

Late-Breaking Abstracts From the International Symposium on Endovascular Therapy (ISET)

January 16-19, 2022, Hollywood, Florida

ISