4) vs. 10.3% in the particle embolization only group (arterial dissections: n= 4, spinal cord infarction: n= 1, and access site retroperitoneal hemorrhage: n= 1). (p= 1.0). One procedure for recurrent hemorrhage was impeded by previously placed embolization coils.

CONCLUSION
Transcatheter embolization for hemoptysis is safe and effective using microcoils and/or microparticles. The incidence rate of recurrent hemoptysis following microcoil vs. microparticle embolization is not significantly different.

CLINICAL RELEVANCE/APPLICATION
Use of microcoils for transcatheter embolization in the treatment of hemoptysis can be safely performed with similar clinical efficacy and complication rates as that of microparticles.

RC314-11 Amplatzer Plugs versus Coils for Pulmonary Arteriovenous Malformations Embolization in HHT Patients - Long Term Results

Tuesday, Dec. 1 10:55AM - 11:05AM Location: E351

Participants
Obesity affects about 30% of the United States population. It is responsible for numerous comorbidities including diabetes mellitus and its complications, cardiovascular disease, sleep apnea, and premature osteoarthritis. This is the first use of left gastric artery embolization in the Western Hemisphere to treat morbid obesity.

**METHOD AND MATERIALS**

Retrospective analysis of all percutaneous PAVMs embolization performed between 2004 and 2014 in our institution. Data from patient files was collected regarding method of embolization (Amplatzer plugs, coils or both) and regarding all complications. Data regarding rates of re-canalization in treated PAVMs was assessed from follow-up imaging (following percutaneous procedure or CT Angiography).

**RESULTS**

36 patients (19M, 17F), median age 32.5 years [1.9-72.7 years] underwent 51 percutaneous trans-catheter procedures at our institution and 8 procedures in outside institutions, with embolization of a total of 142 simple or complex PAVMs [72 coils, 56 Amplatzer plugs and 14 plugs and coils]. Two patients had self-resolving mild hemoptysis following embolization. No other major procedure-related complications occurred. Of this group, 16 patients with 63 PAVMs that were occluded [37 with coils, 21 with Amplatzer plugs and 5 with both plugs and coils] underwent follow-up imaging [13 angiographies, 1 CT Angiography]. 7 PAVMs showed re-canalization of occluded vessels, at a median follow-up of 8.6 years [1.5-18.11 years]. All re-canalizations occurred in coiled vessels. No re-canalizations occurred through Amplatzer plugs [7/37 vs. 0/21], p-value = 0.0413 (Fisher's exact test).

**CONCLUSION**

The use of Amplatzer plugs for PAVMs embolization in HHT patients appears to be safe and effective, and has a lower re-canalization rate of feeding vessels compared to coils.

**CLINICAL RELEVANCE/APPLICATION**

The use of coils as the standard of care for PAVMs embolization should be re-evaluated, since the use of Amplatzer vascular plugs is shown to have better long term results, without additional risks.

**RC314-12**

**Bariatric Embolization for Morbid Obesity, First Western Hemisphere Experience: Gastric Artery Embolization Trial for Lessening Appetite Nonsurgically (GET LEAN)**

Tuesday, Dec. 1 11:05AM - 11:15AM Location: E351

Participants

- Muhammed Syed, MD, Dayton, OH (Presenter) Consultant, CareFusion Corporation; nothing to disclose
- Talal Akhter, MD, Minneapolis, MN (Abstract Co-Author) Nothing to Disclose
- Azim Shahid, MD, MBA, Dayton, OH (Abstract Co-Author) Nothing to Disclose
- Talal Akhter, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
- Hooman Khabiri, MD, Columbus, OH (Abstract Co-Author) Nothing to Disclose
- Omar Khan, Dayton, OH (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

The purpose of this pilot study is to achieve the collection of safety and efficacy data in patients undergoing left gastric artery embolization for morbid obesity in the Western Hemisphere.

**METHOD AND MATERIALS**

This is an FDA-IDE pilot study. 5 patients have been approved to undergo the left gastric artery embolization procedure for the purpose of weight loss using Beadblock 300-500 micron particles. All patients will undergo EGD follow up pre and post procedure. Ghrelin, Leptin and CCK levels will also be measured at baseline and post procedure per follow up protocol. Inclusion Criteria Morbid obesity with a BMI ≥ 40 Age ≥ 22years Ability to lay supine on an angiographic table <400lbs due to table weight limits Appropriate anesthesia risk as determined by certified anesthesia provider evaluation preprocedure Subjects who have failed previous attempts at weight loss through diet, exercise, and behavior modification (as it is recommended that conservative options, such as supervised low-calorie diets combined with behavior therapy and exercise, should be attempted prior to enrolling in this study).

**RESULTS**

The first patient has lost 30lbs at 3 months. Second patient has lost 12lbs at 1 month. Third patient has lost 6lbs in 1 week. There have been no major adverse events. The final 2 patients in this study are still being selected.

**CONCLUSION**

This is the first experience in the United States of performing left gastric artery embolization for the purpose of treating morbid obesity. Early results are promising and show no major adverse events thus far. The radial artery has also proven to be a feasible approach to performing this procedure with implications for a safer access site.

**CLINICAL RELEVANCE/APPLICATION**

Morbid obesity is a prevalent and deadly public health problem. Obesity affects about 30% of the United States population. It is responsible for numerous comorbidities including diabetes mellitus and its complications, cardiovascular disease, sleep apnea, and premature osteoarthritis. This is the first use of left gastric artery embolization in the Western Hemisphere to treat morbid obesity.
This is also the first radial artery access experience with implications for the morbidly obese where groin access may be more challenging.

**RC314-13**  **Bariatric Embolization. Is This the Next Big Thing?**

Tuesday, Dec. 1 11:15AM - 11:30AM Location: E351

Participants
Jafar Golzarian, MD, Minneapolis, MN *(Presenter)* Chief Medical Officer, EmboMedics Inc

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**RC314-14**  **Visceral Aneurysms**

Tuesday, Dec. 1 11:30AM - 11:45AM Location: E351

Participants
Michael D. Darcy, MD, Saint Louis, MO *(Presenter)* Speakers Bureau, W. L. Gore & Associates, Inc; Speaker, Cook Group Incorporated;

**LEARNING OBJECTIVES**

1) The incidence and presentation of visceral aneurysms. 2) The indications for treating visceral aneurysms. 3) Techniques for treating visceral aneurysms. 4) Potential complications from treatment of visceral aneurysms.

**RC314-15**  **Wrap Up and Discussion**

Tuesday, Dec. 1 11:45AM - 12:00PM Location: E351

Participants
Carotid and Renal Doppler (Hands-on)

Tuesday, Dec. 1 8:30AM - 10:00AM Location: E264

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Gowthaman Gunabushanam, MD, New Haven, CT, (gowthaman.gunabushanam@yale.edu) (Moderator) Editor, WebMD Health Corp
Gowthaman Gunabushanam, MD, New Haven, CT, (gowthaman.gunabushanam@yale.edu) (Presenter) Editor, WebMD Health Corp
Mark E. Lockhart, MD, Birmingham, AL, (mlockhart@uabmc.edu) (Presenter) Nothing to Disclose
Shweta Bhatt, MD, MBBS, Rochester, NY (Presenter) Nothing to Disclose
Wui K. Chong, MD, Chapel Hill, NC, (wk.chong@med.unc.edu) (Presenter) Nothing to Disclose
Corinne Deurdulian, MD, Los Angeles, CA (Presenter) Nothing to Disclose
Vikram S. Dogra, MD, Rochester, NY (Presenter) Editor, Reed Elsevier
Edward G. Grant, MD, Los Angeles, CA (Presenter) Research Grant, General Electric Company; Medical Advisory Board, Nuance Communications, Inc
Ulrike M. Hamper, MD, MBA, Baltimore, MD (Presenter) Nothing to Disclose
Felix A. Hester, Helena, AL (Presenter) Nothing to Disclose
Michelle L. Robbin, MD, Birmingham, AL, (mrobbin@uabmc.edu) (Presenter) Consultant, Koninklijke Philips NV;
Leslie M. Scott, MD, New Haven, CT (Presenter) Consultant, Koninklijke Philips NV
Ravinder Sidhu, MD, Rochester, NY, (ravinder_sidhu@urmc.rochester.edu) (Presenter) Nothing to Disclose
Sadhna Verma, MD, Cincinnati, OH (Presenter) Nothing to Disclose
Margarita V. Revzin, MD, Wilton, CT, (margarita.revzin@yale.edu) (Presenter) Nothing to Disclose
Davida Jones-Manns, Hampstead, MD (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Describe the technique and optimally perform carotid Doppler ultrasound. 2) Describe the technique and optimally perform renal Doppler ultrasound. 3) Review qualitative and quantitative criteria for diagnosing abnormalities in carotid and renal ultrasound Doppler examinations.

ABSTRACT
This hands-on course will provide participants with a combination of didactic lectures and an extended 'live' scanning opportunity on normal human volunteers, as follows: Didactic lectures (30 minutes): 1. Carotid Doppler Ultrasound: scanning technique, diagnostic criteria and interesting teaching cases. 2. Renal Doppler Ultrasound: scanning technique, diagnostic criteria and interesting teaching cases. Mentored scanning (60 minutes): Following the didactic lectures, the participants will proceed to a scanning area with normal human volunteers and ultrasound machines from different manufacturers. Participants will be able to perform live scanning with direct assistance (if needed) by faculty. Faculty will be able to offer feedback, help participants improve their scanning technique as well as answer any questions. Faculty will also be available to answer general questions relating to all aspects of vascular Doppler, not limited to carotid and renal Doppler studies.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Leslie M. Scott, MD - 2014 Honored Educator
Sadhna Verma, MD - 2013 Honored Educator
**Vascular Interventional Tuesday Poster Discussions**

**Tuesday, Dec. 1 12:15PM - 12:45PM Location: VI Community, Learning Center**

**VA IR**

**AMA PRA Category 1 Credit™: .50**

**Participants**
James T. Bui, MD, Chicago, IL (*Moderator*) Nothing to Disclose

**Sub-Events**

**VI226-SD-TUA1**

**Significance and Efficacy of Super-selective ACTH-stimulated Adrenal Venous Sampling, Compared to Conventional Sampling Method**

Station #1

Participants
Masahiro Kobayashi, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose
Nobuyuki Shiraga, MD, Ohta-Ku, Japan (*Abstract Co-Author*) Nothing to Disclose
Keiko Matsumoto, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Kenichi Suzuki, Ota, Japan (*Abstract Co-Author*) Nothing to Disclose
Hideaki Suzuki, MD, PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Jyunichi Kodera, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

**PURPOSE**

To assess the utility and superiority of super-selective ACTH (adrenocortiotropic hormone) -stimulated AVS (adrenal venous sampling), comparing to conventional sampling method.

**METHOD AND MATERIALS**

Institutional review board approval and written informed consent were obtained. Between January 2010 and March 2015, 122 patients (mean age: 54.0 ± 11.4 years, range: 27 - 73 years) with primary aldosteronism underwent super-selective AVS. Before and after ACTH stimulation, conventional venous sampling was performed at infra and supra renal inferior vena cava (IVC), and left renal vein, common trunk of left inferior phrenic and adrenal vein, and right adrenal vein. Proceedingly, super-selective venous sampling was performed with microcatheter at left central adrenal vein, superio-medial, superior-lateral, and lateral branch of left adrenal vein. Aldosterone/Cortisol ratio was calculated in all sites and compared each other to detect unilateral lesion.

**RESULTS**

We could successfully perform super-selective AVS for all subjects. Seventeen patients (13.9% of total) had negative findings of primary aldosteronism on adrenal venous sampling. Sixty-six patients (54.1% of total) had bilateral excess aldosterone secretion. Thirty-nine (32.0% of total) patients had unilateral excess production of aldosterone. Six cases out of 39 (15.4%, 5.0% of total) had negative results on conventional AVS, whereas unilaterality was proved by super-selective AVS. Those cases are thought to have the possibility to miss the opportunity of surgical treatment with conventional AVS.

**CONCLUSION**

Super-selective AVS is superior to detect the unilaterality of excess secretion of aldosterone, as well as identifying the location of the lesion in adrenal grand, compared to conventional AVS. Without super-selective AVS, 5% of primary aldosteronism patients have possibility to miss the opportunity of surgical treatment.

**CLINICAL RELEVANCE/APPLICATION**

Adrenal venous sampling with high accuracy is needed for primary aldosteronism to decide treatment options.

**VI227-SD-TUA2**

**Robust Image Quality with a 60% Reduction in Both Contrast Material and Radiation Dose using 70-kV Images in Third Generation Dual-source CT**

Station #2

Participants
Erina Suehiro, RT, Kobe, Japan (*Presenter*) Nothing to Disclose
Tatsuya Nishii, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Kiyosumi Kagawa, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Nogi, RT, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshiaki Watanabe, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Atsushi K. Kono, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Satoru Takahashi, MD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuro Sugimura, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, DAIICHI SANKYO Group
Hideaki Kawamatsu, MD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose

**PURPOSE**

This study aimed to evaluate radiation and contrast material requirements for thoraco-abdominal CT angiography (CTA) at 70-kV compared with conventional 120-kV CTA using third-generation dual-source CT (3rd DSCT).

**METHOD AND MATERIALS**

Seventy-nine consecutive patients (mean, 72 years old, 25 females) who had undergone helical CTA with a bolus tracking method
using 3rd DSCT were retrospectively reviewed. We excluded 36 patients who already had stenting or coiling, which could affect image quality by artifacts. In 120-kV scanning (n = 19), 400 mgI/kg of contrast material was injected for 30 s. For 70-kV scanning (n = 24), 240 mgI/kg (60%) of contrast material was injected at the same rate as that for 120-kV scanning. For objective image quality, the CT value and standard deviation in the ascending, descending, and abdominal aorta, and bifurcation were obtained. The signal-to-noise ratio (SNR) in each part of the aorta, contrast-to-noise ratio (CNR) of the abdominal aorta compared with the psoas muscle, and CNR per unit dose (CNRD = CNR / square root of the CT dose index) were evaluated. Differences in objective image quality, amount of contrast material, and radiation dose between the two methods were assessed by Welch's test.

RESULTS
The SNR and CNR were not significantly different between the two methods. However, in the 70-kV scan, the CNRD was significantly higher (11.6 ± 4.2 vs. 9.4 ± 2.9; P = 0.04), with a significantly lower amount of contrast material (14.3 ± 2.7 vs. 23.5 ± 5.6 gI; P < 0.01) and radiation dose (DLP, 570.5 ± 55.5 vs. 842.0 ± 221.3 mGy*cm; P < 0.01) compared with the 120-kV scan.

CONCLUSION
CTA at 70-kV with 3rd DSCT results in robust image quality with a significantly reduced amount of contrast material and radiation dose compared with 120-kV CTA.

CLINICAL RELEVANCE/APPLICATION
CTA at 70-kV with 3rd DSCT results in a 60% reduction in the amount of contrast material and radiation dose with robust image quality compared with 120-kV CTA.

Efficacy of Ultrasound-guided Axillary Brachial Plexus Blocks for Analgesia during Percutaneous Transluminal Angioplasty for Dialysis Access

Participants
Emiko Chiba, MD, Saitama, Japan (Presenter) Nothing to Disclose
Kohei Hamamoto, MD, Saitama, Japan (Abstract Co-Author) Nothing to Disclose
Tomohisa Okochi, MD, Saitama, Japan (Abstract Co-Author) Nothing to Disclose
Kesuke Tanno, Saitama, Japan (Abstract Co-Author) Nothing to Disclose
Katsuhiko Matsuura, MD, Saitama, Japan (Abstract Co-Author) Nothing to Disclose
Osamu Tanaka, MD, Saitama, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
During percutaneous transluminal angioplasty (PTA) for dialysis access, the pain of balloon dilatation is severe. Previously, local injection of anesthetic or venous injection of analgesic agent was used, but the efficiency of these procedures lacked stability or they were difficult to use for outpatients. We evaluated the efficacy of ultrasound (US)-guided ABP blocks for analgesia during PTA for dialysis access.

METHOD AND MATERIALS
From April to 2014 to March 2015, 21 patients who underwent PTA for dialysis access shunts and who had an experience of PTA without analgesia were included. The access type in all patients was forearm native arteriovenous fistulae. Two radiologists performed US-guided ABP blocks before PTA; 5 mL of 1.8% lidocaine was injected around both the radial and musculocutaneous nerves. The patients’ responses were evaluated using a visual analog scale (VAS), and motor/sensory paralysis after PTA was examined.

RESULTS
The mean time required to achieve nerve block was 8 min. The success rate of this procedure was 100%, and there were no significant complications. All 21 patients reported a decrease in their VAS score (100 to 22) (p<0.05). All patients requested an ABP block for future PTA sessions, if required. Motor paralysis occurred in 2 patients, but resolved in all after 1 h.

CONCLUSION
With US-guided ABP blocks, all cases exhibited significantly decreased VAS scores. US-guided ABP blocks were effective and utilized safe analgesia during PTA for dialysis access. US-guided ABP block with lidocaine is suitable for outpatients because it does not result in prolonged motor paralysis or affect consciousness and respiration.

CLINICAL RELEVANCE/APPLICATION
Previously, no studies have reported the efficacy of US-guided ABP blocks for PTA for dialysis access. US-guided ABP block is an effective and safe technique for analgesia during PTA for dialysis access. Time required for this procedure is less than 10 min. It can ease the severe pain of dilatation and improve patients' compliance to medical treatment.

Is Biopsy Necessary Prior to Thermal Ablation of Primary NSCLC in High-Risk Patients?

Participants
David A. Johnson, MD, Providence, RI (Presenter) Nothing to Disclose
Grayson L. Baird, MS, Providence, RI (Abstract Co-Author) Nothing to Disclose
Terrance T. Healey, MD, Providence, RI (Abstract Co-Author) Nothing to Disclose
Damian E. Dupuy, MD, Providence, RI (Abstract Co-Author) Research Grant, NeuWave Medical Inc Board of Directors, BSD Medical Corporation Stockholder, BSD Medical Corporation Speaker, Educational Symposium

PURPOSE
To compare rates of mortality, disease recurrence, and major complications of thermal ablation of presumed non-small cell lung cancer (NSCLC) between patients who had prior biopsy, biopsy performed at the same time as ablation, or no biopsy.

METHOD AND MATERIALS
To compare rates of mortality, disease recurrence, and major complications of thermal ablation of presumed non-small cell lung cancer (NSCLC) between patients who had prior biopsy, biopsy performed at the same time as ablation, or no biopsy.
A retrospective analysis was conducted on 356 patients treated with thermal ablation of primary lung malignancies over a 10-year period. A sample of patients having single lung masses and no history of prior lung malignancy or evidence of metastatic disease was identified, and from this sample, patients were categorized as having either a biopsy prior to procedure date; a biopsy at the same time as ablation, with immediate pathology; or no biopsy. Statistical analysis comparing these groups was performed using Kaplan-Meier estimation with Wilcoxon tests of significance.

RESULTS

No significant differences in mortality or recurrence rates were observed based on biopsy status. Median time to death was 32 months for those who had standard treatment (biopsy prior to ablation), 27 months for those who had modified treatment (biopsy and pathology during the ablation), and 24 months for those who did not have biopsy (p=0.9). The median time to recurrence was 30 months for those who had standard treatment (biopsy prior to ablation), 17 months for those who had modified treatment (simultaneous biopsy and pathology during the procedure), and 45 months for those who did not have biopsy (p=0.24). The odds of pneumothorax were 5 times greater for patients receiving simultaneous biopsy and ablation relative to those with prior biopsy (p=0.008). The odds of pneumothorax for patients with no biopsy were not significantly greater relative those with prior biopsy (p=0.18). No significant differences between these groups were observed for necessity of post-procedural chest tube (p=0.13) or admission (p=0.30).

CONCLUSION

The data suggest that patients with presumed primary NSCLC can be treated with thermal ablation without tissue biopsy with no significant difference in mortality or disease recurrence rate than those with biopsy-proven disease. Biopsy performed at the time of ablation leads to an increased rate of pneumothorax.

CLINICAL RELEVANCE/APPLICATION

In high-risk patients referred for thermal ablation of presumed primary NSCLC, the utility of biopsy before or at the time of ablation is questionable given high likelihood of malignancy and the increased risks associated with biopsy.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Damian E. Dupuy, MD - 2012 Honored Educator

TEACHING POINTS

- To review the congenital IVC variants
- To explain the embryologic development of the vena cava
- To show the imaging findings based on the embryology
- To review the importance of planning the vascular procedures

TABLE OF CONTENTS/OUTLINE

- Embryologic development explained with graphics

Station #5

Participants

Daniela Segura, MD, Bogota, Colombia (Presenter) Nothing to Disclose
Carlos Corredor, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose
Felipe Aluja, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose
Juan M. Lozano, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose
Daniel Upegui, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose
Feasibility of Non-contrast-enhanced Magnetic Resonance Angiography with Time-spatial Labeling Inversion Pulse for the Assessment of Pulmonary Arteriovenous Malformation

Method and Materials

Twelve consecutive patients (3 men, 9 women; age, 21-81 years) with 36 documented PAVMs (30 untreated and 6 treated lesions at initial examination) underwent NCE-TSMRA with a 3.0-tesla unit. Eight patients with 20 lesions were examined twice, once before and once after the embolotherapy for follow-up examination. The lesions were divided into two groups: "Initial diagnosis" and "Follow-up" corresponding to untreated and treated lesion, respectively, and were evaluated separately. For evaluation of the "Initial diagnosis" group, two reviewers assessed the presence, location, and classification of PAVM on NCE-TSMRA, and all results were compared with those of digital subtraction angiography. Image quality was also rated on a qualitative 4-point scale (1: not assessable to 4: excellent). For evaluation of the "Follow-up" group, the reviewers assessed the status of treated PAVM on NCE-TSMRA. The reperfusion and occlusion of PAVMs on NCE-TSMRA are defined as visualization and disappearance of aneurysmal sac corresponding to treated lesions, respectively. The diagnostic accuracies of NCE-TSMRA were assessed and compared with standard reference images. Interobserver agreement was evaluated with the k statistic.

Results

In the "Initial diagnosis" group, NCE-TSMRA correctly determined the presence, location, and classification of PAVMs in all but one patient with one lesion, who represented image degradation due to irregular breath. Additionally, NSE-TSMRA could selectively visualize the feeding artery and venous sac, which provide hemodynamic information for the diagnosis of PAVM. Image quality were considered excellent (3.5 ± 0.7) and the k coefficient was 0.85. In the "Follow-up" group, the sensitivity and specificity of NSE-TSMRA for reperfusion of PAVM was all 100%, and the k coefficient was 1.00.

Conclusion

NCE-TSMRA is technically and clinically feasible and represents a promising technique for non-invasive assessment of PAVM.

Clinical Relevance/Application

NCE-TSMRA is a good alternative modality for the assessment of PAVMs, particularly in young subjects, women of childbearing age, and patients with renal sufficiency.

Percutaneous Transluminal Angioplasty versus Drug Eluting Stents for Infrapopliteal Lesions in Critical Limb Ischemia, PADI Trial

Method and Materials

Twelve consecutive patients (3 men, 9 women; age, 21-81 years) with 36 documented PAVMs (30 untreated and 6 treated lesions at initial examination) underwent NCE-TSMRA with a 3.0-tesla unit. Eight patients with 20 lesions were examined twice, once before and once after the embolotherapy for follow-up examination. The lesions were divided into two groups: "Initial diagnosis" and "Follow-up" corresponding to untreated and treated lesion, respectively, and were evaluated separately. For evaluation of the "Initial diagnosis" group, two reviewers assessed the presence, location, and classification of PAVM on NCE-TSMRA, and all results were compared with those of digital subtraction angiography. Image quality was also rated on a qualitative 4-point scale (1: not assessable to 4: excellent). For evaluation of the "Follow-up" group, the reviewers assessed the status of treated PAVM on NCE-TSMRA. The reperfusion and occlusion of PAVMs on NCE-TSMRA are defined as visualization and disappearance of aneurysmal sac corresponding to treated lesions, respectively. The diagnostic accuracies of NCE-TSMRA were assessed and compared with standard reference images. Interobserver agreement was evaluated with the k statistic.

Results

In the "Initial diagnosis" group, NCE-TSMRA correctly determined the presence, location, and classification of PAVMs in all but one patient with one lesion, who represented image degradation due to irregular breath. Additionally, NSE-TSMRA could selectively visualize the feeding artery and venous sac, which provide hemodynamic information for the diagnosis of PAVM. Image quality were considered excellent (3.5 ± 0.7) and the k coefficient was 0.85. In the "Follow-up" group, the sensitivity and specificity of NSE-TSMRA for reperfusion of PAVM was all 100%, and the k coefficient was 1.00.

Conclusion

NCE-TSMRA is technically and clinically feasible and represents a promising technique for non-invasive assessment of PAVM.

Clinical Relevance/Application

NCE-TSMRA is a good alternative modality for the assessment of PAVMs, particularly in young subjects, women of childbearing age, and patients with renal sufficiency.
on Computed Tomography Angiography. Stenosis > 50%, re-treatment, major amputation and CLI related death were regarded as treatment failure. Severity of failure was assessed with an ordinal score, ranging from vessel stenosis through occlusion to the clinical failures.

RESULTS
Seventy-four limbs (73 patients) were treated with DES and 66 limbs (64 patients) received PTA±BMS. Six-month patency rates were 48.0% for DES and 35.1% for PTA±BMS (p=0.096) in the modified-intention-to-treat and 51.9% and 35.1% (p=0.037) in the per-protocol analysis. The ordinal score showed significantly worse treatment failure for PTA±BMS vs. DES (p=0.041). The observed major amputation rate remained lower in the DES group until 2 years post-treatment (p=0.066). Less minor amputations occurred after DES until 6 months post-treatment (p=0.03).

CONCLUSION
In CLI with infrapopliteal lesions, DES provide better 6-month patency rates compared with PTA with bail out BMS. The major amputation rate of DES remains lower until two years post-treatment, with a trend towards significance. Therefore, a treatment strategy with DES should be considered in CLI patients with infrapopliteal lesions.

CLINICAL RELEVANCE/APPLICATION
Drug-eluting stents achieve better morphological and clinical results in patients with critical limb ischemia and infrapopliteal lesions in comparison with the current standard endovascular treatment.

VI231-SDDTUB3 The Utility of Four-dimensional CT Angiography (4D-CTA) in the Pre-embolization Planning of Extracranial Arteriovenous Malformations

Participants
Satomi Mine, Omura, Japan (Presenter) Nothing to Disclose
Hideki Ishimaru, MD, Nagasaki, Japan (Abstract Co-Author) Nothing to Disclose
Minoru Morikawa, MD, Nagasaki, Japan (Abstract Co-Author) Nothing to Disclose
Ichiro Sakamoto, Nagasaki, Japan (Abstract Co-Author) Nothing to Disclose
Masataka Uetani, MD, Nagasaki, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
For successful embolization of arteriovenous malformation (AVM), it is critical to comprehend the angioarchitecture, such as feeding arteries, draining veins, and shunting point; however, catheter angiography is too invasive for the purpose of the planning of intervention. 4D-CTA using a 320-detector row CT has sufficient time resolution and higher spatial resolution, and may replace catheter angiography.

METHOD AND MATERIALS
Fifteen exams (eleven patients) with AVM (face 10, toe 1, chest wall 2, mesentery 1, and spinal cord 1) who underwent 4D-CTA using a 320-detector row CT scanner before embolization were included. Time-resolved (arterial to venous phase) maximum intensity projection images were produced on a workstation. Two interventional radiologists prospectively analyzed and compared with the results of the embolization procedure about the following; 1) Detection of feeding arteries, 2) AVM type classification by Houdart and Cho, 3)Whether the embolization was performed as planned on 4D-CTA.

RESULTS
4D-CTA detected all AVMs. 4D-CTA could not demonstrate very small feeding artery that was demonstrated on catheter angiography in four exams. Except for one case in which very small feeding arteries were not visualized, the type classification proposed by Houdart and Cho based on 4D-CTA matched completely with the results of DSA. Except for three exams which were complicated by subtraction artifact, it was possible to formulate the strategy for the embolization by 4D-CTA. Embolization was performed as planned on 4D-CTA in these 12 exams. 4D-CTA also allowed visualization of draining veins and the anatomical structure around AVM using source images, which facilitated the embolization of shunting pouch by direct puncture (n =3) or transvenous approach (n =2).

CONCLUSION
4D-CTA is an effective method to understand the angioarchitecture of AVM before embolization procedures. Diagnostic catheter angiography might be omitted in many cases.

CLINICAL RELEVANCE/APPLICATION
4D-CTA is useful to plan for the embolization of extracranial arteriovenous malformations.

VI253-SDDTUB4 Thermoablation of Extra-spinal Bone Metastasis : RFA or MWA ? A Comparison Study

Participants
Adrian I. Kastler, MD, MSc, Grenoble, France (Abstract Co-Author) Nothing to Disclose
Hussein Alnassan, Besancon, France (Abstract Co-Author) Nothing to Disclose
Alexandre Kainik, MD, PhD, Grenoble CEDEX, France (Abstract Co-Author) Nothing to Disclose
Bruno A. Kastler, MD, PhD, Besancon, France (Presenter) Nothing to Disclose

PURPOSE
To compare intra procedural data and efficacy of CT guided RFA and MWA of extra spinal metastasis

METHOD AND MATERIALS
Between 2004 and 2014, 53 patients who underwent extra spinal bone metastasis thermal ablation for pain alleviation were retrospectively included in the study, and divided into two groups : RFA group and MWA. All procedure were performed under local
anesthesia and CT guidance. Analysis were made in both groups regarding: age, sexe, tumor size. The following data were assessed in both groups concerning procedures: ablation time, intra procedural pain, postoperative pain. Post procedural efficacy at 1 and 3 month were also compared in both groups and complication rates were also compared.

RESULTS

Twenty eight patients underwent RFA and 25 underwent MWA. There were no differences in ages (61 vs 66y.o), sex, tumor size (33x48 vs 30x47mm) or pain prior procedure (8.4/10 vs 7.7/10) in both groups. Intra procedural pain were similar in both groups: tolerable or not painful in 85% of cases for RFA and 86%. However, significant differences were found between RFA and MWA for procedure time: 23mn (1-45) vs 4mn (1-11). Post procedural efficacy rates did not statistically differ at 1 and 3months with similar low complication rates (10 vs 13%).

CONCLUSION

This study shows that in case of extraspinal bone metastasis ablation, MWA appears to be 4 times faster than bipolar RFA for a similar efficacy. This is particularly interesting when CT guidance is used or when aiming at large or multiples tumors where sparing time is an issue.

CLINICAL RELEVANCE/APPLICATION

RFA and MWA present similar efficacy rates, however, MWA appears to be 5 times faster for thermoablation: this data is important to consider in case of large or multiple lesions.

VI169-ED-TUBS  Upper Extremity Angiography: A Review of Anatomy, Pathology, and Interventions

Participants
Eric J. Monroe, MD, Seattle, WA (Presenter) Nothing to Disclose
Christopher R. Ingraham, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Guy E. Johnson, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Matthew J. Kogut, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The learner will develop an understanding of the modern role of catheter angiography of the upper extremity and utility before or in addition to cross sectional imaging. The learner will review patient preparation and angiographic technique for obtaining high quality images of the upper extremity arterial vasculature. The learner will review normal and variant anatomy of the upper extremity arterial vasculature. The learner will recognize classic appearances of conditions for which catheter angiography remains the gold standard imaging modality. The learner will review indications and basic concepts for interventions in the upper extremity.

TABLE OF CONTENTS/OUTLINE

Historical Perspective Modern Utilization Trauma Preoperative Planning Hemodialysis and Flow Phenomena Small Vessel Vasculitides Optimizing Technique Interpretation Normal Anatomy and Variants Classic Angiographic Diagnoses Endovascular Interventions Indications Pharmacology Patient Management
Advanced Vascular Imaging Techniques and Applications

Tuesday, Dec. 1 4:30PM - 6:00PM Location: S504AB

Participants

Sub-Events

RC412A  Aortic Imaging - Beyond Diameters

Participants
Michael D. Hope, MD, San Francisco, CA, (michael.hope@ucsf.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Explain why imaging approaches beyond assessment of vessel diameter are needed for improved risk stratification of aortic disease. 2) List potential aortic imaging targets for improved evaluation of disease progression. 3) Appraise the merits of advanced aortic imaging techniques including the use of MRI and PET for the evaluation of aortic hemodynamics and vessel wall inflammation.

RC412B  Renal MRA and Functional MRI

Participants
Ulrike I. Attenberger, MD, Mannheim, Germany (Presenter) Research Consultant, Bayer AG

LEARNING OBJECTIVES
1) To describe the technical pre-requisites for successful contrast and non-contrast-enhanced renal MRA (i.e. signal-to-noise-ratio, scan time, spatial resolution, voxel size). 2) To review contrast-agent dose optimization strategies. 3) To understand the basics of functional renal MR imaging techniques and to illustrate their potential implications on patient care.

RC412C  Functional CTA in Athletes

Participants
Richard L. Hallett II, MD, Stanford, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify anatomic and functional lesions that predispose to vascular entrapment and fibrotic syndromes in athletes. 2) Describe methods to assess vascular entrapment and fibrotic syndromes in athletes using dynamic, functionally challenged CTA and MRA. 3) Describe the imaging findings for diagnosis and follow-up of affected athletes.

ABSTRACT
While exercise is a mainstay in preventing and treating atherosclerotic peripheral vascular disease, some vascular disorders manifest primarily in athletes. Both recreational and competitive athletes are at risk for development of non-atherosclerotic vascular diseases. These disease entities range from iliac endofibrosis in cyclists, popliteal entrapment syndrome in running sports, and thoracic inlet / outlet syndromes in "overhead" athletes. Recently, computed tomography angiography (CTA) and magnetic resonance angiography (MRA) have become valuable diagnostic options for many vascular diseases that can occur in the athlete. Optimum imaging in these disorders requires the ability to tailor the exam protocol to the specific disease entity and vascular territory in question. By combining rapid CT image acquisition with functional, physiologic provocative maneuvers, diagnostic information can be maximized. Newer blood-pool MR contrast agents also allow functional assessment without ionizing radiation exposure. This session will review the pathophysiology, risk factors, diagnosis, and classification of vascular diseases seen in the athlete. Logical protocol development utilizing (when necessary) provocative maneuvers will be reviewed. Interpretation strategies for interacting with these resulting large, dynamic datasets will also be reviewed.

RC412D  Cardiovascular 3D Printing

Participants
Frank J. Rybicki III, MD, PhD, Ottawa, ON (Presenter) Research Grant, Toshiba Corporation;

LEARNING OBJECTIVES
1) To understand the difference between 3D visualization and 3D printing as related to cardiovascular diagnoses. 2) To review the different 3D printing technologies that have impacted and will impact cardiovascular care. 3) To review the clinical impact of current 3D modelling in both cardiovascular diagnoses and intervention.

ABSTRACT
While advanced visualization in cardiovascular imaging is instrumental for diagnoses and communication with referring clinicians, there is an unmet need to render DICOM images as 3D printed models capable of providing both tactile feedback and tangible depth information of both anatomic and pathologic states. 3D printed models are being rapidly embraced in cardiovascular diagnoses. The purpose of this this lecture is to review and summarize the numerous studies to date that support such benefits from cardiovascular 3D printing, as it is expected that the number of 3D printed models generated from DICOM images for planning intervention and fabricating implants will grow exponentially. 3D printing has closed the gap on the unmet need for true 3D visualization in
cardiovascular surgical planning. Source image data is primarily contrast-enhanced MRI and CT. Various approaches have been used to develop a hollow STL model, including segmenting the blood pool and printing vessels with a high-resolution technology to achieve a smooth lumen. Growing data supports the use of models to capture complex anatomy including congenital heart disease requiring surgery. Applications have included acquired cardiac abnormalities such as ventricular aneurysms and cardiac tumors. Models have been useful to plan high-risk valve cases and for intra-operative navigation. Electrocardiographic (ECG) gated CT studies for Trans-catheter Aortic Valve Replacement (TAVR) planning enable 3D printed models of the aortic annulus and surrounding structures for potentially safer valve deployment. Incorporation of patient-specific elasticity of the normal versus calcified aorta will likely be an important area of future research. Models of the aorta and other smaller vessels, including the coronary arteries, enable studies of blood flow dynamics that otherwise would not be possible in vivo.
RC350

CTA from Head to Toe

Tuesday, Dec. 1 8:30AM - 10:00AM Location: S404AB

Participants
Alison Wilcox, MD, Los Angeles, CA (Moderator) Speaker, Toshiba Corporation

Sub-Events

RC350A Cardiac CT- Pre, Peri and Post Procedural Management

Participants
Cameron Hassani, MD, Los Angeles, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Review pre-procedural patient preparation including appropriate patient selection, beta blockade, contraindications and alternatives to beta blockers
2) Discuss how to manage non-standard scenarios (atrial fibrillation, pacemaker, young adults)
3) Peri-procedural issues including vasodilation, continued heart rate control, and breathholding requirements.
4) Image acquisition including radiation dose reduction techniques, technique choice, and post CABG patient.
5) Postprocedural complications include contrast reactions and their management.

ABSTRACT
Cardiac CTA involve slightly more preparation than the standard CT acquisition. Heart rate control is the most important aspect that needs to be addressed prior to the patient arriving in the radiology department. Periprocedural issues mostly involved how to optimize technique while having the lowest radiation dose especially in the new age of dose reduction. Almost as important as heart rate management is how to treat postprocedural complications especially contrast reactions. This presentation will discuss these aspects and include treatment options as well as their alternatives.

RC350B TEVAR/EVAR- Pre, Post and Periprocedural Evaluation

Participants
Alison Wilcox, MD, Los Angeles, CA (Presenter) Speaker, Toshiba Corporation

LEARNING OBJECTIVES
1) What are some clinical indications for acute aortic imaging.
2) What are some CT parameters that can aid in various diagnosis?
3) What are some of common complications seen in TEVAR and EVAR?
4) What are the important measurements and vessel variants that help guide surgical approach.
5) New suggestions for type B management.
6) What are some imaging problems and pitfalls and some methods to assist.
7) Briefly discuss TAVR acquisition.

ABSTRACT
The acute aorta is part of a syndrome of diseases affecting the aorta with significant overlap of findings and clinical presentations. Clinically the diagnosis is difficult as there is overlap between patients with suspected coronary disease, pulmonary embolism and acute aortic syndrome. In the past several years, minimally invasive surgery with Thoracic Endovascular Aortic Repair (TEVAR) or Endovascular Aortic Repair (EVAR) have become increasingly popular. The images choices include gated vs non gated studies, non-contrast imaging, and delayed imaging. The literature is mixed on how and when to use these modalities. The complications of these procedures is often complex and subtle as well. Knowledge of these vascular complications is imperative for patient management. In addition, these patients often have significant atherosclerotic disease elsewhere that might be limiting factors for stent placement, including renal insufficiency. Newer scanners and imaging techniques can reduce radiation dose, and limit the amount of contrast delivery to preserve renal function while preserving image quality. TAVR is an example of another minimally invasive technique gaining popularity that has imaging challenges. Again, newer scanning techniques with limited contrast delivery can provide excellent image quality while limiting radiation dose and preserving renal function.

RC350C Peripheral CTA-A How-to

Participants
Ilya Lekht, MD, Los Angeles, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Enhance knowledge of normal and abnormal coronary and cardiac anatomy, with an emphasis on differentiating benign from significant variants.
2) Demonstrate the spectrum of nonatherosclerotic congenital and acquired diseases that may affect the coronary arteries.
3) Demonstrate the spectrum of non-atherosclerotic congenital and acquired diseases that may affect the heart.

ABSTRACT
A variety of non-atherosclerotic conditions are detectable on cardiac CT scans, including diseases of the heart, and disease processes which may affect the coronary arteries, or other vascular structures. Cardiac CT has a number of unique advantages in detecting non-atherosclerotic conditions, including congenital and acquired diseases. The focus of this presentation will be non-atherosclerotic conditions of the coronary arteries and of the heart. Variants of normal and abnormal anatomy of the coronary arteries will be discussed, including tips for identifying when coronary anatomic variants are significant. Acquired, non-atherosclerotic diseases of the coronary arteries will also be discussed. This presentation will also discuss the spectrum of non-
atherosclerotic diseases of the heart which may be detected at cardiac CT, including congenital and acquired valvular and cardiac diseases. At the end of this exhibit, the viewer will have a better appreciation for abnormal coronary and cardiac anatomy and the broad spectrum of non-atherosclerotic cardiovascular diseases which may be seen at cardiac CT.
RC512-01  Iterative Image Reconstruction

Participants
Dominik Fleischmann, MD, Palo Alto, CA (Moderator) Research support, Siemens AG;

Sub-Events

RC512-02  Impact of Iterative Reconstruction and Improved Spatial Resolution in CT Angiography (CTA) of Fenestrated Stent Grafts

Participants
Norbert J. Pelc, ScD, Stanford, CA (Presenter) Research support, General Electric Company; Research support, Koninklijke Philips NV; Consultant, Varian Medical Systems, Inc; Consultant, NanoX; Scientific Advisory Board, RefleXion Medical Inc; Scientific Advisory Board, Prismatic Sensors AB; Medical Advisory Board, OurCrowd, LP ;

LEARNING OBJECTIVES
1) Understand the basic concepts behind iterative reconstruction algorithms. 2) Understand the differences between these methods and conventional reconstruction. 3) Appreciate the potential advantages and disadvantages of iterative methods.

ABSTRACT
For many decades, essentially all CT images have been reconstructed using an "analytic" algorithm, such as filtered backprojection. These methods are computationally efficient, allowing fast image reconstruction, and if the raw data are of high quality the images can be exact. As the dose is reduced or if there are deterministic errors in the data, analytic reconstruction may produce lower image quality than may be possible. Iterative reconstruction methods can build in knowledge of measurement noise and other errors and yield higher image quality. They can produce lower noise images in low dose settings and in some cases higher spatial resolution. Iterative methods are generally nonlinear, meaning that the image quality depends on the object being scanned. They also produce images whose properties are "non-stationary", meaning that the image quality can vary significantly across the image. Understanding these allows the user to best evaluate their performance and appropriately use them in clinical settings.

PURPOSE
To determine if improved spatial resolution and advanced model iterative reconstruction (IR) could improve confidence or reduce artifacts at CTA in patients with fenestrated stent grafts (FSGs).

METHOD AND MATERIALS
Patients with FSGs underwent 2 CTA exams, one using a CT system with IR and improved spatial resolution (System A: Somatom Force, Siemens), and the other without IR (System B: Somatom Definition Flash or Sensation 64, Siemens). A kV selection/chart and identical slice thickness were used for both exams. Anonymized images from each system were reviewed by a 2 radiologists in side-by-side comparison, with readers specifying preference and rationale. In a separate session, readers evaluated each artery with a stent for stenosis (0=none to 3=>80%) and intraluminal artifacts (0=none to 4=non-diagnostic). Occlusion, in-stent neointimal hyperplasia, and kinks were also noted (present vs. not). Confidence for each parameter was recorded (0=uncertain to 9=completely confident). Slice-specific CTDIvol at the proximal portion of each artery was recorded from the DICOM header.

RESULTS
21 pts with FSGs having 73 vessels with stents (14 Celiac, 18 SMA, 41 renal) underwent CTA on both CT systems. System A used lower tube potentials across the study cohort. The slice-specific CTDIvol with System A was lower (mean diff -13%). In 86% (36/42) of side by side comparisons, System A was preferred due to better in-stent visualization (n=8), less noise (n=22), and fewer artifacts (n=14). System B was preferred in 5 cases with increased metal artifacts but lower slice-specific radiation dose. When in-slice radiation dose of System A was ≥ 10% lower than System B, mean intraluminal artifacts scores were lower for System A (1.8 vs. 2.1, p<0.01) and confidence for in-stent stenosis was higher (7.2 vs. 6.5, p<0.002). Otherwise, there was no difference in artifact score, stenosis, occlusion, kink or artifact (p>0.34), except that System B had a higher confidence for neointimal hyperplasia (7.6 vs. 6.8, p=0.02).

CONCLUSION
Improved spatial resolution and IR were visually preferred in unblinded comparisons, and resulted in higher confidence for in-stent visualization at lower relative doses.

**CLINICAL RELEVANCE/APPLICATION**

Improved spatial resolution and IR can improve confidence and reduce stent-related artifacts at lower dose levels, which facilitates surveillance in patients with fenestrated endografts.

**RC512-03 Assessment of Adamkiewicz Artery Using Low Dose Multi-detector Computed Tomography with Novel Iterative Model-based Reconstruction Technique**

Wednesday, Dec. 2 9:05AM - 9:15AM Location: E352

**Participants**

Tae Hyun Nam, Seongnam-Si, Korea, Republic Of (Presenter) Nothing to Disclose
Eun Ju Chun, Seongnam-Si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hyun Jin Kim, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Bon Seung Gu, Seongnam, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Soon Ahn Kwon, Seongnam-si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Gwan Hong Min, Seongnam-si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To compare the visualization of the Adamkiewicz artery (AKA) on multi-detector computed tomography (MDCT) with novel iterative model-based reconstruction (IMR) in comparison to the iterative reconstruction (iDOSE) and filtered back projection (FBP) when the low dose CT protocol was applied.

**METHOD AND MATERIALS**

Forty patients (male 65.0%, mean age 65±16 years) with aortic aneurysm or dissection who underwent 256-slice MDCT with low dose CT protocol (100 kVp and 20 mA) were enrolled. Acquired raw data were reconstructed by using FBP, median level of iDOSE (iDOSE4) and IMR, and analyzed blindly by two observers. In the quantitative analysis, the signal-to-noise ratio (SNR) of the aorta and contrast-to-noise ratio (CNR) of the anterior spinal artery relative to the spinal cord were measured on multi-planar reformatted images. In qualitative analysis, the visualization of the AKA and its continuity with the intercostal or the lumbar artery were evaluated by using a four-point scale (1, poor to 4, excellent). The visualization scale of 3 or 4 was considered assessable.

The one-way analysis of variance was used to evaluate the image quality of three reconstruction algorithm.

**RESULTS**

The interobserver agreement was good for SNR (k=0.94) and fair for CNR (k=0.73). In qualitative analysis, both SNR and CNR of IMR (SNR, 29.4±7.3; CNR, 4.8±1.7) were significantly higher than iDOSE (SNR, 20.3±6.2; CNR, 3.7±1.4) and FBP (SNR, 14.3±3.1, CNR, 3.2±1.2) (P<.05 for all comparisons). The visualization of AKA was also significantly better in IMR (SNR, 29.4±7.3; CNR, 4.8±1.7) from than iDOSE (SNR, 20.3±6.2; CNR, 3.7±1.4) and FBP (SNR, 14.3±3.1, CNR, 3.2±1.2) (P<.05 for all comparisons). The prevalence of the assessable AKA was highest in IMR (87.5%) followed by iDOSE (70.0%) and FBP (42.5%) (p<0.05).

**CONCLUSION**

IMR algorithm led to improving the visualization of the AKA compared to the use of iDOSE and FBP when the low dose CT protocol was applied.

**CLINICAL RELEVANCE/APPLICATION**

Presurgical localization of the AKA is very important for protecting the spinal cord injury. As compared to iDOSE and FBP, novel IMR algorithm is helpful for evaluation of the AKA.

**RC512-04 CT-angiography (CTA) with Low kV and Low Contrast Medium Volume Using a 256 Multi Detector CT Scanner (MDCT) in the Evaluation of Abdominal Aorta Disease: Diagnostic Efficacy and Radiation Dose Reduct**

Wednesday, Dec. 2 9:15AM - 9:25AM Location: E352

**Participants**

Camillo R. Talei Franzesi, Milan, Italy (Presenter) Nothing to Disclose
Davide Ippolito, MD, Monza, Italy (Abstract Co-Author) Nothing to Disclose
Davide Fior, MD, Monza, Italy (Abstract Co-Author) Nothing to Disclose
Pietro A. Bonaffini, MD, Monza, Italy (Abstract Co-Author) Nothing to Disclose
Maria V. Schiavone, MD, Monza, Italy (Abstract Co-Author) Nothing to Disclose
Sandro Sironi, MD, Monza, Italy (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To reduce the radiation dose exposure and the contrast medium volume by using low-kV setting CT-angiography (CTA) protocol, in the evaluation of abdominal aorta disease.

**METHOD AND MATERIALS**

From January 2013 to December 2014, 60 patients (23 women and 37 men; mean age 64.2 years; range, 34-83 years) with abdominal aorta disease were prospectively enrolled in our study. All patients underwent 256 MDCT scan examination of abdominal aorta (Brilliance-iCT, Philips, NL). Thirty-four patients were evaluated using low-dose radiation protocol (100 kV; automated tube current modulation) and low-contrast volume (30 mL; 4 mL/s; 350 mgI/mL). Twenty-six patients, as control group, underwent standard CTA protocol (120 kV; automated tube current modulation), with 80 mL of contrast medium volume. Intravessels density measurements (HU) were performed manually drawing a region of interest (ROI) in the lumen of abdominal aorta, renal arteries and common iliac arteries. The radiation dose exposure (dose-length product, DLP; CT dose index, CTDIvol) and the signal-to-noise-ratio (SNR) were calculated. The obtained data were then compared between the two groups and statistically analysed.

**RESULTS**

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All exams reached high diagnostic quality, permitting to correctly visualize and evaluate the lumen and wall of the main aortic branches. In the study group higher density measurements were observed as compared to control group, in abdominal aorta (mean attenuation value 332 HU vs 318 HU), renal arteries (341 HU vs 305 HU) and common iliac arteries (324 HU vs 311 HU). No significant noise increase was observed in the study group (mean signal to noise ratio, SNR 14.3) in comparison to control group (SNR 18.2). A significant (P<0.05) reduction in radiation dose exposure was achieved using low-kV protocol (DLP 335 mGy*cm, CTDIvol 5.8 mGy), as compared to control group (DLP 973 mGy*cm; CTDIvol 19.4 mGy), with an overall radiation dose reduction of 65%.

CONCLUSION
Low kV protocol with low contrast medium volume allows reducing the radiation dose exposure, preserving the renal function, in the evaluation of patients with abdominal vascular disease.

CLINICAL RELEVANCE/APPLICATION
Low-kV protocol with low contrast media volume reduces the radiation exposure, preserving renal function and providing an effective tool for the evaluation of patients with abdominal vascular disease.

Impact of Noise-Optimized Virtual Monochromatic Imaging at Third-Generation Dual-Source Dual-Energy CT Angiography of the Lower Extremity Run-off

Wednesday, Dec. 2 9:25AM - 9:35AM Location: E352

Participants
Julian L. Wichmann, MD, Charleston, SC (Presenter) Nothing to Disclose
Matthew R. Gillett, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Carlo N. De Cecco, MD,PhD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Ako Vanga-Szemes, MD, PhD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
U. Joseph Schoepf, MD, Charleston, SC (Abstract Co-Author) Research Grant, Bracco Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; ;
Ricardo Yamada, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Marcelo Guimaraes, Charleston, SC (Abstract Co-Author) Consultant, Cook Group Incorporated ; Consultant, Baylis Medical Company; Consultant, Terumo Corporation; Patent holder, Cook Group Incorporated
Stefanie Mangold, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Giuseppe Muscogiuri, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Stephen R. Fuller, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Christian Canstein, Charleston, SC (Abstract Co-Author) Employee, Siemens AG

PURPOSE
To assess the impact of a noise-optimized image-based virtual monochromatic imaging algorithm (VMI+) on objective and subjective image quality at third-generation dual-source dual-energy CT angiography (CTA) of the lower extremity run-off.

METHOD AND MATERIALS
We retrospectively evaluated dual-energy CTA studies of the lower extremity run-off in 48 patients (32 male, 16 female; mean age 63.3 ± 13.8 years) performed on a third-generation dual-source CT system. Images were reconstructed with standard linear blending (F_0.5) representing 120-kVp polychromatic acquisition, VMI+ and traditional monochromatic (VMI) algorithms at 40-120 keV energy levels in 10-keV increments. Vascular attenuation and image noise in 18 run-off artery segments were measured; signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were calculated. Two observers used five-point scales to subjectively evaluate vascular attenuation and image noise.

RESULTS
Objective image quality metrics peaked in the 40 and 50 keV VMI+ series (SNR: 20.2 ± 10.7 and 19.0 ± 9.5, respectively; CNR: 18.5 ± 10.3 and 16.8 ± 9.1, respectively) and were significantly (all P <0.0001) higher compared to the corresponding 40 and 50 keV VMI series (SNR: 8.7 ± 4.1 and 10.8 ± 5.0; CNR: 8.0 ± 4.0 and 9.6 ± 4.9) and the standard linearly-blended F_0.5 datasets (SNR: 10.7 ± 4.4; CNR: 8.3 ± 4.1). Subjective assessment of attenuation was highest for the 40 and 50 keV VMI and VMI+ image series (range, 4.84-4.91), both superior to F_0.5 (4.07; P <0.0001). Corresponding subjective noise assessment was superior for 50 keV VMI+ (4.71; all P <0.0001) compared to corresponding VMI (2.60) and F_0.5 (4.11).

CONCLUSION
Image reconstruction with VMI+ at low keV levels (40-50 keV) improves objective and subjective image quality compared to traditional VMI and standard linear blending reconstructions at dual-energy CTA of the lower extremity run-off.

CLINICAL RELEVANCE/APPLICATION
Improved image quality using VMI+ may improve evaluation and diagnosis in lower extremity run-off dual-energy CTA cases with suboptimal vascular opacification and potentially facilitate reduction of iodine load.

Salvage of Suboptimal CT Angiographic Studies Using Virtual Monoenergetic Images from Novel Spectral Detector CT Scanner

Wednesday, Dec. 2 9:35AM - 9:45AM Location: E352

Participants
Hamid Chalian, MD, Cleveland, OH (Presenter) Nothing to Disclose
Bahar Mansoori, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Majid Chalian, MD, Cleveland Heights, OH (Abstract Co-Author) Nothing to Disclose
Mohajen Hojjati, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Amar Dhanantwari, PhD, Highland Heights, OH (Abstract Co-Author) Employee, Koninklijke Philips NV
Prabhakar Rajah, MD, FRCR, Cleveland, OH (Abstract Co-Author) Institutional Research Grant, Koninklijke Philips NV
PURPOSE
To evaluate the ability of spectral detector CT (SDCT), a novel dual-layer technology to salvage suboptimal CT angiographic studies utilizing retrospectively generated virtual monoenergetic images.

METHOD AND MATERIALS
This study included 17 patients who had CTA on SDCT prototype (Philips Healthcare, Cleveland, OH, USA) and had a suboptimal study, defined as aortic attenuation < 200 HU. Monochromatic image sets were generated at 40, 50, 60, 70, 80 keV. Attenuation, noise, SNR and CNR were measured at ascending aorta (AA), descending aorta (DA), aortic root (AR), LAD, and left ventricle (LV). Subjective evaluation of vascular enhancement, image noise and overall image quality were graded on a 5-point scale (1= Non diagnostic, 5= excellent) by cardiac imager. From the monenergetic reconstructions, an ideal set was chosen, defined as the highest energy that provided a mean attenuation value of > 200 HU, while maintaining good image quality. At this ideal energy level, attenuation, noise, SNR and subjective image quality were compared to standard 120 kVp polychromatic study. Paired t-test was used for analysis of quantitative variables. Qualitative analysis was done using Chi-square test.

RESULTS
Mean attenuation in the conventional images was 175.9±/-55.9 HU, 188.9±/-70.4 HU, 178.2±/-67.1 HU, 164.6±/-60.1 HU, and 153.3±/-86.1 HU in the AA, DA, AR, LV, and LAD, respectively. With monochromatic images, there was improved attenuation at 40, 50, 60, 70, 80 keV levels (p value < 0.001 for all) in all patients. 50 keV image provided the best subjective image quality (4.1 vs. 1.5 on conventional images, p=0.017). Attenuation (175.9±/-55.9 vs. 334.7±/-126.8 HU, p<0.001), SNR (10.5±/-9.0 vs. 18.2±/-14.2, p<0.001) and CNR (16.0±/-13.9 vs. 25.4±/-20.2, p=0.001) of AA was significantly higher at 50 keV as compared to the conventional polyenergetic images. Similar trends were seen in other structures. Attenuation, CNR, and SNR increased for 46.5%, 37.5%, and 41.5% at 50 keV compared to conventional 120 keV.

CONCLUSION
All suboptimal CTAs were salvaged using low monoenergetic reconstruction. At the optimal monoenergetic level, the attenuation, SNR, CNR and image quality were significantly higher than that of conventional polychromatic image.

CLINICAL RELEVANCE/APPLICATION
Suboptimal angiographic studies can be salvaged using SDCT, thus obviating the need for additional contrast and radiation.

Honored Educators
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Prabhakar Rajiah, MD, FRCR - 2014 Honored Educator

RC512-07 Dual-energy and Low kVp CTA
Wednesday, Dec. 2 9:45AM - 10:10AM Location: E352
Participants
Thomas Henzler, MD, Mannheim, Germany, (thomas.henzler@medma.uni-heidelberg.de) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) The lecture will review the technical background behind dual-energy CT and primarily acquired low kVp single energy CT angiography. 2) Advantages and disadvantages between dual energy CT angiography and low kVp CT angiography are discussed. 3) Practical advices for different CTA protocols are given. 4) The clinical impact of the techniques regarding radiation dose reduction as well as contrast medium reduction will be discussed.

RC512-08 Implications for Contrast Medium Delivery
Wednesday, Dec. 2 10:20AM - 10:45AM Location: E352
Participants
Dominik Fleischmann, MD, Palo Alto, CA (Presenter) Research support, Siemens AG;

LEARNING OBJECTIVES
1) Physics of kVp dependent attenuation of x-rays (see previous lecture). 2) Physiologic principles (rules) of early arterial enhancement following intravenous contrast medium injection. 3) Potential limitations and disadvantages of low-contrast protocols in clinical practice.

ABSTRACT
Advances x-ray tubes technology allow the routine use of lower kVp settings for CT data acquisition. Lower kVp increases the x-ray attenuation of iodine relative to soft tissues, with the potential to either increase vascular opacification for the same contrast medium volume, or decrease the total contrast medium volume while maintaining image contrast. Judicious selection and modification of contrast medium injection parameters requires not only a basic understanding of the physics of kVp-dependent x-ray attenuation of x-rays (see previous presentation in this course), but also a fundamental understanding or early arterial contrast dynamics, and the potential limitations of reducing contrast medium volume for a given cardiovascular CT exam. CONTRAST PHYSIOLOGY: early arterial contrast medium dynamics can be summarized by four basic rules describing arterial opacification as a function of intravenous contrast administration: (1) Arterial enhancement is proportional to the contrast medium injection rate (iodine / second) (2) Arterial enhancement also increases in a cumulative fashion with a longer injection duration (3) The main physiologic parameter controlling the strength of arterial enhancement is cardiac output (4) For large (runoff) or diseased (aneurysm) vascular territories, the contrast medium transit time within a vascular territory has to be accounted for. LIMITATIONS OF REDUCING CONTRAST MEDIUM VOLUME: While theoretically the contrast/noise ratio may be unchanged when a low kVp / low contrast medium volume protocol is used, such calculations are based on well opacified large vessels, where the high vascular attenuation suggests that an
increase in image noise can be tolerated. However, relevant vascular features are often displayed in less attenuated small vessels or vascular borders which are affected by partial volume, and both, 3D visualization and quantitative measurements may in fact be less accurate. Any study-design aimed at assessing a low-contrast medium volume protocol thus requires a rigorous design that proves equal or better image quality. Furthermore - since low-contrast medium volume protocols are inherently justified by the perceived harm of intravenous contrast use - a study design also needs to demonstrate that a new low-dose protocol in fact reduces harm in the population of interest.

**RCS12-09 Low Contrast Media Volume for CTA of the Aorta: Individualized Protocols Adapted to the Tube Voltage**

**METHOD AND MATERIALS**

In this prospective, IRB approved study, 190 patients (69.6±11.3 years) undergoing thoracoabdominal CTA with ATVS (ref.kVp=110, ref.mAs=130) on a 192-slice dual-source CT were included. Intravenous contrast media (CM) volume was adapted based on iodine attenuation curves derived from a phantom study and depending on automatically selected tube voltages (range: 80–110kVp at 10kVp intervals). CM volume and injection rate decreased at a maintained bolus length from 110kVp (68 ml@3.6 ml/s) to 80kVp (33 ml@1.8 ml/s). Subjective image quality was assessed by three blinded, independent readers. Objective image quality (aortic attenuation and contrast-to-noise ratio [CNR]) was determined. Volume CT-dose-index (CTDIvol) and size-specific dose estimates (SSDE) were recorded. Cohen’s kappa was calculated to evaluate inter-reader agreements. Linear regression was used to assess relationships between selected tube voltage and aortic attenuation/CNR.

**RESULTS**

62 Patients were imaged at 80kVp, 84 at 90kVp, 33 at 100kVp and 11 at 110kVp. Agreements between the three readers were good for subjective image quality ($k = 0.691$). Diagnostic image quality was achieved in 96.9% of scans. Scans at 80kVp showed mean aortic attenuation of 330±54HU, at 90 kVp 325±54HU, at 100kVp 336±74HU and at 110kVp 387±62HU. CNR values were as follows: 80kVp 15±3, 90kVp 15±4, 100kVp 14±4 and 110kVp 15±4. Linear regression analysis showed no significant correlation between selected tube voltage and mean aortic attenuation ($p=0.108$) and between selected tube voltage and CNR ($p=0.795$). Mean CTDI was 3.50±0.83mGy and mean SSDE was 4.08±0.72mGy.

**CONCLUSION**

Individualized adaptation of the CM volume and injection rate to automatically selected tube voltages using ATVS allows for a reduction of CM in CTA of the aorta, while maintaining a constant and diagnostic image quality.

**CLINICAL RELEVANCE/APPLICATION**

Contrast media can be reduced in an individualized fashion according to the automatically selected tube voltage for CTA of the aorta.

**RCS12-10 Low Iodine-dose Abdominal CT Angiography Using Low Energy (keV) Images from ssDECT**

**METHOD AND MATERIALS**

This IRB approved clinical trial was designed in three phases. A total of 105 patients with AAA, scheduled for a follow-up CTA were enrolled. Each subject had a standard-iodine dose CTA. The follow-up CTA was performed on a ssDECT scanner (Discovery CT750 HD, GE Healthcare), with DECT mode and Iodixanol (GE Healthcare). This follows: Phase 1) 35 patients were scanned with standard-iodine dose (33 to 35g). Phase 2) 64 patients were scanned with 30%-reduced iodine dose (21-24g). Phase 3: 10 patients were scanned with 55%-reduced iodine dose (16g). Virtual monochromatic images (VMI) (40, 50, 60 and 70kVp) were generated from arterial-phase DECT images. Two experienced-radiologists evaluated the VMI images for image quality, diagnostic keV-range,
optimal keV for vascular assessment, and vascular evaluation. Aortic attenuation was measured and contrast-to-noise-ratio (CNR) was calculated from SECT and VMC images. CTDIvol and DLP were measured and recorded. Statistical analysis was conducted with pair student t-test.

RESULTS

Standard, low and ultra-low-dose DE-CTA exams were rated as high diagnostic quality by the readers (IQ=4.5, 4.2 and 4, respectively). VMC (40 to 70 keV) images were rated diagnostic, and 40 to 50keV were rated optimal for vascular evaluation for all 3 groups. Compared to SE-CTA images, intravascular attenuation and CNR on 40-50keV DECT images were higher at standard (3X/35%), low (2X/30%) and ultra-low (2X/20%) iodine dose (p<0.001). Both readers detected 18/18 endoleaks on the DECT scans. Radiation dose was 20-30% lower on DE-CTA, compared to SE-CTA (p<0.05).

CONCLUSION

DECT increases intravascular attenuation and CNR enabling substantial iodine dose reduction, compared to SECT. Ultra-low iodine dose DE-CTA is feasible without reduction in diagnostic quality.

CLINICAL RELEVANCE/APPLICATION

DECT allows substantial reduction of iodine dose for CT angiography while rendering high quality images, providing an opportunity to decrease contrast media related renal risks, especially in older patients. These results can be applied to other vascular regions.

Honored Educators

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Dushyant V. Sahani, MD - 2012 Honored Educator
Dushyant V. Sahani, MD - 2015 Honored Educator

RC512-11  Diagnostic Value of 70 kVp Time-resolved 4D Bone Subtracted CT Angiography with 80 cm -z-axis Coverage in Addition to Static High-pitch CT Angiography: Diagnostic Confidence and Impact on Patient Management

Participants

Georg Bier, MD, Tubingen, Germany (Presenter) Nothing to Disclose

PURPOSE

To prospectively investigate the diagnostic value of time-resolved CT angiography 4D bone subtracted datasets with 80 cm z-axis coverage in addition to static CT angiography in patients with lower limb peripheral arterial occlusive disease (PAOD).

METHOD AND MATERIALS

40 (mean age:71.7yrs;24men) patients with suspected lower limb PAOD underwent a combined CTA protocol consisting of a high-pitch-CTA run-off study starting from the abdominal aorta as well as a time-resolved-CTA of the lower limbs over 80cm (60s total scan time (8x3s, 6x6s); 70kV; 20ml iomeprol400). In addition to the time-resolved series, time-resolved bone subtracted maximum-intensity-projections were generated for each examination. Each of seven lower leg artery segments was rated with regard to contrast and diagnostic confidence (3-point scale) for stenosis assessment. In addition, two radiologists and one vascular surgeon assessed the time-resolved examination regarding additional information leading to changes in patient management.

RESULTS

Compared to the static high-pitch-CTA, time-resolved-CTA datasets with peak contrast enhancement showed significantly higher contrast and CNR in all lower limb vessel segments (p<0.05). Diagnostic confidence was rated higher for time-resolved studies when compared to the standard static high-pitch CTA studies (median: time-resolved-CTA: 3 [range 2-3]; high-pitch: 2 [1-3]). Clinically relevant findings with subsequent impact on patient management that were only visible in the time-resolved-CTA studies were found in 7 of 40 patients, including complete vessel occlusion that was mimicked by extensive calcification.

CONCLUSION

Compared to static high-pitch-CTA, time-resolved-CTA improves arterial contrast enhancement and provides higher diagnostic confidence in patients with suspected lower limb PAOD. Compared to static high-pitch run-off studies, time-resolved studies CTA acquisitions lead to a higher number of clinically important findings that directly influenced patient management.

CLINICAL RELEVANCE/APPLICATION

Adding 70 kVp dynamic CTA examinations to standard static run-off CTA improves diagnostic confidence while retaining low iodine loads, potentially influencing patient management.
To evaluate the role of CT perfusion-based assessment of inflammatory activity in patients with treated and untreated aortitis and chronic periaortitis (A/CP) and to compare results with those of clinical and serological markers.

**METHOD AND MATERIALS**

35 patients (20 female, 15 male) with aortitis/chronic periaortitis (A/CP) and clinical symptoms were examined by whole-body contrast-enhanced computed tomography (CECT) and subsequently by segmental volume perfusion-CT (VPCT) for assessment of the degree of vascularization of A/CP as surrogate marker for inflammatory activity. Blood flow (BF), blood volume (BV), volume transfer constant (k-trans), time to peak (TTP) and mean transit time (MTT) were determined and the thickness of the increased connective tissue formation was measured. Imaging data was subsequently correlated with clinical symptoms as well as with acute phase inflammatory parameters (C-reactive protein/CRP, erythrocyte sedimentation rate/ESR and leukocyte number).

**RESULTS**

21/35 patients were untreated, 14/35 had previous of ongoing immunosuppression. The interobserver agreement was good (0.78) for all VPCT parameters. Average values of perfusion parameters were higher in untreated patients, but remained also abnormally elevated in treated patients. Good agreement was found between perfusion data and CRP as well as ESR in aortitis (treated and untreated; p <0.05) and in untreated patients with periaortitis (p<0.05).

**CONCLUSION**

Perfusion-CT parameters in untreated aortitis and periaortitis show good correlation with serological markers with respect to disease activity assessment. In treated periaortitis, however, correlations with serological markers were week or inexistent suggesting an increased role for (perfusion-based) imaging.

**CLINICAL RELEVANCE/APPLICATION**

For the first time the use of a new imaging technique for diagnosis and assessment of disease activity in patients with treated and untreated aortitis and periaortitis is reported. The weak correlation of VPCT with serological parameters in treated periaortitis patients suggests a potentially increased role for VPCT displaying serologically ‘occult’ disease activity.
aortic prosthetic grafts, as well as providing insights on atherosclerotic changes of aortic wall.

**RC512-14  Post Processing, Workflow and Interpretation**

Wednesday, Dec. 2 11:35AM - 12:00PM Location: E352

Participants
Karin E. Dill, MD, Evanston, IL *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the newest post processing techniques currently available for CT angiography. 2) Describe patient-centric imaging and workflow tools which optimize patient care.

**ABSTRACT**

Rapid evolution of imaging post-processing tools allows for continued advancement in the ability to manipulate data for image interpretation. The newest CTA post processing software will be demonstrated, leading to improved diagnostic capability. Efficient workflow algorithms will be reviewed which center around the patient, bringing multidisciplinary teams together in the workup, diagnosis and treatment of those seeking care. An emphasis will be placed on imaging guidelines which will ultimately be linked to decision support for reimbursement.
Participants
Parag J. Patel, MD, Milwaukee, WI (Moderator) Consultant, Medtronic, Inc; Consultant, C. R. Bard, Inc; Consultant, Penumbra, Inc; Jonathan M. Lorenz, MD, Chicago, IL (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
1) Describe pros and cons of intervention for median arcuate ligament compression on the celiac axis. 2) Explain the use of radial artery access. 3) Outline 3 recommendations for endovascular treatment of peripheral vascular disease. 4) Describe current status of true percutaneous endovascular repair of abdominal aortic aneurysms. 5) Describe 2 vascular compression syndromes.

Sub-Events

Participants
Marcelo Guimaraes, Charleston, SC (Presenter) Consultant, Cook Group Incorporated; Consultant, Baylis Medical Company; Consultant, Terumo Corporation; Patent holder, Cook Group Incorporated

LEARNING OBJECTIVES
View learning objectives under main course title.

RC514-02 Application of Monochromatic Imaging on Lower Extremity Artery CTA: Comparison with Conventional 120kVp CT Imaging

Participants
Likun Li, Weifang, China (Presenter) Nothing to Disclose
Hai Geng, Weifang, China (Abstract Co-Author) Nothing to Disclose
Wenjuan Wang, Guangzhou, China (Abstract Co-Author) Nothing to Disclose
Guang Dong, MD, Weifang, China (Abstract Co-Author) Nothing to Disclose
Yujing Zhu, Weifang, China (Abstract Co-Author) Nothing to Disclose
Huizhi Cao, Beijing, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the application value of computed tomography (CT) monochromatic imaging on lower extremity artery computed tomography angiography (CTA), compare with conventional 120kVp.

METHOD AND MATERIALS
40 patients with clinically suspected lower extremity arterial disease were randomly divided into two groups, each group included 20 cases. Patients of group A were scanned by conventional CT (tube voltage was 120kVp, tube current was 360mA). Patients of group B were scanned by spectral CT imaging (80kVp/140kVp switching, tube current was 360mA). 60keV monochromatic images were reconstructed. The other scanning parameters keep consistent. All of the patient were injected iodine contrast agent 90–100ml with 350mg/ml. Two experienced radiologists double blindly assessed image quality subjectively. Objective evaluation of the image quality included CT value of the aorta, the iliac artery and the femoral artery, and image noise (SD). Average volume CT dose index (CTDvol), signal to noise ratio (SNR) and contrast agent injection volume were calculated.

RESULTS
The image quality excellent and good rate of group A and B were 92.5% and 100%, respectively. The subjective score of the image quality were 3.45±0.76 and 3.70±0.47, respectively. The average CTDvol of group A and B was 17.75±0.20mGy and 12.17±0.14mGy, respectively(p<0.01). The average SNR of the end of aorta, iliac artery and femoral artery of group A was 33.97±11.49, 19.31±4.23 and 29.47±19.01, which was lower than that of group B (46.84±13.40, 19.46±3.15 and 31.07±9.16), with no statistically significant.

CONCLUSION
In the lower extremity artery CTA imaging, monochromatic images of 60keV can improve image quality on low radiation dose.

CLINICAL RELEVANCE/APPLICATION
Optimal image quality with substantially higher venous attenuation is provided by 60-keV monochromatic images from dual-energy CT acquisition compared with 120kVp images.
PURPOSE

To investigate the morphological characteristics of long-segment chronic total occlusions of the femoropopliteal arteries (LFP-CTOs) as predictors of the optimal recanalization strategy.

METHOD AND MATERIALS

We retrospectively evaluated the morphological characteristics of 102 CTOs (74 patients) treated with antegrade and/or retrograde recanalization using contrast enhanced-magnetic resonance / computed tomography angiography and digital subtraction angiography imaging results. Proximal morphology, lesion length, calcification, proximal branching, collateral circulation, runoff vessels, and concomitant arterial occlusion were used as predictors for univariate analysis. Multivariate logistic regression analysis was performed to identify independent predictors of successful angioplasty and recanalization.

RESULTS

Antegrade and retrograde recanalization were successful in 82 and 10 CTOs, respectively (total success rate, 90.2%). The antegrade approach was frequently used for wire crossing and had a shorter mean procedure time than the retrograde approach (90.7 ± 35.3 min vs. 185.5 ± 41.2 min, P < 0.001). Multivariate analysis revealed that concomitant artery occlusion [odds ratio (OR): 0.299; 95% confidence interval (CI): 0.103-0.868; P=0.026] was a lower likelihood technical success; flush occlusion (OR: 41.795; 95% CI: 4.567-382.517; P<0.001) and large collateral (OR: 14.829; 95% CI: 1.350-162.898; P=0.027) were predictors of retrograde recanalization. During follow-up, sustained ABI improvement was founded in 79.3% limbs, and the binary restenosis rate was 40.2% in antegrade group and 50.0% in retrograde group (P > 0.05), but the flush occlusion (OR: 3.736; 95% CI: 1.152 - 12.119; P=0.028) was associated with a significantly higher likelihood of binary restenosis.

CONCLUSION

We recommend that LFP-CTOs with concomitant occlusion should be treated with bypass surgery, whereas flush occlusions and those with large collateral circulation should be managed with retrograde recanalization earlier if antegrade approach fails.

CLINICAL RELEVANCE/APPLICATION

Morphological characteristics of long-segment chronic total occlusions of femoropopliteal arteries can help predict the optimal strategy for endovascular recanalization.

PURPOSE

The U.S Preventive Services Task force has never supported routine screening for peripheral arterial disease (PAD). There is no need to treat asymptomatic (or even many symptomatic) patients and studies suggest only very modest recent growth in PAD incidence. For these reasons, our goal was to assess recent trends in the use of ultrasound (US) and noninvasive physiologic tests (NPTs), the most common tests used to screen for and initially diagnose PAD.

METHOD AND MATERIALS

The nationwide Medicare Part B databases for 2001 through 2013 were used. The 2 CPT codes for extremity arterial US and the 3 codes for extremity NPTs were selected. Procedure volume trends were evaluated. Medicare’s physician specialty codes were used to determine which specialists were doing the studies. Utilization rates per 1000 were calculated.

RESULTS

Total Medicare volume of extremity arterial US was 396,734 in 2001, increasing every year thereafter to 818,272 in 2013 (+106%). The US utilization rate per 1000 was 11.7 in 2001, rising to 21.9 in 2013 (+87%). NPT volume increased from 716,005 in 2001 to a peak of 1,362,789 in 2010, then dropped to 1,278,145 in 2013 (+79% vs 2001)). The NPT rate per 1000 increased from 21.0 to a peak of 39.7 in 2010, then dropped to 34.3 in 2013 (+63% vs 2001). The 3 highest volume specialties in arterial US in 2013 were surgery (258,104 - up 108% vs 2001), radiology (210,477 - up 93% vs 2001) and cardiology (187,275 - up 267% vs 2001). The 3 highest volume specialties in NPTs in 2013 were surgery (444,623 - up 35% vs 2001), cardiology (267,005 - up 206% vs 2001), and primary care (229,215 - up 208% vs 2001). The overall rate of use of these 2 major kinds of tests for PAD increased from 32.7 per 1000 in 2001 to 56.2 in 2013 (+72%).

CONCLUSION

Use of both US and NPTs for possible PAD grew rapidly from 2001 to 2013. Growth was especially high among surgeons and cardiologists. There is no apparent medical rationale for the increasing utilization of these tests for PAD. The rapid growth in use of both US and NPTs raises concern about overuse, especially given the fact that surgeons and cardiologists are in a position to self-refer.

CLINICAL RELEVANCE/APPLICATION

n/a

PURPOSE

Update on Recommendations for Endovascular Treatment of PVD in 2015-This Is What To Do and Why to Do It

Participants

Jungong Zhao, MD, Shanghai, China (Presenter) Nothing to Disclose

Laurence Parker, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

Geoffrey A. Gardner Jr, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

Vijay M. Rao, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

Participants

David C. Levin, MD, Philadelphia, PA (Presenter) Consultant, HealthHelp, LLC; Board of Directors, Outpatient Imaging Affiliates, LLC

Laurence Parker, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

Geoffrey A. Gardner Jr, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

Vijay M. Rao, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
RC514-06 **EVAR: True Percutaneous Devices? When?**

Participants
Martin A. Funovics, MD, Vienna, Austria (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
View learning objectives under main course title.

RC514-07 **Automated Quantification of Muscle Perfusion Using contrast Enhanced Ultrasound: Initial in Vitro and in Vivo Evaluation of Lower Limb Perfusion**

Participants
Parag J. Patel, MD, Milwaukee, WI (Presenter) Consultant, Medtronic, Inc; Consultant, C. R. Bard, Inc; Consultant, Penumbra, Inc;

**LEARNING OBJECTIVES**
View learning objectives under main course title.

PURPOSE
An accurate and automated technique for quantification of tissue microperfusion is desirable for a wide-range of clinical applications including atherosclerotic and diabetic peripheral vascular disease. Existing studies evaluating peripheral vascular disease still use qualitative visual assessment and studies quantifying contrast ultrasound signals have limited outcomes. In this study, we develop a pixel-based automated bubble detection algorithm capable of separating contrast signals from both tissue signal and noise thus generating a quantitative surrogate measure of muscle blood flow.

**METHOD AND MATERIALS**
Quantification of contrast signal at varying dilutions of microbubble was performed within an in-vitro phantom to develop the automated bubble detection algorithm. After ethical approval and informed consent, the in-vivo study evaluated muscle perfusion of the right calf before and after physical exercise in 5 healthy volunteers. Imaging was acquired using a Phillips iU-22 ultrasound platform with a L9-3 linear probe. Offline blinded image analysis was performed using an average of 5 regions of interest placed over the muscle bulk. Surface area ratio of bubble pixel intensity to background signal was calculated as a surrogate of muscle microperfusion which was compared before and after exercise.

**RESULTS**
The in vitro study demonstrated a good agreement between known bubble concentrations and quantification measures generated by the algorithm (R=0.94). For in vivo data the quantification results were calculated using the algorithm and compared before and after subject exercise. Initial analysis showed that the average blood volume in the calf muscle increased by 48% after exercise (P<0.004).

**CONCLUSION**
The automated bubble detection algorithm has shown to be a promising tool for detecting and quantifying microbubble signals representing muscle microperfusion both in vitro and in vivo.

**CLINICAL RELEVANCE/APPLICATION**
Contrast enhanced ultrasound may provide a novel imaging technique for assessment of lower limb muscle microperfusion. This novel imaging biomarker may provide valuable information in diagnosis and treatment response in lower limb peripheral vascular disease.

RC514-08 **Twins Study: Role of Femoral Ultrasound Examination in Predicting Cardiovascular Risk**

Participants
Pierleone Lucatelli, MD, Roma, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Cirelli, Rome, Italy (Presenter) Nothing to Disclose
Renato Argiro, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Beatrice Sacconi, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Riccardo Rosati, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Fabrizio Fanelli, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
Compare Common-Femoral-Artery (CFA) and Common-Carotid-Artery (CCA) Echo-Color-Doppler examination in predicting the cardiovascular risk in a sample of apparently healthy twins recruited from the Italian Twin Registry.

**METHOD AND MATERIALS**
The multicenter study included 322 twins (59.9% female) aged 20-78 years (52.1±15.3). Subjects underwent Echo-Color-Doppler examination of CCA and CFA. Mean IMT in both right and left sides of the CCA or CFA was recorded. Mean values were compared by Student’s t test for paired data and by robust regression model to take account of the dependence of twin data within pairs and of confounders (age and gender). Plaques (thickening ≥1.5 mm over IMT) prevalence and composition (calcific, fibro-lipidic, mixed) in the two regions were estimated and compared by chi-squared test or logistic regression for clustered observation.

RESULTS
A significant difference (P<0.01) between mean CCA-IMT and mean CFA-IMT was detected (0.70±0.20 vs 0.73±0.24mm), although mean difference between the two traits was relatively small (0.03±0.17mm). Plaque prevalence was significantly higher in CFA compared to CCA (40.7% vs 30.4%). This result was confirmed even when only lipid plaque (33.6% in CCA and 24.5% in CFA) was considered and when age and gender were incorporated in the analysis. Isolated plaque prevalence was 18.3% for CCA and 8.1% for CFA. 51.2% of the sample had at least a plaque in both traits.

CONCLUSION
Echo-Color-Doppler identifies more plaques in CFA than in CCA, with prevalent fibro-lipid composition. Femoral Echo-Color-Doppler should be introduced as part of screening protocols in order to assess the cardiovascular risk.

CLINICAL RELEVANCE/APPLICATION
Echo-Color-Doppler identifies more plaques in CFA than in CCA therefore Femoral Echo-Color-Doppler should be introduced as part of screening protocols in order to assess the cardiovascular risk.

PURPOSE
Elite overhead athletes, like volleyball players, are at risk of finger ischemia due to arterial emboli originating from an injured and degenerated proximal posterior circumflex humeral artery (PCHA) in the dominant shoulder. Ultrasound (US) is the first line imaging modality for assessment of the PCHA in symptomatic athletes. However, identification and assessment of the PCHA is cumbersome in the hands of inexperienced ultrasonographers, partially due to anatomical variations and the nearby originating and resembling deep brachial artery (DBA). The purpose of this study is (1) to determine the prevalence of PCHA aneurysms in elite volleyball players and (2) to describe PCHA and DBA characteristics that can be used for accurate identification and assessment of the PCHA.

METHOD AND MATERIALS
From January 2014 until July 2014, two experienced ultrasonographists completed the standardized PCHA US-protocol in 286 elite volleyball players. Assessment included determination of PCHA aneurysms (defined as segmental vessel dilatation ≥150%), anatomy/branching pattern, and PCHA and DBA vessel characteristics: course and diameter.

RESULTS
The PCHA was identified in 100% of volleyball players (n=286) and the DBA in 96% (n=276). An aneurysm of the PCHA was detected in 4.1% of the volleyball players (n=12) with a mean diameter of 5.9mm ±1.7 and was significantly larger compared to non-dilated PCHA vessel segments (p<0.01). The mean non-dilated PCHA and DBA diameters were 3.8mm ±0.5 (95%CI 3.7-3.8) and 2.3mm ±0.5 (95%CI 2.2-2.3), respectively. The PCHA originated directly from the axillary artery in 82% (n=235) and the DBA in 70% (n=200). PCHA anatomical variations included a common trunk with the DBA (n=24), common trunk with a different artery than the DBA (n=21) and a common trunk with two other arteries (n=3). The PCHA showed a tortuous course towards the humerus in 100% of the cases. The DBA showed a straight course parallel to the axillary artery in 100% of the cases.

CONCLUSION
The prevalence of PCHA aneurysms was 4.1% in our study cohort of 286 elite volleyball players. The reported PCHA and DBA vessel characteristics provide clear guidance for identification and assessment of the PCHA.

CLINICAL RELEVANCE/APPLICATION
One in twenty-five elite volleyball players showed a PCHA aneurysm on ultrasound. We provide PCHA characteristics and diameters that can be used as reference values (normal vs. aneurysmatic) for clinical assessment and research.

METHOD AND MATERIALS
From January 2014 until July 2014, two experienced ultrasonographists completed the standardized PCHA US-protocol in 286 elite volleyball players. Assessment included determination of PCHA aneurysms (defined as segmental vessel dilatation ≥150%), anatomy/branching pattern, and PCHA and DBA vessel characteristics: course and diameter.

RESULTS
The PCHA was identified in 100% of volleyball players (n=286) and the DBA in 96% (n=276). An aneurysm of the PCHA was detected in 4.1% of the volleyball players (n=12) with a mean diameter of 5.9mm ±1.7 and was significantly larger compared to non-dilated PCHA vessel segments (p<0.01). The mean non-dilated PCHA and DBA diameters were 3.8mm ±0.5 (95%CI 3.7-3.8) and 2.3mm ±0.5 (95%CI 2.2-2.3), respectively. The PCHA originated directly from the axillary artery in 82% (n=235) and the DBA in 70% (n=200). PCHA anatomical variations included a common trunk with the DBA (n=24), common trunk with a different artery than the DBA (n=21) and a common trunk with two other arteries (n=3). The PCHA showed a tortuous course towards the humerus in 100% of the cases. The DBA showed a straight course parallel to the axillary artery in 100% of the cases.

CONCLUSION
The prevalence of PCHA aneurysms was 4.1% in our study cohort of 286 elite volleyball players. The reported PCHA and DBA vessel characteristics provide clear guidance for identification and assessment of the PCHA.
RC514-11  Median Arcuate Ligament Syndrome

Wednesday, Dec. 2 11:30AM - 12:00PM Location: E353A

Participants
Jonathan M. Lorenz, MD, Chicago, IL (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.
**Title:** Reverse Attenuation Gradient Sign at CT angiography- A Potentially Useful Sign for Differentiating Type II Endoleak from Other Types of Endoleak

**Station #1**

**Participants**
Sarah B. White, MD, Philadelphia, PA (Moderator) Consultant, Guerbet SA; Research support, Guerbet SA; Consultant, Vascular Solutions, Inc; Consultant, Cook Group Incorporated; Research support, Seimens AG

**Overview**

The purpose of this study was to examine the clinical importance of the reverse attenuation gradient (RAG) sign in patients with endoleaks after endovascular aortic aneurysm repair (EVAR) observed with computed tomographic angiography.

**Method and Materials**

Our institutional review board approved this retrospective study, and informed consent was waived. Fifteen consecutive patients (12 male and 3 female patients; mean age, 77.5 years ± 7.6 [standard deviation]; range 62-90 years) with endoleaks confirmed at invasive angiography after either thoracic (n=8) or abdominal (n=7) EVAR were enrolled in this study. The RAG sign was defined as the reverse intraluminal opacification gradients of vessels distal to the proximal lesions, which has lower attenuation in the proximal segment and gradually increased attenuation along the vessel. Two experienced radiologists (with 12 and 8 years of experience in vascular imaging, respectively) were reviewed the images of CT angiography and invasive angiography. We compared the blood flow direction at invasive angiography and the frequency of RAG sign. Fisher's exact probability test was used for comparison.

**Results**

There were 15 patients with EVAR endoleaks confirmed at invasive angiography. Invasive angiography was used to confirm 6 anterograde flows (AFs) and 9 retrograde flows (RFs). The RFs group had the RAG sign significantly more frequently than did the AFs group (89% [8 of 9] vs 17% [1 of 6]; P< .05).

**Conclusion**

The RAG sign in CT angiography might represent the flow direction from proximal to distal. The RAG sign might be a help to differentiate type2 endoleak from other types of endoleak.

**Clinical Relevance/Application**

To accurately differentiate type 2 endoleak from other types of EVAR endoleak is very important to plan for additional treatment, because it is different depending on the types of endoleak.

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**Title:** Comparative Study of Doxorubicin-loaded Drug Eluting Microspheres: An In Vitro Evaluation

**Station #2**

**Participants**
Hsiang-Jer Tseng, MA, MD, Atlanta, GA (Presenter) Recipient of RSNA medical student research grant in 2012.
Lihui Weng, PhD, Minneapolis, MN (Abstract Co-Author) Chief Scientific Officer, EmboMedics Inc
Parinez Rostamzadeh, Minneapolis, MN (Abstract Co-Author) Nothing to Disclose
Jafar Golzarian, MD, Minneapolis, MN (Abstract Co-Author) Chief Medical Officer, EmboMedics Inc

**Overview**

To compare the in vitro loading and post-injection drug recovery rates of two drug eluting microspheres (DEMs), DC Beads (DCBs) and bioreabsorbable microspheres (BRMS).

**Method and Materials**

DCBs (Bioresorbables, UK) and BRMS in the size range of 100-300 μm were compared. For the drug loading process, DEMs were immersed in a doxorubicin hydrochloride aqueous solution (2 mL, 25 mg/mL) at 5°C. At predetermined time points, the concentration of the loading solution was monitored with a UV spectrophotometer (by measuring the absorbance (at 482 nm) with the aid of a calibration curve. DEMs were suspended in a mixture (20 mL) of normal saline and contrast at a ratio between 4:6 and 6:4. The suspension was injected into a beaker using a 2.8 F Progreat microcathether (ID=0.027", Terumo, NJ). The following data were recorded: (1) Weight of DEMs delivered. (2) Dosage remained on the delivered DEMs. This dosage was obtained with a complete elution of the recovered DEMs after injection. (3) Dosage loss during injection. This was calculated by measuring the concentration of the injection medium after removing the post-injection DEBs. Each experiment was performed in triplicate.

**Results**

[Further details on results and discussion would follow here.]
Both DEMs can load >98% of doxorubicin after 2 hours. 75.92% and 83.33% of the DEMs by weight were recovered post-injection for DCBs and BRMS, respectively (p=0.0779). 80.58% of doxorubicin remained on post-injection DCBs while 82.24% remained on BRMS (p=0.3804). 3.57% of drug was eluted in the contrast/normal saline medium for DCBs while 8.2% of drug was eluted for BRMS (p=0.0171).

CONCLUSION
Both DEMs exhibited similar loading efficacies for doxorubicin. Even though more drug was lost by elution for the BRMS when compared with the DCBs, this was made up for by a higher fraction of the beads recovered during injection from the BRMS. Overall, both DEMs perform similarly in terms of drug dosage delivery.

CLINICAL RELEVANCE/APPLICATION
BRMS has been shown to be non-cytotoxic, degradable, injectable and loadable with doxorubicin, showing great promise as a vehicle for transarterial chemoembolization.

VI235-SD-WEA3 Magnetic Resonance Image-guided Cryoablation of Recurrent Prostate Cancer: 3 Year Follow up

Participants
Kristin A. Kinsman, MD, Rochester, MN (Presenter) Nothing to Disclose
David A. Woodrum, MD, PhD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Akira Kawashima, MD, Scottsdale, AZ (Abstract Co-Author) Nothing to Disclose
Krzysztof Gorny, PhD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Joel P. Felmlee, PhD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
R. Jeffrey Karnes, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Eugene D. Kwon, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Lance A. Mynderse, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the intermediate-term (3 year follow up) effectiveness of MRI-guided percutaneous cryotherapy for biopsy proven locally recurrent prostate cancer, after radical prostatectomy, with curative intent.

METHOD AND MATERIALS
IRB approved single arm study to examine the effectiveness of MR guided cryoablation for locally recurrent prostate cancer. Eight patients, of a 31 patient cohort, treated for curative intent had a 3 year follow up. Each patient was treated with MRI-guided cryoablation for locally recurrent prostate cancer. All patients (mean 63.57-73 years old) had visible nodules on multiparametric MRI (mpMRI) with TRUS, biopsy proving recurrent prostate cancer. All eight patients had primary prostatectomy for prostate cancer with 3 of 8 receiving subsequent radiation therapy for recurrent cancer afterwards. After careful confirmation of locally recurrent disease using PET choline and MRI, MR guided cryoablation was discussed. MR guided cryotherapies were performed with 1.5T MRI (Siemens Espree, Erlangen, Germany). Cryoprobes (2-4) were placed using transperineal guidance grid (Biotex, Houston TX). MR-guided cryoablation (Galil Inc., Minneapolis, MN) was performed using 3 freeze-thaw cycles with continuous MRI monitoring during the freezing. Follow up was performed with serial PSA (1,3,6,12,18,24,30, and 36 months), mpMRI (6,12,24, and 36 months), and clinic visit (6,12,24, and 36 months). If there was a rise in PSA to >1ng/mL then a PET choline is performed.

RESULTS
The mean pre-ablation PSA was 0.67ng/mL (0.29-2.2) All 8 patients had a PSA <0.2ng/mL at 1 month status post ablation. The mean 3 year PSA was 0.21ng/mL (0.1-0.95). Five of 8 patient’s PSA remained <0.2 ng/mL throughout the 3 year follow up without subsequent therapy. One patient with a bladder neck lesion recurred at 6 months, and went on to radiation therapy. Two patients have had a slow rise in PSA but no definite recurrence in the prostate bed by imaging or biopsy. Treatment related complications include worsening erectile dysfunction (1/8), minor incontinence (2/8), and worsening of moderate urinary incontinence (1/8). No patient developed rectal injury or ureteral injury.

CONCLUSION
MRI-guided cryoablation for patients with locally confined prostate bed recurrences can be an effective treatment option.

CLINICAL RELEVANCE/APPLICATION
MRI-guided cryoablation offers patients with recurrent prostate cancer another possible option for treatment beyond surgery and radiation.

VI254-SD-WEA4 The Safety and Efficacy Profile of TACE for Treating Hepatocellular Carcinoma in Patients Co-infected with HIV and HCV: A Propensity Score Matching Study

Participants
Jae Ho Sohn, MD, MS, New Haven, CT (Presenter) Nothing to Disclose
Reham R. Haroun, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Julius Chapiro, MD, Berlin, Germany (Abstract Co-Author) Nothing to Disclose
Sonia P. Sahu, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Yan Zhao, MS, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Rafael Duran, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Florian N. Fleckenstein, MS, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Ruediger E. Schernthaner, MD, Vienna, Austria (Abstract Co-Author) Nothing to Disclose
Li Zhao, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Susanne Smolka, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Ming De Lin, PhD, Briarcliff Manor, NY (Abstract Co-Author) Employee, Koninklijke Philips NV
Jean-Francois H. Geschwind, MD, Westport, CT (Abstract Co-Author) Researcher, BTG International Ltd; Consultant, BTG International Ltd; Researcher, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Researcher, Guerbet SA; Consultant, Guerbet
Percutaneous ablation of oligometastatic prostate cancer appears safe, achieves acceptable local control rates, and can delay anti-retroviral therapy (ART). Significant complications were recorded.

RESULTS

Of the 456 patients, 35 patients in EXP group were successfully matched to 75 patients in CTRL group. 15 (42.9%) patients had detectable HIV viral load. Median CD4 count was 406 x 10^6 cells/mm^3 (range 121 to 1086). 31 (88.5%) patients were on ART. The cohort spanned all BCLC/HKLC stages. KM revealed MOS of 20.0 months for the EXP group and MOS of 21.3 months for the CTRL group (p = 0.907). Cox model on EXP group did not identify any infectious disease variables of significance on survival. No significant complication, such as death, ICU stay, or fulminant liver failure within 30 days of TACE, was observed in the EXP group.

CONCLUSION

In HCC patients with HIV/HCV co-infection and CD4 > 100, TACE demonstrated comparable safety and efficacy profile as in HCC patients with HCV only.

CLINICAL RELEVANCE/APPLICATION

Interventional oncologists should feel comfortable offering TACE as a treatment option to HCC patients with HIV/HCV co-infection.
Novel Uses of Cone-Beam CT in the Interventional Radiology Suite

Station #6

Participants
Prakhar K. Agarwal, MD, Bronx, NY (Presenter) Nothing to Disclose
Cyrus Shabrang, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Amit Daftari, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Oren T. Herman, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Yosef Golowa, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Marcy B. Jagust, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Jacob Cynamon, MD, Suffern, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To review the set-up and acquisition of cone-beam CT. Discuss the pros and cons of using cone-beam CT. To review the utility of cone-beam CT in pre-procedural planning, immediate procedure outcome, and detection of post-procedural complications.

TABLE OF CONTENTS/OUTLINE
Physics and acquisition of cone-beam CT Cone-beam CT setup in the IR suite Pros and cons of cone-beam CT Pre-procedure evaluation Immediate post-procedure assessment Detecting post-procedural complications Summary and conclusions
**Vascular Interventional Wednesday Poster Discussions**

**Clinical and Imaging Predictors for Positive Angiographic Findings in Blunt Splenic Trauma**

Station #1

**Participants**

Aaron Ashton, MD, Houston, TX *(Presenter)* Nothing to Disclose
Derek L. West, MD, Houston, TX *(Abstract Co-Author)* Nothing to Disclose
Dhivya Srinivasa, MD, Houston, TX *(Abstract Co-Author)* Nothing to Disclose
Salman Erraj, Houston, TX *(Abstract Co-Author)* Nothing to Disclose
Joseph J. Love, Houston, TX *(Abstract Co-Author)* Nothing to Disclose
Alan M. Cohen, MD, West University, TX *(Abstract Co-Author)* Research Consultant, Medical Components, Inc Chief Medical Officer, Itomography Corp

**PURPOSE**

To determine the likelihood of positive findings on splenic angiography (SA) for blunt spleen trauma (BST) based on American Associate for Surgery of Trauma (AAST) grading and clinical indicators.

**METHOD AND MATERIALS**

Medical charts from 990 patients with BST at a level 1 trauma center, between January 1, 2008 and December 31, 2013, were retrospectively reviewed. Eighty-five received SA (mean age: 36.7 +/- 16.0 years, range 8-82) and 22 were female (25.9%). Grade of injury (AAST scale), angiography findings, hemodynamic status, ACT, and outcomes were analyzed.

**RESULTS**

All seventy patients (82.4%) with positive angiographic findings received embolization using gelfoam and/or coils. A logistic regression to compare high versus low grade injuries demonstrated an odds ratio (OR) of 4.35 (95% CI= 1.24 to 15.23, p=0.0215) that high grade injuries will have positive angiography. Of the patients who underwent angiography, a total of 10 (11.7%) had complications requiring further procedure. Five (5.9%) underwent splenectomy after angiography, two (2.4%) required repeat embolization, and one (1.2%) each developed a pseudoaneurysm, underwent splenorrhaphy, or required a drain placement. No statistically significant association was found between positive angiographic findings and the clinical indicators.

**CONCLUSION**

Traditionally, a patient’s clinical status is a significant motivator for urgency of angioembolization. Our data suggests that there is no predictive value, and therefore no indication for angiography based on clinical parameters alone. A statistically significant correlation between AAST grading and positive angiography suggests high grade injuries may benefit from angiography in order to prevent failure in non-operative management. Our data would support the use of CT findings as the key decision point in indication for angiography, as opposed to the traditional use of a patient’s clinical status.

**CLINICAL RELEVANCE/APPLICATION**

AAST grading of traumatic splenic injury using CT should be used in addition to hemodynamic and clinical parameters when determining whether a patient should undergo conventional angiography.

**Patient-specific Prostate Deformation Modelling via Shear Wave Elastography for TRUS-guided Interventions**

Station #2

**Participants**

Yi Wang, Hong Kong, Hong Kong *(Presenter)* Nothing to Disclose
Dong Ni, BEng, MPH, Hongkong, China *(Abstract Co-Author)* Nothing to Disclose
Jing Qin, Shenzhen, China *(Abstract Co-Author)* Nothing to Disclose
Ming Xu, Guangzhou, China *(Abstract Co-Author)* Nothing to Disclose
Xiaoyan Xie, Guangzhou, China *(Abstract Co-Author)* Nothing to Disclose
Pheng Ann Heng, PhD, Shatin, Hong Kong *(Abstract Co-Author)* Nothing to Disclose

**PURPOSE**

Shear wave elastography (SWE) shows promise as a technological achievement that provides quantitative information about tissue elasticity. The purpose of this study was to take advantage of the patient-specific biomechanical properties obtained from SWE to reliably predict the prostate deformation during transrectal ultrasound (TRUS)-guided interventions.

**METHOD AND MATERIALS**

A 3D patient-specific prostate deformation model was generated with the finite element analysis and the quantitative tissue parameters measured from the SWE. With the incorporation of personalized prostate elasticity parameters into the finite element modelling, our deformation model can precisely estimate the complicated volumetric deformation within the prostate during the TRUS-guided interventions. The patient-specific deformation model was applied to register the preoperative MR images with the
TRUS images for boosting the efficacy and accuracy of TRUS-guided interventions.

RESULTS
Experiments were carried out on the datasets obtained from ten patients with suspected prostate cancer. A set of SWE, MR, and TRUS images were reviewed by two radiologists: 482 consecutive patients with reported slow venous flow and 493 consecutive patients without reported slow venous flow were identified for retrospective analysis. The presence or absence of subjective slow venous flow and absence of initial DVT was confirmed by consensus reevaluation. Peak venous flow velocities were recorded at the common femoral, femoral and popliteal levels, respectively. Each patient had at least one year clinical and/or sonographic follow-up to determine the possible presence of subsequent DVT. The associations between DVT and the presence of slow venous flow were examined using Fisher's exact test. A 2-sample t-test was employed for peak velocity comparison of the slow flow versus normal flow groups and DVT vs non-DVT groups. The optimal cut off peak velocity to correlate with radiologist perceived slow flow was determined by Youden's index.

CONCLUSION
The use of true tissue elasticity measured from SWE shows promise for patient-specific deformation modeling and thus benefits the MR-TRUS registration for image-guided interventions.

CLINICAL RELEVANCE/APPLICATION
The true tissue stiffness obtained from SWE benefits the patient-specific biomechanical modeling and shows promise for providing precise treatments in applications that use TRUS-guided interventions.

PARTICIPANTS
Veral D. Amin, MD, Pearland, TX (Presenter) Nothing to Disclose
Corey T. Jensen, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Khaled M. Elsayes, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Nicolaus A. Wagner-Bartak, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Tharakeswara K. Bathala, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Shouhao Zhou, Houston, TX (Abstract Co-Author) Nothing to Disclose
Deepak G. Bedi, MBCh, Houston, TX (Abstract Co-Author) Consultant, Koninklijke Philips NV

PURPOSE
To determine whether the qualitative sonographic appearance of slow venous flow in the lower extremities correlates with an increased risk of subsequent deep venous thrombosis (DVT) in oncology patients.

METHOD AND MATERIALS
In this institutional review board approved, retrospective study, 975 lower extremity venous Doppler ultrasound examinations were reviewed by two radiologists: 482 consecutive patients with reported slow venous flow and 493 consecutive patients without reported slow venous flow were identified for retrospective analysis. The presence or absence of subjective slow venous flow and absence of initial DVT was confirmed by consensus reevaluation. Peak venous flow velocities were recorded at the common femoral, femoral and popliteal levels, respectively. Each patient had at least one year clinical and/or sonographic follow-up to determine the possible presence of subsequent DVT. The associations between DVT and the presence of slow venous flow were examined using Fisher's exact test. A 2-sample t-test was employed for peak velocity comparison of the slow flow versus normal flow groups and DVT vs non-DVT groups. The optimal cut off peak velocity to correlate with radiologist perceived slow flow was determined by Youden's index.

RESULTS
There was a significant, small increased rate of subsequent DVT development in the slow venous flow group (21/482) compared to patients with normal flow (11/493) (P=0.0456). Additionally, measured peak venous velocities were significantly lower in the slow venous flow group at each assessed venous level (P<0.001) by an average of 9, 5 and 6 cm/sec at the common femoral, femoral and popliteal levels, respectively. The patients with subsequent DVT did not have a significant difference in venous velocities compared with their respective group. An average of three venous level velocities resulted in the best cutoff to dichotomize groups into normal versus slow venous flow with a sensitivity and specificity of 0.757 and 0.746, respectively, using a value of 14.5 cm/sec.

CONCLUSION
Subjective identification of slow venous flow in the lower extremities on Doppler ultrasound correlates with a mild, but significant increased rate of subsequent DVT development in oncology patients.

CLINICAL RELEVANCE/APPLICATION
These results suggest that patients identified to have slow venous flow should be followed to closer degree clinically, perhaps with a lower threshold for follow-up Doppler ultrasound evaluation.

HONORED EDUCATORS
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Khaled M. Elsayes, MD - 2014 Honored Educator

Three Dimensional Quantitative Tumor Response to Repetitive Transarterial Chemoembolization Predicts Survival for Hepatocellular Carcinoma
Retained products of conception (RPOC) are a common and treatable cause of post-partum or post-abortion genital haemorrhage. Hysteroscopic removal is the classical admitted treatment. Embolization is described in case reports with good clinical issue. The aim of this study was to evaluate the efficiency of embolization in this pathology.

METHOD AND MATERIALS
A total of 94 consecutive patients (87.2% men; mean age, 62 years) with Barcelona Clinic Liver Cancer stage B (intermediate-stage) HCC were retrospectively included. Tumor response was assessed on contrast-enhanced multiphasic magnetic resonance imaging using quantitative EASL (qEASL), a volumetric enhancement criterion. qEASL defines response as a ≥65% decrease in enhancing tumor volume. The Kaplan-Meier method with the log-rank test was used to compare overall survival (OS) for responders and nonresponders.

RESULTS
Median follow-up period was 25 months (range 2.1-106.2). 81 (86.2%) patients were nonresponders after the first TACE and OS was similar for responders and nonresponders [24.3 months (95%CI 15.5-33.1) vs. 23 months (95%CI 18.8-27.2), P=0.82, respectively]. 51 nonresponders underwent a second TACE within 3 months. Of those, 47 (92.6%) patients had follow-up imaging. After the second TACE, 14 (29.8%) patients achieved response and their median OS was significantly longer than nonresponders (63.5 months (95%CI 31.0-96.0) vs. 28.7 months (95%CI 18.7-38.7), P=0.07, respectively).

CONCLUSION
Patients who initially showed 3D nonresponse to the first TACE treatment could have a prolonged survival from a second TACE treatment.

CLINICAL RELEVANCE/APPLICATION
Repeated TACE can be beneficial for patients even if they show initial nonresponse as assessed by qEASL criteria on MR imaging.
Inferior Vena Cava Filters for Diagnostic Radiologists: What you Should Look for and Tell Your Referring Physicians

Station #6

CONCLUSION

Embolization is a simple, safe and efficient procedure in RPOC management and mostly sufficient for a complete resolution in case of precoce treatment. Our series suggests a possible evolution from RPOC to uterine AVMs in case of delayed management.

CLINICAL RELEVANCE/APPLICATION

Mini-invasive treatment such as uterine embolization could be proposed in management of RPOC with good clinical outcomes.

TEACHING POINTS

1. Review current guidelines for indications and contraindications for IVC filter placement, including for retrievable versus non retrievable filters; 2. Illustrate proper filter placement on angiography and CT; 3. Demonstrate improper filter placement and its clinical implications, including complications on multiple modalities (radiography, CT and angiography)

TABLE OF CONTENTS/OUTLINE

Our exhibit will review common appearances of properly and improperly placed IVC filters across multiple modalities, as encountered by radiologists on a daily basis. After a brief discussion and imaging review of historically used filters, we will present current guidelines regarding filters from Society of Interventional Radiology and American College of Chest Physicians. Angiographic images demonstrating routine filter placement will be presented. Demonstration of anatomic variants (e.g. duplicated vena cava, circumaortic renal veins, megacavas) and complex conditions (e.g. extensive proximal thrombus) requiring special filter placement considerations will be presented. Complications of filters we be reviewed, including IVC penetration, filter migration, filter fracture, and IVC thrombosis. Review of current controversies, including filter longevity. Finally, key points for evaluating filters seen on routine diagnostic imaging will be summarized.

Participants

Amanda L. Steinberger, DO, Darby, PA (Presenter) Nothing to Disclose
Salmi Simmons, MD, Darby, PA (Abstract Co-Author) Nothing to Disclose
Oleg Teytelboym, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Participants
Deborah J. Rubens, MD, Rochester, NY (Director) Nothing to Disclose

LEARNING OBJECTIVES
1) Recognize the diverse applications of ultrasound throughout the body and when it provides the optimal diagnostic imaging choice. 2) Understand the fundamental interpretive parameters of ultrasound contrast enhancement and its applications in the abdomen. 3) Know the important factors to consider when choosing ultrasound vs CT for image guided procedures and how to optimize ultrasound for technical success.

ABSTRACT
Ultrasound is a rapidly evolving imaging modality which has achieved widespread application throughout the body. In this course we will address the major anatomic areas of ultrasound use, including the abdominal and pelvic organs, superficial structures and the vascular system. Challenging imaging and clinical scenarios will be emphasized to include the participant in the decision-making process. Advanced cases and evolving technology will be highlighted, including the use of ultrasound contrast media as a problem solving tool, and the appropriate selection of procedures for US-guided intervention.

Sub-Events

MSCU41A Problem Solving with Contrast Enhanced Ultrasound

Participants
Stephanie R. Wilson, MD, Calgary, AB (Presenter) Research Grant, Lantheus Medical Imaging, Inc; Consultant, Lantheus Medical Imaging, Inc; Equipment support, Siemens AG; Equipment support, Koninklijke Philips NV

LEARNING OBJECTIVES
1) Attendees will appreciate the multiple varied applications for CEUS in the abdomen. 2) They will recognize the value of CEUS as a real time procedure with exquisite sensitivity to its contrast agent allowing for superior detection of arterial phase vascularity. 3) They will realize the safety of CEUS with no requirement for ionizing radiation, and no nephrotoxicity for evaluation of any problems requiring contrast enhancement in those with renal failure. 4) They will understand the fundamentals for interpretation of contrast enhancement patterns for the noninvasive diagnosis of focal liver masses and other pathology.

ABSTRACT

MSCU41B Image Guided Intervention: When Is Ultrasound Best?

Participants
Michael D. Beland, MD, Providence, RI (Presenter) Consultant, C. R. Bard, Inc

LEARNING OBJECTIVES
1) Understand factors to consider when choosing ultrasound versus CT as a modality for image guidance. 2) Review the potential challenges and advantages of ultrasound for procedure guidance. 3) Demonstrate the variety of cases for which ultrasound can be used to perform image guided procedures and learn some techniques for maximizing success.

ABSTRACT
Image-guided procedures are commonly performed. There are several important considerations when selecting an appropriate imaging modality to guide the procedure. Ultrasound has several advantages over CT but there are also limitations. These advantages and disadvantages will be reviewed, including various factors to consider when evaluating a case for a potential procedure. When ultrasound is used, there are techniques which may offer increased likelihood of success or decreased procedural time. Through multiple case presentations, this session will review the considerations and techniques for successful ultrasound guided interventions.

MSCU41C Vascular Ultrasound Update

Participants
Laurence Needleman, MD, Philadelphia, PA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.
Participants
Jonathan Mazal, MS, RRA, Bethesda, MD (Presenter) Nothing to Disclose
Toby Rogers, BA, MRCP, Bethesda, MD (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Define interventional cardiovascular magnetic resonance (iCMR). 2) Compare advantages and disadvantages of MRI versus other imaging modalities to guide cardiovascular interventions. 3) Describe personnel and infrastructure requirements to start an iCMR program. 4) Identify current clinical applications of iCMR. 5) Review pre-clinical applications of iCMR to inform future clinical directions.
Peripheral Artery Disease (PAD)

Thursday, Dec. 3 8:30AM - 10:00AM Location: N229

Participants
Stephen T. Kee, MD, Stanford, CA (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
1) Discuss the basic pathology of peripheral artery disease. 2) Describe the risk factors associated with the development of peripheral artery disease. 3) Outline the benefits of providing a comprehensive clinical service in the management of PVD. 4) Discuss how to build a PVD practice. 5) Describe the basic techniques employed in the treatment of PVD.

ABSTRACT

Peripheral arterial disease (PAD) is a common cause of morbidity and mortality in developed countries. Traditionally, imaging for risk stratification and therapeutic planning involved catheter angiography. In recent years, cross-sectional imaging by CTA and MRA has proven a robust technique for non-invasive PAD assessment. Given ubiquity of CT scanning technology, CTA is widely available. High resolution datasets can be acquired rapidly, which facilitates assessment of clinically labile or trauma patients. To be optimally effective, CTA techniques require particular attention to contrast medium and scan protocol. With appropriate protocol design, data acquisition requires limited operator dependence. The acquired 3D dataset is rich with information, but requires careful scrutiny by the interpreting physician. Volumetric review of these datasets produces the most accurate results. Extensive small vessel calcification remains a potential barrier to full assessment of pedal vessels by CTA. Recent published data validates the clinical effectiveness of CTA for diagnosis of PAD and for the direction of treatment planning. Ongoing research aims to exploit the newest generation of CT scanners to acquire additional information, including dual energy data, time-resolved information, and radiation dose savings.

URL
www://stanford.edu/~hallett

Participants
Richard L. Hallett II, MD, Stanford, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Describe techniques for patient selection, acquisition, reconstruction, and interpretation of lower extremity CTA. 2) Describe evidence-based results for lower extremity CTA, and expected impact on patient care. 3) Describe a coherent plan that integrates lower extremity CTA into cost-effective clinical care.

ABSTRACT

Peripheral arterial disease (PAD) is a common cause of morbidity and mortality in developed countries. Traditionally, imaging for risk stratification and therapeutic planning involved catheter angiography. In recent years, cross-sectional imaging by CTA and MRA has proven a robust technique for non-invasive PAD assessment. Given ubiquity of CT scanning technology, CTA is widely available. High resolution datasets can be acquired rapidly, which facilitates assessment of clinically labile or trauma patients. To be optimally effective, CTA techniques require particular attention to contrast medium and scan protocol. With appropriate protocol design, data acquisition requires limited operator dependence. The acquired 3D dataset is rich with information, but requires careful scrutiny by the interpreting physician. Volumetric review of these datasets produces the most accurate results. Extensive small vessel calcification remains a potential barrier to full assessment of pedal vessels by CTA. Recent published data validates the clinical effectiveness of CTA for diagnosis of PAD and for the direction of treatment planning. Ongoing research aims to exploit the newest generation of CT scanners to acquire additional information, including dual energy data, time-resolved information, and radiation dose savings.

URL
www://stanford.edu/~hallett

Participants
Harald Kramer, MD, Munich, Germany (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify the appropriate technique for peripheral MRA depending on the available hardware and the clinical question and condition of the patient. 2) Differentiate between different contrast agents and their specific characteristics. 3) Chose between different contrast agent application schemes depending on the technique used and the clinical question. 4) Compare the pros and cons of contrast-enhanced and non contrast-enhanced techniques for peripheral MRA.

ABSTRACT

The prevalence of symptomatic peripheral artery disease (PAD) ranges around 3% in patients aged 40 and 6% at an age of 60 years. Additionally, the prevalence of asymptomatic PAD lies between 3% and 10% in the general population increasing to 15% to 20% in persons older than 70 years of age. However, these data still might underestimate the total prevalence of PAD since screening studies showed that between 10% and 50% of all patients with intermittent claudication (IC) never consult a doctor about their symptoms. These data prove the need for an accurate and reliable method for assessment of the peripheral vasculature.
Digital subtraction angiography (DSA) still serves as the reference standard for all vascular imaging techniques. However, because of the absence of ionizing radiation, the use of non-nephrotoxic contrast agents or even non contrast-enhanced sequences and the large toolbox of available techniques for high-resolution static and dynamic imaging Magnetic Resonance Angiography (MRA) constitute an excellent non-invasive alternative. Different acquisition schemes and contrast agent application protocols as well as different types of data sampling for static, dynamic, contrast- and non contrast-enhanced imaging enable to tailor each exam to a specific question and patient respectively.

**RC612D  Endovascular Treatment of PAD**

Participants
Stephen T. Kee, MD, Stanford, CA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.
**SSQ22**

**Vascular/Interventional (Concepts in Aortic Aneurysm Interventions)**

Thursday, Dec. 3 10:30AM - 12:00PM Location: N227

**VA**

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

**Participants**

Parag J. Patel, MD, Milwaukee, WI (Moderator) Consultant, Medtronic, Inc; Consultant, C. R. Bard, Inc; Consultant, Penumbra, Inc; Anisha S. Martin, MD, Chicago, IL (Moderator) Nothing to Disclose

**Sub-Events**

**SSQ22-01  Is Contrast Enhanced Ultrasound the Endograft Imaging Modality of the Future?**

Thursday, Dec. 3 10:30AM - 10:40AM Location: N227

**Participants**

Rayshelle Finch, Orange, Australia (Presenter) Nothing to Disclose
Steven Dubenec, Camperdown, Australia (Abstract Co-Author) Nothing to Disclose
SharynRussell, MBBS, Orange, Australia (Abstract Co-Author) Nothing to Disclose
Bryan Khoury, FRANZCR, Orange, Australia (Abstract Co-Author) Nothing to Disclose
Karen Pollard, Wagga Wagga, Australia (Abstract Co-Author) Nothing to Disclose
Kenneth Russell, BA, Wagga Wagga, Australia (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

The aim of this study was to evaluate the clinical effectiveness of Contrast Enhanced Ultrasound (CEUS) in detecting the presence of endoleaks after Endovascular Aortic Aneurysm Repair (EVAR) and to compare the diagnostic accuracy with other imaging modalities.

**METHOD AND MATERIALS**

One hundred and seven patients, all post EVAR, underwent surveillance utilising CEUS, CDU and CTA. Each modality assessed for the presence of an endoleak. The presence of contrast within the stent graft established patency and contrast within the residual aneurysm sac indicated the presence of an endoleak. Endoleaks were classified by type, origin and size. Quantitative comparison was made between each modality.

**RESULTS**

There is a statistically significant increased rate of endoleak detection, especially for low amplitude, slow flowing endoleaks using CEUS in comparison to CDU and CTA. Two-tailed P value was calculated with McNemar's Test and continuity correction at<.0001. CDU identified thirty-six endoleaks, CTA identified thirty-nine endoleaks and CEUS identified sixty-three endoleaks. Statistical analysis has also highlighted that CDU in comparison to CTA in the detection of Endoleaks is not statistically significant. The two-tailed P Value equals 0.6625. These two imaging modalities were considered to be equivalent.

**CONCLUSION**

In this prospective study, CEUS has proven to be an extremely effective imaging modality in the detection, visualisation and classification of endoleaks in comparison to CDU and CTA. CEUS is a sensitive adjunct to unenhanced ultrasound and is an extremely useful imaging modality in patients where CTA is contraindicated. CEUS is an accurate and minimally invasive way to interrogate these endografts and has in this study, demonstrated statistically significant improvements in the detection of endoleaks. If the advances in ultrasound imaging technology, with the use of contrast agents, continue to demonstrate its dominance, we believe CEUS will become a routine part of EVAR surveillance.

**CLINICAL RELEVANCE/APPLICATION**

CEUS has a significant role to play in EVAR surveillance. It is an accurate and minimally invasive way to interrogate endografts and has demonstrated statistically significant improvements in endoleak detection.

**SSQ22-02  Endoleak and Thrombus Characterization with Dynamic Elastography after Endoleak Embolization Following Aneurysm Endovascular Repair**

Thursday, Dec. 3 10:40AM - 10:50AM Location: N227

**Participants**

Antony Bertrand-Grenier, Montreal, QC (Presenter) Nothing to Disclose
Fatemeh Zehtabi, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Helene Heon, DVM, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Guy Cloutier, PhD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Sophie Lerouge, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Gilles P. Soulez, MD, Montreal, QC (Abstract Co-Author) Speaker, Bracco Group Speaker, Siemens AG Research Grant, Siemens AG Research Grant, Bracco Group Research Grant, Cook Group Incorporated Research Grant, Object Research Systems Inc

**PURPOSE**

SuperSonic Imagine (SSI) measure the tissue elasticity in real-time. The goal of this study was to characterize in a canine model...
METHOD AND MATERIALS

EVAR was done with creation of type I endoleak in eighteen aneurysms created in nine dogs (common iliac arteries). Two embolization gels (Chitosan (Chi) or Chitosan-Sodium-Tetradecyl-Sulfate (Chi-STS)) were injected in the sac to seal the endoleak and promote healing. SSI and DUS were performed at baseline (implantation, 1-week, 1-month, 3-months) whereas angiography and CT-scan were performed at sacrifice. Macroscopic and histopathological analyses were processed to identify and segment five different regions of interest (ROIs) (endoleak, fresh or organized thrombus, Chi or Chi-STS). Elasticity modulus values were compared.

RESULTS

At sacrifice, 10 aneurysms had endoleaks, 9 had fresh thrombus, 15 had organized thrombus and 3 were completely sealed. At 3 months, elasticity modulus (in kPa) of 0.1±0.2, 9.4±3.3, 47.6±28.1, 51.7±24.1 and 49.1±33.5 were respectively found in endoleak, fresh and organized thrombus, Chi and Chi-STS regions. Elasticity values of endoleak and fresh thrombus areas were significantly lower than organized thrombus, Chi and Chi-STS areas (p<0.001). Elasticity values of fresh thrombus ranged between 3 and 19 kPa (8.7±3.6 kPa) at 1-week and 30.2±13.8 kPa at 3-months indicating that SSI can evaluate thrombus maturation. It can also characterize embolization agents degradation (39.3±21.1 and 30.5±13.8 kPa at 6-months for Chi and Chi-STS regions). SSI was able to detect endoleak where DUS failed and distinguish fresh thrombus (possibly endotension) which cannot be detected on CT-scan.

CONCLUSION

The results confirm that SSI was able to evaluate thrombus organization and embolization agents over time after endoleak embolization following EVAR. A lower elastic modulus value corresponds to fresh thrombus whereas a higher value corresponds to organized thrombus.

CLINICAL RELEVANCE/APPLICATION

The SSI can complement conventional DUS in post-EVAR surveillance. It could reduce the cost, the exposition to ionizing radiation and nephrototoxic contrast agents of surveillance CT-scan follow-up.
EVAR success. An 'at risk' Type II endoleak. An enhanced understanding of Type II endoleaks will aid in future interventional and implementation secondary intervention. Our additional sub-categorisations of Type II B (i) and (ii), C and D has shown initial benefit in determining of endoleaks. The type and size of an endoleak and the residual sac size are the most important factors that influence the need for CEUS has a significant role to play in EVAR routine surveillance and is a sensitive adjunct to unenhanced ultrasound in the detection increase in sac size of >=5mm over a 6month period. identified as the endoleak that may cause potential pressurisation to the residual aneurysm and were thought to be the most likely (i) and (ii) based on their communications and devised two further Type II subcategories C and D. Type IIC endoleaks were characterization. We added Doppler information to Type II subcategories A and B. We distinguished two variants in subcategory IIB Type II endoleaks were identified and subcategorised based on vessel origin, behaviour, channel connection and spectral Doppler results. Endoleaks were classified by type, origin and size. Type II underwent surveillance utilising CDUS, CEUS and CTA to assess for presence/absence of an endoleak. This observational study enrolled one hundred and seven patients who had undergone EVAR as treatment for their AAA. All patients were associated with a significantly increased risk for eGFR decrease at discharge (Hazard Ratio (HR) 3.19, 95%CI: 1.36 - 7.51; p= 0.008 and HR 2.87, 95%CI: 1.34 - 6.14; p= 0.007).There was also a significant association between AKI and eGFR decrease at IFU (HR 2.79, 95%CI: 1.44 - 5.39, p= 0.002). Iodinated contrast volume was not associated with eGFR decrease neither at discharge nor at IFU (HR 0.998; p= 0.463 and HR 1.000; p= 0.857, respectively).

CONCLUSION
Post-EVAR AKI is significantly associated with short- and long-term eGFR decrease.

CLINICAL RELEVANCE/APPLICATION
Higher intra-arterial iodinated contrast volume is associated with higher probability of AKI, but the data provide no evidence that iodinated contrast volume is an independent risk factor for long-term eGFR decrease.

SSQ22-05 Type II Endoleak Proposed New Sub-Categorisation

Participants
Rayshelle Finch, Orange, Australia (Presenter) Nothing to Disclose
Steven Dubeneck, Camperdown, Australia (Abstract Co-Author) Nothing to Disclose
Bryan Khoury, FRANZCR, Orange, Australia (Abstract Co-Author) Nothing to Disclose
Sharyn Russell, MBBS, Orange, Australia (Abstract Co-Author) Nothing to Disclose
Karen Polland, Wagga Wagga, Australia (Abstract Co-Author) Nothing to Disclose
Ian Garbett, BS,MSc, Wagga Wagga, Australia (Abstract Co-Author) Nothing to Disclose

PURPOSE
The aim of this study was to evaluate the behaviour of Type II endoleaks utilising CEUS to aid visualisation and to determine the endoleak origin and communication with branch vessels.

METHOD AND MATERIALS
This observational study enrolled one hundred and seven patients who had undergone EVAR as treatment for their AAA. All patients underwent surveillance utilising CDUS, CEUS and CTA to assess for presence/absence of an endoleak. Contrast enhancement within the residual aneurysm sac indicated the presence of an endoleak. Endoleaks were classified by type, origin and size. Type II endoleaks were further subcategorised according to vessel behaviour, origin, communications and duplex Doppler characteristics.

RESULTS
Type II endoleaks were identified and subcategorised based on vessel origin, behaviour, channel connection and spectral Doppler characterization. We added Doppler information to Type II subcategories A and B. We distinguished two variants in subcategory IIB (i) and (ii) based on their communications and devised two further Type II subcategories C and D. Type IIC endoleaks were identified as the endoleak that may cause potential pressurisation to the residual aneurysm and were thought to be the most likely to cause risk to the patient, requiring intervention. All patients with this new endoleak subcategory were noted to have had an increase in sac size of >5mm over a 6month period. The haemodynamic effect of this endoleak subtype was thought to be significant.

CONCLUSION
CEUS has a significant role to play in EVAR routine surveillance and is a sensitive adjunct to unenhanced ultrasound in the detection of endoleaks. The type and size of an endoleak and the residual sac size are the most important factors that influence the need for secondary intervention. Our additional sub-categorisations of Type II B (i) and (ii), C and D has shown initial benefit in determining an/at risk Type II endoleak. An enhanced understanding of Type II endoleaks will aid in future interventional and implementation strategies, which will ultimately lead to EVAR success.
This study identifies and subcategorises Type II-endoleak behaviour. Additional subcategorisation has shown initial benefit, extrapolating 'benign' and 'at risk' endoleaks. CEUS is a sensitive adjunct to CDU and CTA.

**SSQ22-06 Integrated Stent-graft for Wireless 4-dimensional Aneurysm Sac Pressure Monitoring after Endovascular Aortic Aneurysm Repair (EVAR): First in Vitro Results**

**Participants**
Clemens Spink, Hamburg, Germany (Presenter) Nothing to Disclose
Bibin John, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Wolfgang H. Krautschneider, PhD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Diezmar Schroeder, PhD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Robert Fischbach, Dresden, Germany (Abstract Co-Author) Nothing to Disclose
Markus Braunschweig, Dresden, Germany (Abstract Co-Author) Nothing to Disclose
Jan-Hendrik Buhk, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Andreas Koops, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose

**METHOD AND MATERIALS**

30 prototype stent-grafts were designed (85 mm x 16 mm), each containing 16 pressure sensors (1.5 mm x 1 mm x 1 mm) within the covering membrane of polytetrafluorethylene (PTFE). The prototypes were mounted on a 26 F delivery sheath and mono-iliac placed into an aortic bifurcation model. Measurements were continuously taken from the sensors while inducing invasive reference pressure from the contralateral iliacal side. Digital data conversion was performed by an integrated microcontroller. Customised antenna technology was designed providing energy and data transfer by inductive coupling.

**RESULTS**

After successful placement of the stent-graft all 16 sensors delivered reliable pressure measurements continuously and could detect pressure-changes accurately up to ± 1.2 mmHg. Wireless energy and data transmission could be successfully demonstrated.

**CONCLUSION**

The non-invasive acquisition of pressure profiles along a stent-graft’s membrane after EVAR can deliver information on regional pressure elevation, indicating early endoleak development. Our trials show practical and efficient ways of continuous aneurysm sac pressure monitoring in patients after EVAR. Further in vivo tests are required, developing an implementation into a product.

**SSQ22-07 Long Term Results after Endovascular Repair of Abdominal Aneurysm (EVAR): Impact of Hostile Neck Anatomy in Early and Long-term Complications and Aneurysm Related Death**

**Participants**
Alvaro M. Morales Vargas, MD, Madrid, Spain (Presenter) Nothing to Disclose
Gonzalo Garzon Moll, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Milagros Marti De Gracia, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Alvaro Fernandez Calvo, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Luis Riera del Moral, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Marta Gutierrez Mistal, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Rosario Madero Jarabo, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose

**METHOD AND MATERIALS**

A cohort study of patients underwent elective EVAR in a tertiary institution between January 2002 and December 2013, prospectively collected and evaluated retrospectively. An angi-CT follow-up was performed before surgery and according to standards follow-up thereafter. Patients were classified as having hostile aortic necks (length of <10 mm, angle of >50°, diameter of >28 mm, circumferential thrombus, calcified neck, and reverse taper), or favorable aortic necks. CT scans were reviewed by an experienced vascular radiologist. Outcomes are described according to reporting standards for endovascular aortic aneurysm repair EVAR. Statistical analysis. Time to event was estimated by the Kaplan-Meier method. 95% Confidence intervals were estimated. Risk Proportional Cox Models were used.

**RESULTS**

378 patients underwent EVAR. Demographics and co-morbidities were similar in hostile and favorable necks. 101 patients (26.7%) had hostile necks (34.7% angulated, 47.5% measured more than 28mm, 5% had circumferential thrombus, 16.8% had calcified neck and 9.9% had reversed taper) and 277 (73.3%) had favorable neck anatomy. Aorto-monoiliac grafts were used in 79 hostile necks and bifurcated grafts in 22 of them. Overall technical success was 96.5%. Postoperative type-I endoleak occurred in 2.2% of hostile necks, and was not present in favorable necks. Perioperative aneurysm-related mortality was 5% in hostile necks and 2.9% in favorable necks. Freedom of proximal type I endoleaks was 99.6% at 3 years and 99.4% at 12 years for favorable necks, compared
We retrospectively analyzed 100 pairs of follow-up CT scans randomly picked from our EVAR database. The maximum aneurysm

CONCLUSION
Hostile aortic neck is associated with unfavorable early and long term results after endovascular repair of abdominal aneurysm, increasing the risk of complications and aneurysm-related death.

CLINICAL RELEVANCE/APPLICATION
Hostile aortic neck increases long-term complications and aneurysm-related death after EVAR.

SSQ22-08 Risk Factors of Stent Graft-Induced New Entry (SINE) after Thoracic Endovascular Aortic Repair (TEVAR) for Stanford Type B Aortic Dissection

Participants
Hyunsik Jang, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Do Yun Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Man Deuk Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jong Yun Won, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sung Il Park, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Gyoun Min Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
Stent graft-induced new entry (SINE) has been increasingly observed after thoracic endovascular aortic repair (TEVAR) for Stanford type B aortic dissection. SINE is often life threatening and re-intervention is required. The current study aims to investigate risk factors of SINE after TEVAR.

METHOD AND MATERIALS
From July 2001 to June 2013, 79 patients who underwent TEVAR for Stanford type B aortic dissection were retrospectively analyzed. Mean age was 55.7 years (range, 25-84 years) and mean follow-up period was 53.5 months (range, 3 days-130.2 months). 17 patients underwent TEVAR within 2 weeks (acute) after diagnosis of aortic dissection and the other 62 patients underwent TEVAR after 2 weeks (chronic). 42 patients underwent TEVAR with modified stent graft with 'inward bended' margin and the others used conventional stent graft. The longitudinal diameter, transverse diameter, mean diameter, area and circumference of true lumen were measured. Then taper ratio, present stent grafting oversizing ratio, poststent grafting oversizing ratio, and expansion mismatch ratio of distal true lumen were calculated and compared between SINE group and non-SINE group.

RESULTS
SINE occurred in 21 patients (26.5%). SINE occurred more frequently in chronic dissection group than acute dissection group (32.3% vs 5.9%, P = 0.032). SINE event was not significantly different between modified and non-modified stent group (53.2% vs 46.8%, P = 0.615). Taper ratio, present stent grafting oversizing ratio and poststent grafting oversizing ratio were not significantly different in SINE and non-SINE group. Expansion mismatch ratio is significantly higher in SINE group than non-SINE groups in terms of longitudinal diameter (117.47 vs 104.44, P = 0.0041), transverse diameter (147.00 vs 106.86, P < 0.0001), mean diameter (137.46 vs 106.52, P < 0.0001), area and circumference (136.72 vs 105.35, P = 0.0004). 10 patients (47.6%) required re-intervention with surgery (n=4) or stent-graft (n=6).

CONCLUSION
SINE after TEVAR was more frequent in chronic aortic dissection than acute dissection. Expansion mismatch ratio was significantly higher in SINE group than non-SINE group.

CLINICAL RELEVANCE/APPLICATION
The time interval between diagnosis of aortic dissection and TEVAR is a factor predictive of late SINE event. SINE after TEVAR was more frequent in chronic aortic dissection than acute dissection.

SSQ22-09 Diagnostic Accuracy of Axial Diameter Measurements for the Detection of Aneurysm Sac Enlargement after Endovascular Repair (EVAR) of Abdominal Aortic Aneurysms (AAA) by Computed Tomography (CT)

Participants
Michael Schnitzbauer, MSc, Berlin, Germany (Presenter) Nothing to Disclose
Oliver Gunterm, Regensburg, Germany (Abstract Co-Author) Nothing to Disclose
Walter A. Wolgemuth, Regensburg, Germany (Abstract Co-Author) Nothing to Disclose
Michael Haerl, Regensburg, Germany (Abstract Co-Author) Nothing to Disclose
Florian Zeman, Regensburg, Germany (Abstract Co-Author) Nothing to Disclose
Thomas Hard, MD, Berlin, Germany (Abstract Co-Author) Nothing to Disclose
Christan R. Stroszczynski, MD, Regensburg, Germany (Abstract Co-Author) Nothing to Disclose
Rene Muller-Wille, Regensburg, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the diagnostic accuracy of diameter measurements for the detection of aneurysm volume increase during follow-up after endovascular aneurysm repair (EVAR) of abdominal aortic aneurysms (AAA).

METHOD AND MATERIALS
We retrospectively analyzed 100 pairs of follow-up CT scans randomly picked from our EVAR database. The maximum aneurysm...
We retrospectively analyzed 100 pairs of follow-up CT scans randomly picked from our EVAR database. The maximum aneurysm diameter was measured on axial planes (Dmax axial). The aneurysm sac volume was separately measured by manual segmentation (standard of reference).

RESULTS

Using a cut-off level of > 0 mm for diameter Dmax axial increased in 35 patients (mean 3.9 mm; range 1.0 to 31.0 mm). The aneurysm sac volume increased in 39 patients (mean, 25.7 cm³; range, 0.2 to 241 cm³). Dmax axial had a sensitivity/specificity of 74%/90%.

CONCLUSION

Overall dependent on the chosen cut-off, diameter measurements showed a low to moderate diagnostic accuracy for the detection of aneurysm sac enlargement after EVAR.

CLINICAL RELEVANCE/APPLICATION

Although broadly used in clinical practice diameter measurements seem to fail to detect size increase of the aneurysm sac during follow-up after EVAR.
Adrenal Venous Sampling in Patients with Primary Aldosteronism; Which is the Best Method for Evaluating an Indication for Surgery?

**PURPOSE**
To investigate the most accurate method of adrenal venous sampling (AVS) for the detection of primary aldosteronism, which can be evaluated as an indication for surgery.

**METHOD AND MATERIALS**
A total of 64 consecutive patients who were diagnosed as primary aldosteronism underwent AVS to find an indication for surgery in four years. The catheter was placed at two locations, such as common trunk below the confluence of inferior phrenic vein (CTV) and central adrenal vein (CAV) of the left adrenal vein, at one location in the right adrenal vein (RAV) and at one location in inferior vena cava (IVC). Adrenocorticotropic hormone (ACTH) was intravenously administrated in all cases. Blood sampling was performed at same positions in both pre- and post-ACTH stimulations. Evaluating methods of AVS were lateralized ratio \([LR; \text{aldosterone/cortisol ratio (ACR) on the high-value side} / \text{ACR on the low-value side}]\), contralateral ratio \([CR; \text{ACR on the low-value side} / \text{ACR on the IVC ratio}]\) and plasma aldosterone concentration \([\text{PAC}]\). Forty-nine bilateral lesions and 15 unilateral lesions (right 5, left 10) were diagnosed by comprehensive results of AVS and other imaging modalities. Adrenalectomy was performed in these 15 patients with unilateral lesions, and they were histologically confirmed to be adenomas or adrenal hyperplasias. When making decisions for surgical resection of unilateral adrenal involvement, the diagnostic accuracy for each method of AVS alone, such as LR, CR and PAC obtained by blood sampling placed in CTV/CAV/RAV at both pre- and post-ACTH stimulations, was compared by the receiver operating characteristic (ROC) analysis.

**RESULTS**
LR-CAV post-ACTH showed the highest detection rate for unilateral adrenal lesions (93.3%) with sensitivity (0.93) and specificity (0.84) at 2.5 of cut-off value. The area under the ROC curve \([Az value]\) of LR-CTV post-ACTH (0.86), LR-CAV post-ACTH (0.87), CR pre-ACTH (0.85) and CR post-ACTH (0.89) were higher than those of other methods (0.510-0.794) of AVS. CR post-ACTH in particular had best \([Az value]\), with the detection rate (86.7%), sensitivity (0.98) and specificity (0.88) at 0.8 of cut-off value.

**CONCLUSION**
CR post-ACTH and LR-CAV post-ACTH allow the sensitive evaluation and high detection rate for AVS.

**CLINICAL RELEVANCE/APPLICATION**
In patients with primary aldosteronism, LR-CAV post-ACTH and CR post-ACTH lead to appropriate treatment, such as a surgical resection of unilateral adrenal involvement.
measurements and volumes of: abdominal aneurysm sac; lowest renal artery to aortic bifurcation (Abd Aorta); and lowest renal artery to common iliac artery bifurcation (Abd Aorta to iliacs). Correlation coefficients between various measurements were calculated. The abdominal aortic volume (from lowest renal artery to aortic bifurcation) was used as reference standard due to consistent availability of the defining structures (renal artery and aortic bifurcation).

RESULTS

161 patients with 830 exams were included in the study. AAA axial diameter was 5.7±1.8cm with AAA volume of 164±150cc. There was excellent correlation between Abd Aorta and Abd Aorta and iliac volumes with correlation coefficient of 0.99. Similarly, very good correlation was seen between Abd Aorta and Aneurysm sac volume with correlation coefficient of 0.98. Good correlation was seen between Abd Aorta volume and AAA diameters, centerline and conventional axial with correlation coefficient of 0.89 and 0.88. There was excellent correlation between centerline aortic diameter and conventional axial diameter with correlation coefficient of 0.97.

CONCLUSION

Excellent correlation is seen between abdominal aortic volume and aneurysmal sac volume, between abdominal aorta and iliac volumes and between conventional axial and centerline AAA measurements. Good correlation was demonstrated between 2D axial measurements and volume. Thus, a single axial and single volume measurement is likely sufficient for follow up of abdominal aortic aneurysm.

CLINICAL RELEVANCE/APPLICATION

Single conventional axial diameter and abdominal aortic volume are sufficient for accurate follow up of AAA, as these measurements show excellent correlation with other available measurements of AAA.

The Effects of Aspirin Therapy on Renal Transplant Biopsy Bleeding Complications

Participants
Francis Baffour, MD, Rochester, MN (Presenter) Nothing to Disclose
Grant D. Schmitt, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Anil N. Kurup, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
John J. Schmitz, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
LaTonya Hickson, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Thomas D. Atwell, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Rickey Carter, PhD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Tina Gunderson, Rochester, MN (Abstract Co-Author) Nothing to Disclose

PURPOSE

To determine if aspirin therapy increases the risk of bleeding complications after renal transplant biopsy.

METHOD AND MATERIALS

Renal transplant biopsy cases were obtained from our prospectively acquired database on percutaneous image-guided biopsies. Potential risk factors for bleeding (including aspirin (ASA) use, platelet count, INR), and bleeding complications within 24 hrs (acute) and within 3 months (delayed) of biopsy were reviewed. Complications were graded based on the Society of Interventional Radiology criteria (Fig. 1).

RESULTS

46 (0.69%) bleeding complications occurred in 44 of the 6700 patients who underwent ultrasound-guided renal transplant biopsy between 9/2005 and 8/2014. This included 11 acute major, 29 acute minor and 6 delayed major complications. There were no permanent adverse sequelae or deaths. 70.2% of patients were not on ASA therapy or had taken their last dose of ASA >10 days prior to biopsy, 9.9% between 8-10 days, 12.8% between 4-7 days and 7.1% between 0-3 days prior to biopsy. For the outcome of 'any complication' (major or minor), the final regression model included ASA use, INR, and platelet count (AUC 0.677), with p-values of <0.05, 0.10 and 0.066 respectively. These variables did not show any collinearity. For the outcome of 'major complication', ASA category and platelet count were included in the final model, but neither was statistically significant. ASA categories were then dichotomized by exposure time: '0-3 days group' vs. '3 days group'. For 'any complication', ASA use had a p-value <0.01 and platelet count had a p-value <0.05 (AUC 0.634). For 'major complications', both the ASA category and platelet count were also found to be significant (p-values <0.01, <0.05; AUC 0.714). 'Any complication' rate in the >3 days group was 0.58% (95% CI 0.42-0.80%), and in the 0-3 days group it was 1.68% (95% CI 0.86-3.29%). 'Major complication' rate in the >3 days group was 0.19% (95% CI 0.11-0.34%), and in the 0-3 days group it was 0.84% (95% CI 0.33-2.14%).

CONCLUSION

There is a significant increase in bleeding complications when ASA therapy is continued within 3 days of renal transplant biopsy, but even in this group, the bleeding complication rate is extremely low.

Dual-Energy CT Angiography of the Abdominal Aorta using an Advanced Monoenergetic Algorithm: Impact on Selection of Optimal Energy Level and Image Quality

Participants
Daniele Marin, MD, Cary, NC (Presenter) Nothing to Disclose
Juan Carlos Ramirez-Giraldo, PhD, Malvern, PA (Abstract Co-Author) Employee, Siemens AG
Cole Denton, MD, Durham, NC (Abstract Co-Author) Nothing to Disclose
Sonia Gupta, MD, Newark, DE (Abstract Co-Author) Nothing to Disclose
PURPOSE
To investigate the impact of an advanced monoenergetic reconstruction algorithm on the selection of the optimal energy level and image quality during dual-energy CT (DECT) angiography of the abdominal aorta.

METHOD AND MATERIALS
This retrospective, single-center HIPAA-compliant study was IRB-approved and informed patient consent was waived. Fifty patients (35 men, 15 women) underwent DECT (80/Sn140 kVp) in the arterial phase, with a dual-source CT system (Siemens Definition Flash). Datasets at energy levels ranging from 40 to 100 keV, 10 keV increments, were reconstructed using conventional and advanced monoenergetic algorithms (Syngo DE Monoenergetic and Monoenergetic Plus, respectively). The advanced monoenergetic algorithm applies energy domain filtering to improve the image noise at low keV reconstructions. Noise, aortic contrast, and aortic contrast-to-noise ratio (CNR) were calculated and compared. Generalized estimating equation was used to identify optimal monoenergetic-energy level to maximize the aortic CNR. The effect on CNR of the patient's body size was also assessed. Subjective assessment of image quality was performed on transverse and volume rendered reconstructed images.

RESULTS
Compared to the conventional algorithm, the advanced monoenergetic algorithm yielded significantly reduced noise at 40, 50, 60, 90 and 100 keV (P < .001, for all energies). Aortic CNR increased significantly with the advanced monoenergetic algorithm, for all reconstructed energies (P <0.001, for all energies). For all patient sizes, the highest aortic CNR was achieved at 40 keV with the advanced algorithm, but ranged from 60 to 80 keV with the conventional algorithm. Aortic CNR improved by approximately 70% with the advanced compared to conventional algorithm (Mean [SD] = 23.6 [12.7] at 40 keV vs. 16.5 [8.7] at 70 keV, respectively; P <.001). Qualitative image quality scores were consistently higher at 40 keV using the advanced monoenergetic algorithm.

CONCLUSION
The 40 keV images reconstructed using an advanced monoenergetic algorithm significantly improve image quality of DECT angiography of the aorta, while simultaneously decreasing the variability introduced by patient's body weight in selecting the optimal energy level.

CLINICAL RELEVANCE/APPLICATION
An advanced monoenergetic algorithm can improve the image quality of aortic DECT angiography examinations and concomitantly streamline the utilization of DECT postprocessing techniques.
**VI245-SD-THB1**

**Spectral CT with ASiR in Low Radiation and Contrast Medium Dose Abdominal Artery Imaging: Comparison of Image Quality and Dose with Standard 120kVp CT Angiography**

**Station #1**

**Participants**

Wang L. Qiong, Guangzhou, China (Presenter) Nothing to Disclose

Xianwei Yang, Guangzhou, China (Abstract Co-Author) Nothing to Disclose

Yun Zheng, Guangzhou, China (Abstract Co-Author) Nothing to Disclose

Huanqi Xu, Guangzhou, China (Abstract Co-Author) Nothing to Disclose

Ying Guo, Guangzhou, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate image quality and dose performance of spectral CT with adaptive statistical iterative reconstruction (ASiR) in low radiation and contrast medium dose abdominal artery imaging in comparison with a standard 120kVp scan protocol.

**METHOD AND MATERIALS**

31 patients (group A) referred to abdominal CT angiography (CTA) underwent spectral CTA with pitch of 1.375 and GSI assist technique and 50%ASiR to optimize dose performance. Another 30 patients (group B) underwent standard 120 kVp CTA with Noise Index of 12, pitch of 1.375. Group A used Iodixanol270 (concentration 270mgI/ml) while group B used Iopromide350 (concentration 350mgI/ml) contrast medium, both with total volume of 1ml/kg and injection rate of 5ml/s. Spectral CT images at 60keV were used for comparison. Regions-of-interest (ROIs) were placed in abdominal aorta, hepatic artery and muscle to measure CT number and image noise (SD). Signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) of vessels were calculated. Radiation dose, contrast medium dose and quantitative measurements reflecting image quality for the two groups were statistically compared.

**RESULTS**

BMI was comparable between two groups (P>0.05). DLP was 245.59±32.96mGy.cm for the spectral CT group and 380.42±104.54 mGy.cm for 120kVp group (P<0.05). Radiation dose and contrast medium dose in the low dose spectral CTA group was reduced by 35% and 23%, respectively. Signal intensity of the abdominal aorta and hepatic artery were significantly higher in the spectral image at 60keV than those of 120kVp (432.0±74.8HU vs. 340.7±65.3HU and 387.0±71.6HU vs. 328.1±62.4HU, respectively, all P<0.05). The CNR and SNR values of aorta were also significantly higher than those of 120kVp (40.63 vs. 30.45 and 48.76 vs. 38.75, respectively, all P<0.05).

**CONCLUSION**

Abdominal CTA using spectral imaging mode coupled with 50% ASiR provides excellent vascular images in arterial phase while significantly reduces radiation dose and contrast media dose compared with the standard 120 kVp scans.

**CLINICAL RELEVANCE/APPLICATION**

CLINICAL RELEVANCE/APPLICATION: Low dose abdominal Spectral CTA imaging using low concentration contrast could provide good vascular images and might be valuable in patients with compromised renal function.

**VI246-SD-THB2**

**Low Tube Voltage and Low-concentration Contrast Material to Reduce Radiation Dose and Iodine Load in the Portal Vein Angiography**

**Station #2**

**Participants**

Chuang Yi, Jilin, China (Presenter) Nothing to Disclose

Zhiren Chen, MD, Changchun, China (Abstract Co-Author) Nothing to Disclose

Yan Liang, MMEd, Changchun, China (Abstract Co-Author) Nothing to Disclose

Bin O. Li, Changchun, China (Abstract Co-Author) Nothing to Disclose

Yongfang Yin, Jilin, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To explore the application value of CT scanning protocol with a low-concentration contrast medium and low kVp in the portal vein angiography

**METHOD AND MATERIALS**

56 consecutive patients were randomized into 2 groups. Group A (n=28) which received 70mL iodixanol(270mgI/ml) with injection rate of 2.7mI/s, underwent 80-100kVp CTA with automatic exposure control. Group B (n=28) which received 70mL iopamidol(370mgI/ml) with injection rate of 3.0 mI/s, underwent conventional 120 kVp CTA. Images of low kVp scans were reconstructed with ASiR70%.ROIs were placed on the trunk, left branch and right branch of portal vein. Signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) was calculated with ROI measurements. Subjective image quality(IQ) was rated on a 5-point-scale. Subjective and objective IQ was statistically compared. CT doseindex(CTDI) was recorded and compared. Figure of
merit (FOM) was computed to normalize CNR, estimated effective dose, and iodine weight.

RESULTS
CTDI of low-kVp (4.75±1.39mGy) was significantly lower than that of conventional 120 kVp (8.56±1.71 mGy) (P<0.05). In low-kVp Group, the CNR and SNR were (8.12±3.09) and (14.72±4.05) for trunk of portal vein, (6.59±2.13) and (13.40±4.68) for its left branch, and (7.24±2.19) and (13.56±4.99) for its right branch respectively. In 120kVp Group, the CNR and SNR were (6.68±3.41) and (12.82±4.11) for its left branch, and (7.09±2.04) and (12.55±4.36) for its right branch respectively. Between low-kVp Group at a 70% ASIR and 120kVp Group, CNR and SNR of portal vein scanning were not significantly different (P>0.05). The figure of merit in the low-kVp group was greater than that in the 120kVp group.

CONCLUSION
The enhanced CT scanning with a low-concentration contrast medium and low kVp achieves a high quality angiography of portal vein, and could be applied in clinical practice.

CLINICAL RELEVANCE/APPLICATION
In low-kVp portal vein angiography, higher intravascular enhancement can be achieved with iodixanol (270mgI/ml) with good vessel conspicuity down to the sub-segmental level.

PURPOSE
To assess the relationship between the types of chemoagents and degree of vascular damage of the liver after transarterial chemoembolization (TACE) in patients with hepatocellular carcinoma (HCC), we retrospectively evaluated the serum level of thrombomodulin (sTM), which has been known to be a marker of systemic vascular damage, in 51 patients (Part 1), and also evaluated chronological angiographic findings in other 46 patients who underwent repetitive TACE (Part 2).

METHOD AND MATERIALS
Part 1: Between 2012 and 2013, 51 patients who underwent TACE for HCC (n<6) were retrospectively recruited. The ratio of sTM (rTM = post-TACE/pre-TACE) were correlated to various clinicoradiological factors using univariate and multivariate analyses. Part 2: Between 2000 and 2013, 46 patients who underwent TACE more than 5 times were retrospectively recruited. Degree of vascular damage was assessed at the level of the 2nd order branches of hepatic artery on the angiography performed at the next TACE using 4-point score. Scores were assigned for each chemoagents, the sum of which were compared among them.

RESULTS
Part 1: rTM peaked at day 1, and returned to the pre-TACE level at day 7. rTM were large in the descending order of Cisplatinum (CIS, n=17), Epirubicin (EPI, n=15), and Miriplatin (MPT, n=19) (p=0.02). Among various factors assessed, number of the tumors, pre-TACE sTM, size of HCC, the types of chemoagents, and the embolized liver volume were related to rTM. Stepwise regression analysis revealed the latter three factors were independently significant (p<0.05). Part 2: In 46 patients, 23, 126, and 26 TACE sessions were performed with EPI, CIS, and MPT, with their scores being 1.18 ± 0.14, 0.94 ± 0.06, and 0.58 ± 0.13, respectively. There were significant difference in the scores between MPT vs both EPI (p<0.01) and CIS (p<0.05, Steel-Dwass test). Short term therapeutic effects were not significantly different among three chemoagents in both Part 1 and Part 2 studies.

CONCLUSION
MPT was suggested to cause less vascular damage after TACE than EPI and CIS.

CLINICAL RELEVANCE/APPLICATION
MPT causes less vascular damage in the liver as compared to EPI and CIS, which should be taken into account when selecting chemoagents for TACE, to preserve liver function for the future procedures.
received an individually body weight adapted CM bolus (volume/flow rate) as determined by contrast injection software (CertegraTM P3T, Bayer). For evaluation both groups were subdivided in a low (40-75kg) and high (76-117kg) weight group. All scans were performed on a 2nd generation dual-source CT using a high-pitch CTA with the following parameters: 100kVp, 200/250 mAsref, rot.time 0.28s, 128x0.6 mm col., image reconstruction 1/0.8 mm, kernel B30f. For both groups the amount of iodine per kilogram (gI/kg) was calculated. Contrast enhancement in Hounsfield Units (HU) was measured at the level of the pulmonary arteries centrally and distally. Statistical analysis was performed using SPSS (version 22.0).

RESULTS
For both groups, mean attenuation values were diagnostic (>250HU). For group 1, attenuation values were significantly different between weight groups (centrally-distally): 475±105 - 431±98HU (40-75kg) and 402±115 - 376±103HU (76-117kg), p<0.03. For group 2, there was no significant difference in attenuation values between weight groups (centrally-distally): 424±76 - 416±82HU (40-75kg) and 418±100 - 405±90 HU (76-117kg), p>0.7. Mean CM volumes for group 1 were: 55±5ml (40-75kg) and 66±5ml (76-117kg). There was a significant difference in gI/kg between group 1 vs. group 2: 0.43±0.05 vs. 0.26±0.05gI/kg, p<0.01 (40-75kg) and 0.30±0.03 vs. 0.20±0.01gI/kg, p<0.01 (76-117kg).

CONCLUSION
The use of individualized CM protocols resulted in more homogenous attenuation values throughout weight groups compared to the standard injection protocol as well as a substantial reduction of CM volume and iodine per kilogram: 38% and 40% for patients between 40-75kg; 26% and 33% for patients between 76-117kg.

CLINICAL RELEVANCE/APPLICATION
Individualized CM injection protocols for CTPA resulted in diagnostically sufficient enhancement of the pulmonary arteries while CM volume could be significantly reduced up to 40%.

VI212-ED-THB5 NC-MRA: Techniques and Applications
Station #5

Participants
Brian Trinh, Chicago, IL (Presenter) Nothing to Disclose
Bradley D. Allen, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Robert J. Lewandowski, MD, Chicago, IL (Abstract Co-Author) Advisory Board, BTG International Ltd; Advisory Board, Boston Scientific Corporation; Consultant, Cook Group Incorporated; Consultant, ABK Medical Inc
James C. Carr, MD, Chicago, IL (Abstract Co-Author) Research Grant, Astellas Group Research support, Siemens AG Speaker, Siemens AG Advisory Board, Guerbet SA
Jeremy D. Collins, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
With recent advances in MR hardware and software in the setting of rising precautions regarding use of contrast agents, non-contrast enhanced MR angiography (NCE-MRA) has become an attractive alternative to contrast enhanced MR angiography (CE-MRA) in patients with renal insufficiency. This educational exhibit will review established and recently developed NCE-MRA techniques and compare and contrast the advantages and disadvantages of each technique to CE-MRA.

TABLE OF CONTENTS/OUTLINE
This educational exhibit will begin with reviewing principles behind distinct NCE-MRA techniques. In particular, the exhibit will discuss in detail inflow-based techniques, ECG-optimized techniques, flow encoding techniques, arterial spin-labeling applications, and relaxation based techniques. Each technique will be reviewed in the context of patient care scenarios with clinical MR images highlighting advantages and disadvantages in comparison to CE-MRA, US, and where applicable, DSA. The exhibit will conclude with a recommended strategy to optimize clinical NCE-MRA protocols in the chest, abdomen/pelvis, and extremities.
**Thoracic Aorta: The Essentials (An Interactive Session)**

Thursday, Dec. 3 4:30PM - 6:00PM Location: S103CD

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Dominik Fleischmann, MD, Palo Alto, CA *(Moderator)* Research support, Siemens AG;

Sub-Events

**RC712A  The Spectrum of Type A Dissections**

Participants
Anne S. Chin, MD, Palo Alto, CA *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the pathology, epidemiology, and natural history of acute type A aortic dissection. 2) Describe the imaging strategies and diagnostic information sought in patients with acute aortic syndromes. 3) Review the recent classification of acute aortic dissection. 4) Illustrate imaging findings of the spectrum of acute type A aortic dissection, with a focus on recognizing subtle CT angiographic findings related to the lesser known 'Class 3' aortic limited intimal tear or limited dissection.

**ABSTRACT**

The traditional Stanford classification distinguishes between dissections involving the ascending aorta (Type A) from those that do not involve the ascending aorta (Type B). Type A aortic dissection is rare, but remains the most lethal of aortic disorders requiring prompt surgical intervention. The common pathologic denominator in patients with acute dissection is an abnormal aortic media ('cystic medial necrosis') which can be found in genetic/inherited diseases (e.g. Marfan's) but also in patients with severe hypertension. The CT imaging strategy of suspected acute aortic syndrome should always include (i) non-enhanced images to assess for intramural hematoma (IMH); when the index of suspicion for aortic dissection is high, also consider (ii) EKG-gating for motion-free evaluation of the aortic root/ascending aorta, and (iii) including common femoral arteries in the CTA scan range to assess lesion extent and identify a percutaneous access route. The spectrum of aortic dissection has recently been classified as the following: Class 1 classic dissection with true and false lumen separated by an intimal flap; Class 2 IMH; Class 3 discrete or limited dissection; Class 4 penetrating atherosclerotic ulcer (PAU); and Class 5 iatrogenic/traumatic. A clarification and modified conceptual classification of aortic dissection will be provided, along with illustrative examples of these aortic lesions. Particular focus will be given to the lesser known Class 3 'limited intimal tear' which is described as a subtle and eccentric bulge of the aortic wall. While it has been reported to elude current imaging techniques, emphasis will be made on recognizing subtle CTA imaging findings characteristic of this uncommon but important dissection variant.

**RC712B  Surgical Procedures and Complications**

Participants
Terri J. Vrtiska, MD, Rochester, MN *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe common indications for surgical intervention in thoracoabdominal aortic disease including aneurysm, vasculitis, infection, trauma and connective tissue disorders. 2) Identify key CTA features of the normal postoperative thoracoabdominal aorta. 3) Present the characteristic CTA findings for complications of postoperative aortic repair including disease progression, thrombosis, stenosis, infection, pseudoaneurysm, aorto-enteric fistula and aortic rupture.

**ABSTRACT**

Surgical procedures and complications of the thoracoabdominal aorta

**RC712C  Traumatic Aortic Injuries**

Participants
Savvas Nicolaou, MD, Vancouver, BC *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Discuss the different mechanisms of injuries, pathophysiology, and types of traumatic aortic injuries including aortic dissection, laceration, transection, pseudoaneurysm and intramural hematoma. 2) Review techniques and advances in imaging including DECT/Spectral and ultra-high-pitch imaging to optimize imaging of traumatic aortic injuries and the role of gating, MRE, and TEE. 3) Discuss and demonstrate examples of the grading scheme for traumatic aortic injuries. 4) Demonstrate imaging pitfalls which can cause misinterpretation of traumatic aortic injuries. 5) Review the appropriate management and treatment options, including open surgical repair and percutaneous endovascular repair, for the traumatic aortic injuries.

**ABSTRACT**
**Vascular Doppler (An Interactive Session)**

Friday, Dec. 4 8:30AM - 10:00AM Location: S402AB

**Participants**

**Sub-Events**

**RC810A**  
**Beyond Peak Velocities: Waveform Interpretation in Carotid Doppler**

Participants  
Mark A. Kliewer, MD, Madison, WI (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Be familiar with how carotid waveforms change with systemic, regional and local vascular disease. 2) Be able to recognize common waveform variants and their attendant clinical significance.

**RC810B**  
**Upper and Lower Extremity Veins**

Participants  
Leslie M. Scoutt, MD, New Haven, CT, (leslie.scourt@yale.edu) (Presenter) Consultant, Koninklijke Philips NV

**LEARNING OBJECTIVES**

1) This course will review the US criteria for the diagnosis of acute and chronic DVT, including a discussion of pitfalls in the US diagnosis of DVT. 2) Current controversies in the US evaluation of DVT will be reviewed. 3) The role of US in the diagnosis of alternative causes of leg pain and swelling will be described. 4) US diagnosis of DVT in the upper extremity will also be discussed.

**ABSTRACT**

This session will discuss the clinical presentation and epidemiology of deep venous thrombosis in the upper and lower extremities. The criteria for and pitfalls in the US the diagnosis of DVT will be discussed with an emphasis on current controversies in the role of US in the work up of patients with clinically suspected DVT. In addition, the role of US in identifying alternative causes of extremity pain and swelling will be presented.

**Honored Educators**

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Leslie M. Scoutt, MD - 2014 Honored Educator

**RC810C**  
**Upper and Lower Extremity Arteries**

Participants  
Michelle L. Robbin, MD, Birmingham, AL, (mrobbin@uabmc.edu) (Presenter) Consultant, Koninklijke Philips NV;

**LEARNING OBJECTIVES**

1) Describe normal anatomy and normal anatomic variants. 2) Demonstrate normal and abnormal waveform patterns. 3) Discuss methods to evaluate stenoses and occlusions, noting pitfalls.

**ABSTRACT**

Upper and lower extremity arterial ultrasounds are becoming more commonly requested because of concerns regarding expense and toxicity of CT/MRI contrast agents, as well as radiation associated with CT. Indications and standard US evaluation of the upper and lower extremity arteries will be detailed, including high brachial artery bifurcation (a normal variant), palmar arch evaluation prior to radial artery harvesting for CABG, and lower extremity arterial waveform analysis.
LEARNING OBJECTIVES

1) Review the epidemiology of aortic side-branch dissections, which can occur as a complication of aortic dissection, or as isolated spontaneous dissections of the visceral or renal arteries. 2) Explain the pathophysiology of side branch malperfusion syndromes in aortic dissection. 3) Present the spectrum of imaging findings in spontaneous aortic branch dissections, including the differential diagnosis (vasculitis, connective tissue diseases, fibromuscular dysplasia, segmental arterial mediolysis).

ABSTRACT

Dissections of aortic side branches is a common complication of Type A and Type B acute aortic dissection which substantially increases mortality. It is important to understand the pathophysiology and the two principle mechanisms of side branch malperfusion in aortic dissection: flow obstruction can be due to (A) local abnormalities, such as occlusive dissection flaps, blind ending false lumen with true lumen occlusion ('windsock'), or frank thrombosis. Side-branch malperfusion may also occur due to (B) limited inflow: The classic situation is complete true lumen collapse in the upstream aorta, resulting in underperfusion of all downstream branches supplied by the true lumen. While local obstructions are most commonly treated by stent placement into the diseased side branch, inflow-lesions typically require surgical or endovascular repair of the upstream aorta. Spontaneous dissections of the celiac, mesenteric, or renal arteries are relatively rare events, and typically present with acute abdominal or flank pain. Dissections of side branch arteries can lead to ischemic complications or to frank rupture with intra- or retroperitoneal hemorrhage. Patients presenting with mesenteric or renal artery dissection require a thorough workup to identify genetic disorders (notably Ehlers Danlos IV), inflammatory conditions (vasculitis), and other entities such as fibromuscular dysplasia and segmental arterial mediolysis (SAM). Imaging findings range from non-obstructive lesions such as intramural hematoma, double-barrel lumen, to partial or complete obstruction ('windsock'). Complications include rupture or ischemia. Spontaneous dissections may heal, or evolve into aortic branch aneurysms.

RC812B Symptomatic Aneurysms

Participants
Phillip M. Young, MD, Rochester, MN, (young.phillip@mayo.edu) (Presenter) Nothing to Disclose

ABSTRACT

Symptomatic aneurysms cover the spectrum of arterial aneurysms presenting with a) localized symptoms secondary to aneurysm expansion and possible rupture b) regional symptoms secondary to dissection and embolism and c) systemic cardiovascular dysfunction related to hypotension and organ dysfunction. Common clinical scenarios include aneurysm rupture - most commonly abdominal aortic, popliteal and abdominal visceral aneurysms as well as thoracoabdominal aortic dissection. Symptomatic aneurysms may also occur in patients with known arterial pathology including connective tissue disorders such as Marfan's and Ehlers-Danlos syndrome and Takayasu aortitis/arteritis. Patients with suspected rupture of abdominal aortic or iliofemoropopliteal artery aneurysms may initially be evaluated by sonography. However, in all circumstances, CT angiography due to its robust implementation and high-resolution imaging of the vasculature and regional anatomy that allows for planning of endovascular and surgical intervention is the preferred technique. CT Angiographic protocols appropriate to the suspected anatomic location of the aneurysm that provide an adequate roadmap for endovascular or surgical intervention are employed. Extended coverage is particularly important in patients with suspected thoracoabdominal aortic dissection or aneurysms associated with peripheral embolism. Cardiac gating should be utilized in any patient with a suspected type A aortic dissection or rupture of an ascending aortic aneurysm. Aortic, cardiac and coronary artery imaging are integral to the evaluation and management of these patients. A particular subset of the "symptomatic aneurysm" is post-trauma aortic disruption, usually thoracic in which diagnosis of traumatic aneurysm is critical and the aneurysm is associated with additional sites of soft tissue and skeletal trauma. Guidelines for endovascular or surgical intervention or non invasive management with serial CT Angiographic imaging will be discussed.

RC812C Mesenteric Ischemia

Participants
Iain D. Kirkpatrick, MD, Winnipeg, MB, (kirkpatrick_iain@hotmail.com) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the various categories of mesenteric ischemia (arterial occlusive, embolic, venous thrombotic, and nonocclusive), and the pathophysiologic basis behind the imaging findings in each case. 2) Understand the basis behind modern CT protocols for mesenteric ischemia, particularly the biphasic examination with CT mesenteric angiography. 3) Demonstrate techniques to rapidly analyze a mesenteric CT angiographic dataset. 4) Review the CT signs of mesenteric ischemia and their sensitivity and specificity.
5) Evaluate the current literature on mesenteric ischemia and discuss optimal diagnostic criteria.

**ABSTRACT**

Acute mesenteric ischemia (AMI) is a life-threatening condition said to affect up to 1% of patients presenting with an acute abdomen, and it carries a mortality rate ranging between 59-93% in the published literature. Time to diagnosis and surgical treatment are the only factors which have been shown to improve mortality, and evidence shows that the clear test of choice for AMI is now biphasic CT. Water is preferably administered as a negative contrast agent, followed by CT mesenteric angiography and then a portal venous phase exam. Diagnostic accuracy is significantly improved by analysis of the CT angiogram for arterial stenoses or occlusions, evidence of emboli, or angiographic criteria of nonocclusive ischemia. It is the use of CT angiography in addition to routine portal phase imaging which has pushed the sensitivity and specificity of the test to >90% in recent published articles. Other nonangiographic CT findings that are relatively specific for AMI in the appropriate clinical setting include pneumatosis intestinalis, portal or mesenteric venous gas or thrombosis, and decreased bowel wall enhancement. Bowel wall thickening, mesenteric stranding, ascites, and mucosal hyperenhancement are more nonspecific findings which may also be seen. Nonocclusive schema may be the most difficult form to diagnose, and findings of shock abdomen can aid in identification. Knowledge of the patient’s clinical history is critical not only for the selection of an appropriate study protocol but also for interpretation of the imaging findings in context.

**RC812D Gastrointestinal Bleeding**

Participants
Jorge A. Soto, MD, Boston, MA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To review the appropriate implementation of CT angiography in the evaluation of patients presenting with acute lower intestinal bleeding. 2) To describe the technical details that are necessary for acquiring good quality CT angiography examinations. 3) Illustrate the characteristic CT angiographic findings of active or recent bleeding with specific examples of multiple etiologies.

**ABSTRACT**

Acute gastrointestinal bleeding is a serious condition that may threaten a patient's life depending on the severity and duration of the event. Precise identification of the location, source and cause of bleeding are the primary objectives of the diagnostic evaluation. Implementation of colonoscopy in the emergency setting poses multiple challenges, especially the inability to adequately cleanse the colon and poor visualization owing to the presence of intraluminal blood clots. Scintigraphy with technetium 99m-labeled red blood cells is highly sensitive but also has some limitations, such as the inability to precisely localize the source of bleeding and determine its cause. Properly performed and interpreted CT angiography examinations offer logistical and diagnostic advantages in the detection of active hemorrhage. A three-phase examination (non-contrast, arterial and portal venous) is typically performed. Potential technical and interpretation pitfalls should be considered and will be explained. The information derived from CT angiography helps direct therapy and select the most appropriate hemostatic intervention (when necessary): endoscopic, angiographic, or surgical. Precise anatomic localization of the bleeding point also allows a targeted endovascular embolization. The high diagnostic performance of CT angiography makes this test a good alternative for the initial emergent evaluation of patients with acute lower intestinal bleeding.

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Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator
Interventional Series: Complications in Interventional Oncology-Avoidance and Damage Control

Friday, Dec. 4 8:30AM - 12:00PM Location: N228

LEARNING OBJECTIVES

1) List 2 important recent publications in interventional oncology. 2) Explain the mechanism of one complication related to thermal ablation. 3) Describe 1 pitfall of radioembolization. 4) Outline 3 complications in combination therapy for hepatocellular carcinoma. 5) List three complications of chemo-embolization.

ABSTRACT

Chemoembolization Complications

Friday, Dec. 4 8:30AM - 8:45AM Location: N228

Participants
Charles E. Ray JR, MD, PhD, Chicago, IL (Moderator) Advisory Board, Novate Medical Ltd; Editor, Thieme Medical Publishers, Inc.; ; ;
Robert J. Lewandowski, MD, Chicago, IL (Moderator) Advisory Board, BTG International Ltd; Advisory Board, Boston Scientific Corporation; Consultant, Cook Group Incorporated; Consultant, ABK Medical Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

RC814-02 DNA ChemoFilter: Novel Method to Prevent Toxicity from Intra-Arterial Administration of Chemotherapeutic

Friday, Dec. 4 8:45AM - 8:55AM Location: N228

Participants
Mariam S. Aboian, MD, PhD, San Francisco, CA (Presenter) Nothing to Disclose
Chia-Hung Sze, MS, San Francisco, CA (Abstract Co-Author) Researcher, ChemoFilter Inc
Jay F. Yu, MS, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Ayuishi Gautam, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Prasheel Lillaney, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
David M. Wilson, MD, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Anand S. Patel, MD, San Francisco, CA (Abstract Co-Author) Stockholder, ChemoFilter, Inc Officer, ChemoFilter, Inc
Mark W. Wilson, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Steven W. Hetts, MD, San Francisco, CA (Abstract Co-Author) Consultant, Silk Road Medical Inc Consultant, Medina Medical Inc Research Grant, Stryker Corporation Data Safety Monitoring Board, Stryker Corporation

PURPOSE

ChemoFilter is a novel medical device that limits systemic toxicity of chemotherapeutics by filtering non-target drug from blood that could be described as intra-vascular dialysis. This method has a potential to prevent toxicity associated with treatment of head and neck cancer, such as renal failure associated with cisplatin. We report a novel method to bind chemotherapeutics in blood that uses immobilized DNA as a platform for binding chemotherapeutics with intrinsic DNA binding activity.

METHOD AND MATERIALS

DNA binding experiments were carried out in vitro with doxorubicin in PBS solution. Genomic DNA was used to determine the concentration of DNA that shows optimum binding kinetics. Binding kinetics in nylon mesh of different pore size was evaluated.

RESULTS

DNA binding kinetics by doxorubicin is dose dependent and is very rapid with 94% decrease in drug concentration from solution within 1 minute of reaction time. DNA demonstrates faster binding kinetics by doxorubicin as compared to previously published polystyrene resin that uses ion exchange to filter doxorubicin out of the solution. DNA sequestered within the Nylon mesh demonstrates approximately 70% decrease in doxorubicin concentration from solution within 5 minutes.

CONCLUSION

DNA ChemoFilter demonstrates rapid binding of doxorubicin and is a model for filtration of DNA binding chemotherapeutics from the bloodstream.

CLINICAL RELEVANCE/APPLICATION

DNA ChemoFilter is optimized for DNA intercalating chemotherapeutics and minimizes their systemic toxicity after intra-arterial administration for treatment of liver and head and neck malignancies.
Therefore, this condition not only has no impact on TARE, but represents an indication, even in case of thrombosis of both portal veins. Indeed, it does not worsen the post-embolization symptoms, while helping retracting portal vein thrombosis if present. TARE showed to be a safe and effective locoregional treatment of locally advanced HCC, even in case of patients with portal vein thrombosis.

**CONCLUSION**

DSMs-TACO offers a valid therapeutic option in patients with unresectable HCC. A careful patients selection is required in order to avoid worsening liver function in patients with border-line liver compensation. Further investigations to establish the best treatment schedule and to define the effect of DSMs-TACO on survival are required.

**CLINICAL RELEVANCE/APPLICATION**

Temporary embolization of the hepatic artery using DSMs is feasible and safe in patients with HCC and an impaired liver function. DSMs-TACO offers a valid therapeutic option in patients with unresectable HCC. A careful patients selection is required in order to avoid worsening liver function in patients with border-line liver compensation. Further investigations to establish the best treatment schedule and to define the effect of DSMs-TACO on survival are required.

**RC814-04**  
**Locoregional Treatment of Advanced HCC with Complete Portal Vein Thrombosis: The Impact of Radioembolization Using 90Y**

Our purpose is to assess effectiveness and safety of Trans-arterial Radioembolization (TARE) using microspheres containing 90Y in case of advanced HCC with thrombosis of both portal branches.

**METHOD AND MATERIALS**

Between March 2010 and March 2013, 41 TARE were performed in 33 patients with unresectable HCC and bilirubine values up to 2.8 mg/dl. Among these, 23 had one portal branch thrombosis and 11 had thrombosis of both portal branches. Multislice Computed Tomography (MSCT) scans and angiography were used to assess the baseline burden and the follow-up studies according to the modified RECIST guideline. Some patients underwent the embolization of the Gastro-duodenal artery, using micro-coils. In these cases, a previous study was performed with the injection of TC-99MAA through a 3F microcatheter. Proton-Pump Inhibitors (PPI) were administered to prevent gastritis and ulcers.

**RESULTS**

The average dose administered was 1.6GBq. After the treatment, a post-embolization syndrome was found in 31/41 patients with no statistically significant difference between patients with portal thrombosis and those without. According to the RECIST guideline at least a partial response was found in 33/41 (79%) of cases three months after the procedure and in 35/41 (88%) at nine months. At two-year follow-up, patients with thrombosis of two portal branches presented survival rates similar to patients with one portal branch thrombosis, and only slightly inferior if compared to patients without thrombosis. Moreover, a retraction of portal vein thrombosis was registered in more than 60% of patients with thrombosis (21/34).

**CONCLUSION**

TARE showed to be a safe and effective locoregional treatment of locally advanced HCC, even in case of patients with portal vein thrombosis. Indeed, it does not worsen the post-embolization symptoms, while helping retracting portal vein thrombosis if present. Therefore, this condition not only has no impact on TARE, but represents an indication, even in case of thrombosis of both portal branches.
CLINICAL RELEVANCE/APPLICATION

If compared to patients without thrombosis, TARE in patients with HCC and portal thrombosis does not reduce the post-treatment quality of life. Thrombosis of both portal branches does not interfere with TARE, and represents one of its major indication in case of locally advanced unresectable HCC, even in case of recurrence after other locoregional treatments.

PURPOSE

IRE has been proposed as a non-thermal ablation method that offers specific advantages over thermal ablation, notably absence of heat sink effect and preservation of both, blood vessels and bile ducts. The purpose of our study was to verify the theoretical advantages of IRE by systematically investigating clinical efficacy and complications of percutaneous IRE for hepatic malignancies located immediately adjacent to major portal and bile ducts or hepatic veins. We were specifically interested in the long-term patency of adjacent venous and biliary vessels.

METHOD AND MATERIALS

CT-guided percutaneous IRE of 37 primary or secondary liver malignancies (mean size 17 mm; range 7-44 mm) was performed in 27 patients (mean age 59 y; 13 men). All lesions were located immediately adjacent to major hepatic veins (n=16), portal vein branches or both (n=21) and therefore not suitable for RFA or MWA. Per standard IRE protocol, 3 to 5 probes (active tip length 1.5-2.5 cm) were placed strictly parallel under CT-guidance. All patients underwent systematic follow-up by CT or MRI.

RESULTS

No major procedure-related complications were observed. All adjacent major portal or hepatic veins remained perfused even at long term follow-up. Complete ablation of the target was achieved in 34/37 (92%) cases with a safety margin of 5-10 mm, confirmed by CT and MRI. In 9 cases (24%) local recurrences within or adjacent to the ablation zone were observed between 1-12 months after treatment. 5 patients with tumors located next to portal veins/ bile ducts (5/21=24%) developed mild to moderate segmental/lobar cholestasis, not requiring treatment. In one patient a clinically asymptomatic arterio-portal fistula developed.

CONCLUSION

IRE for primary and secondary liver malignancies located adjacent to large portal or hepatic veins proved to be safe and effective with regards to local control, and will leave venous blood vessels unaffected. Bile duct strictures may, however, occur, in up to 25% of lesions located close to portal structures.

CLINICAL RELEVANCE/APPLICATION

CT-guided IRE is a useful ablation method for primary and secondary liver tumors that are not amenable to thermal ablation (RFA, MWA). While blood vessels are preserved, bile duct stricutes do occur.

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Not applicable.

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Not applicable.

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Not applicable.
METHOD AND MATERIALS

With IRB approval and HIPAA compliance, our institutional clinical database was queried to access all patients who had development of one or more extrahepatic recurrences in the skin, subcutaneous tissues, or peritoneum from March 2006 to December 2012. The study cohort consisted of 305 consecutive patients (217 men and 88 women) and a total of 498 RFA sessions. All lesions were treated with single, double or cluster internally cooled straight electrodes mated to a 200W generator and switching controller (Covidien, Boulder Co) by one of four experienced interventionalists. Tract ablation was used in almost all cases. Six patients were treated by using combined ethanol injection.

RESULTS

Over a 6 year period, 581 HCC nodules were treated by RF ablation with a mean follow up of 28±16 months (range from 3-66 months). Tumor seeding was evaluated by pathological report of explant liver in 96 patients and by imaging follow up in 209 patients. During this time in two patients, single chest wall nodules were detected in or near the needle tract (0.3% per nodule, 0.6% per patient) in the setting of extrahepatic metastases. One nodule was detected at 5.3 months post ablation concurrent with lymph node metastasis. The other nodule was detected at 18.3 month after liver transplantation in a patient with concurrent lung metastases. In both cases, the ablated nodules were subcapsular, poorly differentiated on concurrent biopsy with direct electrode insertion into the nodule. There was no further lesion treatment due to advanced metastatic disease.

CONCLUSION

In this series, no needle tract seeding was detected in patients without concurrent extrahepatic metastases. However, with two solitary chest wall nodules at or near the needle tract, the possible risk of tumor seeding after RF Ablation of HCC was 0.3% per nodule and 0.6% per patient. Both nodules were poorly differentiated and subcapsular.

CLINICAL RELEVANCE/APPLICATION

Using optimal technique, there is very low risk of possible tumor seeding after percutaneous radiofrequency ablation of hepatocellular carcinoma.
Fisher's exact test.

RESULTS
There were no major complications in both groups. Enhancing wall thickening of GB adjacent to RFA zone was noted in 19.4% (7/36, abutting group; 5, non-abutting group; 2) and it disappeared on subsequent follow-up imaging. There is no statistically significant difference between abutting group and non-abutting group (p >0.05). The technical success rate based on immediate follow-up and one-month follow-up CT was 94.4% (34/36) and two patients remained enhancing foci on immediate follow up (1 abutting group, 1 non-abutting group) and they were retreated successfully. Local tumor progression of completely ablated tumors during follow-up period less than 6 months was noted in two patients (2/34, 1 abutting group, 1 non-abutting group). Except these two patients, there was no local tumor progression during follow-up periods.

CONCLUSION
RF ablation can be a safe and effective treatment for FHL adjacent to GB with rearrangement of electrode and reduction of ablation time.

CLINICAL RELEVANCE/APPLICATION
The treatment of FHL adjacent to GB is challenging issue. RF ablation may be a safe and effective treatment option even though the lesion is located right beside GB.

RC814-11  Combination Therapy Complications
Friday, Dec. 4 10:45AM - 11:00AM Location: N228

Participants
Thuong G. Van Ha, MD, Chicago, IL (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

RC814-12  Complications due to Imaging Errors
Friday, Dec. 4 11:00AM - 11:15AM Location: N228

Participants
Aradhana M. Venkatesan, MD, Houston, TX, (avenkatesan@mdanderson.org) (Presenter) Institutional research agreement, Koninklijke Philips NV

LEARNING OBJECTIVES
View learning objectives under main course title.

ABSTRACT
RC814-13  Tumor Board-Ask the Experts
Friday, Dec. 4 11:15AM - 11:30AM Location: N228

Participants
Charles T. Burke, MD, Chapel Hill, NC (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

RC814-14  Literature Review: The Most Important IO Papers from the Past 5 Years that Everyone Should Know
Friday, Dec. 4 11:30AM - 11:45AM Location: N228

Participants
Ryan Hickey, MD, Chicago, IL (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

RC814-15  Questions and Wrap-up
Friday, Dec. 4 11:45AM - 12:00PM Location: N228

Participants
**SST16**

**Vascular/Interventional (Advances in CT angiography)**

**Friday, Dec. 4 10:30AM - 12:00PM Location: E352**

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**FDA** Discussions may include off-label uses.

**Participants**
James C. Carr, MD, Chicago, IL (Moderator) Research Grant, Astellas Group Research support, Siemens AG Speaker, Siemens AG Advisory Board, Guerbet SA
Elizabeth M. Hecht, MD, New York, NY (Moderator) Nothing to Disclose

**Sub-Events**

**SST16-01 Patient Tailored Contrast Volume for Preoperative CT Angiography of the Aorta: A Prospective Study Based on Patient Heart Rate and Body Surface Area Differences**

**Friday, Dec. 4 10:30AM - 10:40AM Location: E352**

**Participants**
Adriana Dubbeldam, MD, Leuven, Belgium (Presenter) Nothing to Disclose
Federica Zanca, PhD, Leuven, Belgium (Abstract Co-Author) Nothing to Disclose
Walter Coudyzer, Leuven, Belgium (Abstract Co-Author) Nothing to Disclose
Hilde Bossmans, PhD, Leuven, Belgium (Abstract Co-Author) Co-founder, Qaelum NV Research Grant, Siemens AG
Geert Maleux, MD, PhD, Leuven, Belgium (Abstract Co-Author) Speakers Bureau, Merit Medical Systems, Inc Speakers Bureau, W. L. Gore & Associates, Inc Speakers Bureau, Medtronic, Inc

**PURPOSE**
The quality of CT aortography is known to critically depend on contrast agent injection. Therefore, relatively high dose (historical and safe) injection protocols are being used. A recent retrospective analysis showed a large variability in contrast enhancement in the aorta, with Hounsfield units (HU) from 123 to 510, while all images remained of acceptable quality. This suggested that contrast doses could be lowered. Our aim is to test whether patient specific contrast dose calculation would allow to reduce contrast dose.

**METHOD AND MATERIALS**
We performed a randomized prospective study of 60 patients undergoing CT-angiography for aortic aneurysm/dissection. Patients were scanned on a Siemens Somatom Definition Flash optimized for fast acquisition. An in-house developed injection-calculator (iCalc by Nemoto Kyorindo, Tokyo) proposed an optimal patient contrast dose based on patient weight, length, heart rate and contrast medium concentration. Image quality was determined quantitatively (HU-measurements) and qualitatively (five-point visual scale with intra-observer control). All patients received a non-contrast and arterial phase acquisition. Triggering was performed at 120HU at the suprarenal level. Patients were randomly divided in 3 study groups: 1) a control group with standard dose of 120ml, 2) an injector-calculated contrast dose, 3) an additional dilution of 50% on top of the injector-calculated dose.

**RESULTS**
The average contrast dose in group 2 was reduced by 15% (mean injected dose 101,8ml) compared to group 1 (p-value 0,0012), with a decrease in mean HU-values of only 1%. The range of HU units reduced from [156,3-569.8HU] to [155,6-421,3HU]. The visual score (4,5/5) was unchanged. For group 3, contrast dose reduction was 60% (mean injected dose 48,1ml) (p-value <<0,00001) with a mean decrease in HU-values of 32% (p-value 0,001) and range [79,1-449,1HU]. Average image quality dropped (3,7/5). In 2/20 patients, both diagnosed with dissection, image quality was suboptimal but still of diagnostic quality.

**CONCLUSION**
Contrast dose for CT-aortography was reduced by 15% without compromising image quality and interpretation. Images remained diagnostic even with further dose reduction to 60%. We would however recommend not to apply this in dissection patients.

**CLINICAL RELEVANCE/APPLICATION**
The use of a patient specific contrast dose determination can be safely applied for CT aortography with a significant contrast dose reduction.

**SST16-02 Feasibility Study of Spectral CT Imaging Associated with Ultra-low Volume Contrast Medium for Aorta CTA: Compared with Conventional 120kVp**

**Friday, Dec. 4 10:40AM - 10:50AM Location: E352**

**Participants**
Ping Hou, MD, Zhengzhou, China (Presenter) Nothing to Disclose
Xiang-Nan Feng, MS, Hong Kong, Hong Kong (Abstract Co-Author) Nothing to Disclose
Jianbo Gao, MD, Zhengzhou, China (Abstract Co-Author) Nothing to Disclose
Jie Liu, Zhengzhou, China (Abstract Co-Author) Nothing to Disclose
Yaojun Jiang, MD, Zhengzhou, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To evaluate the image quality of Spectral CT associated with ultra-low volume contrast medium for aorta CTA, compared with conventional 120kVp scan with 70ml contrast medium.
METHOD AND MATERIALS

62 patients underwent aorta CTA examination on a spectral CT scanner (Discovery CT, GE Healthcare) were divided into 2 groups. 31 patients were scanned using GSI mode with contrast agent volume of 0.4ml/kg and injection rate calculated as volume/(delay time + exposure time) were the study group. After examined, images using 55keV and 70keV were reconstructed. Those two sets of images were named as set 1 and 2. Another 31 patients scanned using 120kvp with contrast agent volume of 70ml and 5ml/s injection rate were control group. The obtained images were regarded as set 3. CT values and CNR of aorta and its branches were obtained and compared. The overall image quality was evaluated on a five-point scale. Results were analyzed using rank-sum test, t test and Bonferroni test.

RESULTS

No significant differences existed in image quality of the renal arteries between set 1 and 3 (p=0.468). However, higher CNR values were obtained in set 1 than in set 2 and 3 (CNR 18.12±5.89 vs 12.11±4.07 vs 13.23±1.89 in ascending aorta; 18.34±5.81 vs 12.19±3.85 vs 12.39±2.17 in celiac trunk; 17.27±4.73 vs 11.61±4.21 vs 12.51±1.94 in renal arteries) (p<0.05), while there was no significant difference between set 2 and 3 (p=0.50). CT values for aorta and its branches were (358.47±69.56 vs 213.80±91.03 vs 374.46±34.23, (361.17±64.09 vs 216.22±37.65 vs 353.72±30.68, (336.89±55.70 vs 205.01±34.45 vs 354.28±46.96) and (333.57±54.62 vs 201.22±34.45 vs 356.99±54.62) HU for the set 1, 2 and 3. There were significant differences among the three groups (p=0.00) and between set 1 and 2, and set 2 and 3 (p=0.00). There was no significant difference between set 1 and 3 (p=0.00). The amount of contrast agent for each patient in the study group was 28.87±4.42ml, while that in the control group was 70ml. There were significant differences of the contrast medium volume among the two groups (F = 537.09, p=0.00).

CONCLUSION

Monochromatic images of 55keV in spectral aortic CTA with ultra-low volume contrast medium was feasible and can provide good image quality compared with conventional 120kVp scan.

CLINICAL RELEVANCE/APPLICATION

Monochromatic images of 55keV in spectral aortic CTA can significantly reduce the amount of contrast agent and injection rate with improved image quality.

SST16-03 Feasibility Study of Spectral CT Imaging Associated with Ultra-Low Volume of 20ml Contrast Medium for Pulmonary CTA

Friday, Dec. 4 10:50AM - 11:00AM Location: E352

Participants
Jie Liu, Zhengzhou, China (Presenter) Nothing to Disclose
Jianbo Gao, MD, Zhengzhou, China (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate the image quality of Spectral CT associated with ultra-low volume of 20ml contrast medium for pulmonary CTA compared with conventional 120kVp scan with 50ml contrast

METHOD AND MATERIALS

25 patients underwent CTPA examination on a spectral CT scanner (Discovery CT, GE Healthcare) using 20ml contrast agent and 5ml/s injection rate as group A. 15 patients scanned by 120kVp with 50ml contrast agent and 5ml/s injection rate was retrospectively reviewed as control group B. 5ml contrast agent were firstly used in the test bolus scan to get the peak time of the aorta and the pulmonary artery (T1, T2). Peak time of CTA scan was calculated as followed: Tpeak = T2 + 1/2(T2-T1). After the examination, images of 60keV with 50%ASiR were reconstructed. CT values of the pulmonary artery, lobar artery, and segmental artery were obtained. The overall image quality was evaluated on a five-point scale by two radiologists. Sample T test were used to compare image quality between A group and group B.

RESULTS

CT value of pulmonary artery, lobar artery and segmental artery in group A and B were 399±479, (t=0.356, P=0.724), 386±59 vs 396±477, (t=0.377, P=0.709) and 428±99 vs 441±81, (t=0.377, P=0.709), SNR was 13.0±2.3 and 14.7±4.2 for Group A and B. CNR was 22.3±9.5 and 23.6±10.1 (both >0.05), respectively. There was no significant difference between group A and group B. But The image quality score were 3.4±0.6 vs 4.5±0.6, (t=4.279, P=0.001), There was significant difference between group A and group B

CONCLUSION

Spectral CT associated with ultra-low volume of 20ml contrast medium for pulmonary CTA can provide good artery enhancement and image quality saving half the contrast medium dose.

CLINICAL RELEVANCE/APPLICATION

There is also potential for further reduction in the contrast volume.

SST16-04 Spot the Clot: Improvements in CT Detection of Thrombus Using an in Vitro Dual-Energy Based Phantom Model

Friday, Dec. 4 11:00AM - 11:10AM Location: E352

Participants
Jason DiPoce, MD, Jerusalem, Israel (Presenter) Nothing to Disclose
Jacob Sosna, MD, Jerusalem, Israel (Abstract Co-Author) Consultant, ActiViews Ltd Research Grant, Koninklijke Philips NV
Dorith Shaham, MD, Jerusalem, Israel (Abstract Co-Author) Employee, Koninklijke Philips NV
Zinam Ronman, Haifa, Israel (Abstract Co-Author) Employee, Koninklijke Philips NV
Nahum Goldberg, Jerusalem, Israel (Abstract Co-Author) Nothing to Disclose
CONCLUSION

Three types TDC were obtained: type A, B and C. Most of the TDCs were type B, which has whole arising part, peak value and descending part. Type A curve was observed in a red hot diabetic foot, which genius-quickly peaks in the early parts of the scans. And type C curves were observed in black swallon feet, which peaks very slow or only has the arising part without the peak value and the descending part. Type B curve was observed in feet both with and without perfusion artifacts, which has whole arising part, peak value and descending part. Because of motion artifact, perfusion parameters (including BV, BF and MTT) of 27 feet out of 36 both with and without perfusion artifacts were analyzed using T-test.

METHOD AND MATERIALS

Phantoms were constructed by collecting fresh swine blood which was allowed to form clots. These clots (n=8) were transferred into 11mL tubes. Heparinized blood containing 2 mg/ml iodine (Iomeron 350 mg/ml) was then added to the tubes. Control tubes (n=8) were filled with blood and the same iodine concentration without clot. A 17cm wide cube water bath phantom held the tubes. Scans were obtained using a 64-slice spectral detector CT (Philips Healthcare, Cleveland, OH) with the following iso-dose imaging parameters: 120kV, 250mAs and 80 kV, 700mAs. For each scan, 120 and 80 kV polyenergetic 1.5mm thick images were reconstructed. Monoenergetic images at 40, 50, 65, 80 and 100keV were generated from the 120kV scan. A 112 image presentation was created to display individual tubes in a random order. Three experienced radiologists blindly ranked the images for the presence of clots according to a 6 point certainty scale and a 4 point graded image quality scale. The clot detection confidence and image quality of monoenergetic compared to polyenergetic images were analyzed using T-test.

RESULTS

The mean HU values of the iodinated blood at 120 and 80 kV, and 40, 50, 65, 80, 100 keV were 87, 118, 207, 142, 91, 66, and 51, respectively. Clot detection and image quality ranks were significantly better in low energy monoenergy images at 40 and 50 keV when compared to 120 and 80 kV polyenergetic images (p<0.05). Greater sensitivity and specificity were seen for 40 keV images (100% and 100%) and 50 keV (77.8% and 85.7%) compared to 120 kV conventional images (20.0% and 14%) and 80 keV conventional images (38.5% and 25.0%). Likewise, 40 and 50 keV monoenergy images significantly increased image quality ranks (3.9 and 3.6, respectively) compared to 120 and 80kV conventional images (2.8 and 3.1) (p<0.05, both comparisons).

CONCLUSION

Visualization of clot is improved when using dual energy monoenergetic images when compared to standard and low kV polyenergetic images. Our phantom model will likely also be useful in further identifying thresholds of low dose contrast for other diagnostic applications.

CLINICAL RELEVANCE/APPLICATION

Our results imply that dual energy scanning can permit reduced contrast dose while increasing reader confidence of clot detection.

METHOD AND MATERIALS

Phantoms were constructed by collecting fresh swine blood which was allowed to form clots. These clots (n=8) were transferred into 11mL tubes. Heparinized blood containing 2 mg/ml iodine (Iomeron 350 mg/ml) was then added to the tubes. Control tubes (n=8) were filled with blood and the same iodine concentration without clot. A 17cm wide cube water bath phantom held the tubes. Scans were obtained using a 64-slice spectral detector CT (Philips Healthcare, Cleveland, OH) with the following iso-dose imaging parameters: 120kV, 250mAs and 80 kV, 700mAs. For each scan, 120 and 80 kV polyenergetic 1.5mm thick images were reconstructed. Monoenergetic images at 40, 50, 65, 80 and 100keV were generated from the 120kV scan. A 112 image presentation was created to display individual tubes in a random order. Three experienced radiologists blindly ranked the images for the presence of clots according to a 6 point certainty scale and a 4 point graded image quality scale. The clot detection confidence and image quality of monoenergetic compared to polyenergetic images were analyzed using T-test.

RESULTS

The mean HU values of the iodinated blood at 120 and 80 kV, and 40, 50, 65, 80, 100 keV were 87, 118, 207, 142, 91, 66, and 51, respectively. Clot detection and image quality ranks were significantly better in low energy monoenergy images at 40 and 50 keV when compared to 120 and 80 kV polyenergetic images (p<0.05). Greater sensitivity and specificity were seen for 40 keV images (100% and 100%) and 50 keV (77.8% and 85.7%) compared to 120 kV conventional images (20.0% and 14%) and 80 keV conventional images (38.5% and 25.0%). Likewise, 40 and 50 keV monoenergy images significantly increased image quality ranks (3.9 and 3.6, respectively) compared to 120 and 80kV conventional images (2.8 and 3.1) (p<0.05, both comparisons).

CONCLUSION

Visualization of clot is improved when using dual energy monoenergetic images when compared to standard and low kV polyenergetic images. Our phantom model will likely also be useful in further identifying thresholds of low dose contrast for other diagnostic applications.
70 kVp CT perfusion could be a potential technique to determine the information about foot vascularization, and meanwhile, further study is needed to justify tailored contrast injection protocol.

**CLINICAL RELEVANCE/APPLICATION**

70 kVp CT perfusion could be a potential technique to determine the information about foot vascularization.

**SST16-06** **Comparison of 4D Dynamic Computed Tomography Angiography and 4D Dynamic Magnetic Resonance Angiography in Patients with Peripheral Arterial Occlusive Disease**

Friday, Dec. 4 11:20AM - 11:30AM Location: E352

**Participants**

Philipp Riffel, MD, Mannheim, Germany (Presenter) Nothing to Disclose
Holger Haubenreisser, Mannheim, Germany (Abstract Co-Author) Speaker, Siemens AG; Speaker, Bayer AG
Sonja Sudarski, MD, Mannheim, Germany (Abstract Co-Author) Nothing to Disclose
Mathias Meyer, Mannheim, Germany (Abstract Co-Author) Speaker, Siemens AG; Speaker, Bracco Group
Stefan O. Schoenberg, MD, PhD, Mannheim, Germany (Abstract Co-Author) Institutional research agreement, Siemens AG
Thomas Hentsch, MD, Mannheim, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

The purpose of this study was to compare diagnostic image quality of 4D dynamic computed tomographic angiography (d-CTA) of the lower leg in comparison to 4D dynamic magnetic resonance angiography (MRA) at 3T in patients with peripheral arterial occlusive disease (PAOD).

**METHOD AND MATERIALS**

22 patients with PAOD (PAOD stage 1: 4 patients; PAOD stage 2: 7 patients; PAOD stage 3: 2 patients; PAOD stage 4: 9 patients) were examined with a combined CTA protocol on a 3rd generation 2 x 192 slice dual-source CT system consisting of a static CTA (s-CTA) of the lower leg runoff and d-CTA of the calves with a z-axis coverage of 80 cm. Additionally the patients underwent a MRA protocol combining continuous table movement (CTM) MRA of the runoff vasculature (s-MRA) as well as time-resolved MRA (d-MRA) of the calves with a z-axis coverage of 45 cm. Diagnostic image quality of s-MRA and s-CTA alone was compared with s-MRA and s-CTA in addition with d-MRA and d-CTA by two independent radiologists with a time interval of 4 weeks between the reading sessions for the static examination and for the combination of static and dynamic examinations. The images were evaluated according to a 4-point Likert-like rating scale assessing image quality on a segmental basis.

**RESULTS**

For static angiography 637 segments were included in the assessment of image quality. For s-CTA 62% of segments were rated as excellent, 20% as good, 16% as moderate and 2% as poor. No segments were rated as non-diagnostic. For s-MRA 20% of segments were rated as excellent, 20% as good, 20% as moderate and 26% as poor. 14% of segments were rated as non-diagnostic (all p-values < 0.0001). For dynamic angiography 264 segments were included in the assessment of image quality. For d-CTA 89% of segments were rated as excellent or good (78% as excellent, 11% as good). For d-MRA 40% of segments were rated as excellent or good (20% as excellent, 20% as good), while 28% of segments were rated as non-diagnostic.

**CONCLUSION**

In patients with PAOD the addition of d-CTA leads to an improved depiction of the calf vessels compared to s-CTA alone. The combined static and dynamic CTA yield improved image quality in comparison to a combined 3-T MRA protocol.

**CLINICAL RELEVANCE/APPLICATION**

A combined static and dynamic CTA yield improved image quality in comparison to a combined 3-T MRA protocol and should be considered as a valuable alternative in patients with all stages of PAOD.

**SST16-07** **Dual-Energy CT with Advanced Image-Based Virtual Monoenergetic Reconstructions Improves Depiction of Portal Vein Thrombosis**

Friday, Dec. 4 11:30AM - 11:40AM Location: E352

**Participants**

Moritz H. Albrecht, MD, Frankfurt am Main, Germany (Presenter) Nothing to Disclose
Jan-Erik Scholtz, MD, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Martin Beeres, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Boris Bodelle, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Ralf W. Bauer, MD, Frankfurt, Germany (Abstract Co-Author) Research Consultant, Siemens AG Speakers Bureau, Siemens AG
Julian L. Wichmann, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Andreas Bucher, MD, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Thomas Lehnerd, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To investigate the impact of an advanced monoenenergetic reconstruction algorithm on visualization and diagnostic performance in dual-energy computed tomography (DECT) imaging of portal vein thrombosis (PVT).

**METHOD AND MATERIALS**

Forty patients (22 men; mean age, 67.5 years ± 17.6 years) who underwent contrast-enhanced portal-venous-phase DECT of the upper abdomen within clinical routine were retrospectively evaluated. Standard linearly blended (M 0.5, 50% low-kV spectrum) and virtual monoenenergetic images were calculated using a basic (Mono) and an advanced image-based monoenenergetic algorithm (Mono+) with energy levels ranging from 40-100 keV (10-keV increments). ROI measurements were performed in the portal vein proximally and, if visible, distal to the thrombus, and the splenic and superior mesenteric vein for objective contrast-to-noise ratio (CNR) calculation. Five-point likert scale ratings regarding image quality, contrast, noise, suitability for PVT assessment and
diagnostic performance of 2 radiologists in the diagnosis of PVT were evaluated.

RESULTS

Twenty patients (50%) showed findings of PVT. Mono+ images at 40 keV showed the best objective image quality (mean CNR, 7.2 ± 5.1, P < 0.01) compared to all other image series and were rated most suitable for PVT assessment (rating, 4.9; P = 0.03). Intravenous attenuation and contrast between Mono and Mono+ series showed no significant difference (objectively, P < 0.88; subjectively, P < 0.52), but substantially increased noise was found for Mono 40 and 50 keV compared to Mono+ and all other reconstructions (objectively, P < 0.01; subjectively, P < 0.01). Mono+ 60 keV images were rated best regarding subjective image quality (P = 0.67). Diagnostic performance for diagnosis of PVT was highest for both radiologists at Mono+ 40 keV compared to all other available image series (mean sensitivity, 100%; mean specificity, 93.4%, P < 0.04).

CONCLUSION

Mono+ reconstructions at 40 keV in DECT facilitate significantly improved diagnostic performance for detection of PVT compared to both standard linearly blended and basic Mono images.

CLINICAL RELEVANCE/APPLICATION

Additional reconstruction of Mono+ DECT series at 40 keV may improve detection and assessment in cases of suspected PVT.

SST16-08  
AngioCTA in the Preoperative Planning of Perforator Flaps in Plastic Reconstructive Surgery

Friday, Dec. 4 11:40AM - 11:50AM Location: E352

Participants
Ruben Guerrero Vara, MD, Barcelona, Spain (Presenter) Nothing to Disclose
Claudia Alejandra Nunez Peralta, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Gemma Pons Playa, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Jose Sarria, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Fernando Gomez, MD, PhD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate the utility of CTA in planning perforator surgery in different kind of flaps. To demonstrate the radiologic correlation between intraoperative and radiological findings.

METHOD AND MATERIALS

202 CTAs performed from January 2011 to January 2014 and their intraoperative findings were reviewed. We focused on DIEP (96), SIEA (25), ALT (51), TDAP (18) and SGAP (12) flaps. The images were pre-operatively evaluated by a radiologist and a plastic surgeon. The best perforator vessel was selected and its position was identified by means of an X and Y axis respect to anatomic references. These anatomic references were different depending on the kind of flap. The obtained coordinates (x-y) for each perforator vessel were transferred to patient’s skin before the surgical intervention. All the vessels depicted in CTA were found in the surgery. We consider good correlation if doppler ultrasound over the skin located at the exact given reference, could detect the vessel. We consider poor correlation if the vessel was located more than 10 mm distant from the reference or if the vessel was not found during surgery.

RESULTS

We found a very reliable relationship for DIEP (99.5%), SIEA (97%) and ALT (98%) flaps. In SIEA flap (80%) the correlation was less exact since it has an inconstant anatomy and a learning curve for the radiologist is necessary. However, when we analysed the data of the last year, a 94% success was achieved. In TDAP flap (80%) the different position between the image acquisition and the surgery was the cause of the results. TDAP was the only flap where the images couldn’t be acquired in the same position as surgery would be performed. Nevertheless, all perforators were always found in an area of 2 cm² around the point given by CTA.

CONCLUSION

CTA provides important information about vascular anatomy before perforator flap surgery. Choosing the dominant vessel allows faster and safer perforator flap surgical procedures. A proper knowledge of the anatomy and a good understanding of the surgical procedure by the radiologist are of paramount importance to achieve optimal results.

CLINICAL RELEVANCE/APPLICATION

CTA is nowadays a pre-operative examination of choice to perform perforator flap surgery since faster and safer surgical procedures have been demonstrated after its use.

SST16-09  
The Gravitational Gradient (GG), Defined as the Dependent Divided by Independent Region of Interest (ROI) Attenuation in Abdominal Aortic Aneurysms (AAA), Strongly Predicts Rapid Aneurysm Growth in Patients with Less Intramural Thrombus

Friday, Dec. 4 11:50AM - 12:00PM Location: E352

Participants
Ayaz Aghayev, MD, Boston, MA (Presenter) Grant, Toshiba Corporation
Andreas Giannopoulos, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Tianxi Cai, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Kanako K. Kumamaru, MD, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Michael L. Steigner, MD, Boston, MA (Abstract Co-Author) Speaker, Toshiba Corporation
Dimitris Mitsouras, PhD, Boston, MA (Abstract Co-Author) Research Grant, Toshiba Corporation; Speakers Bureau, Toshiba Corporation
Frank J. Rybicki III, MD, PhD, Ottawa, ON (Abstract Co-Author) Research Grant, Toshiba Corporation;

PURPOSE

The GG quantifies 1st pass AAA CTA contrast variation; uniform enhancement (0.90.4 cm/yr) AAA growth, and (b) the presence of
Near-Circumferential (>270° of sac) Intraluminal Thrombus (NCIT) significantly modifies the ability of GG to predict rapid growth.

**METHOD AND MATERIALS**

156 consecutive pre-intervention AAA pts who met study criteria (multiple exams >6mo apart to compute growth, >= 1 first-pass CTA to compute GG) underwent AAA dimension and volume (sac, lumen, and intramural thrombus) measurements. The GG was computed from the CTA dated closest to intervention. We evaluated (a) the relationship between abnormal GG (defined as <0.9 and >1.1) and rapid growth, and (b) if the presence of NCIT modifies the GG predictive ability.

**RESULTS**

42/156 (26%) pts were female; age=71±9.6 (22-92yrs). 103 pts had >2 scans. 66/156 (42%) had NCIT. The mean of the largest AAA diameter was 4.2±0.7cm on the first scan and 5.0±0.9 cm on the scan closest in time to the intervention. Mean vol of AAA sac, lumen, and thrombus on initial scan=65.2±34.7cc, 38.6±16cc and 26.6±25.7 cc, respectively. On scan closest to intervention, mean volume of AAA sac, lumen, and thrombus=91.04±38.9cc, 52.6±24.3cc and 38.4±29.3cc, respectively. 53/156 (33%) of patients had rapid growth (>0.4cm/year). 63/156 (40%) of patients had an abnormal GG. GG is significantly associated with rapid growth with unadjusted OR 1.19 (95% CI: [1.03, 1.38], p<0.02). Furthermore, its ability in predicting rapid growth is dependent on the presence of circumferential thrombus. Based on a logistic regression model including an interaction between GG and presence of circumferential thrombus, the OR for GG=6.05 (95% CI: [2.0, 18], p<0.001) for those without NCIT and 1.30 (95% CI: [0.45, 3.72], p=0.63) for those with NCIT. The presence of NCIT significantly modifies the ability of GG to predict rapid growth (test for interaction, p<0.05).

**CONCLUSION**

Patients with a positive GG within the AAA sac have rapid aneurysm growth, and AAA patients with an abnormal GG and without NCIT have an odds ratio > 6 for rapid growth, a significant modification of the predictive ability of the GG.

**CLINICAL RELEVANCE/APPLICATION**

Observation of a positive GG in an AAA sac warrants close attention, particularly when there is little intramural thrombus.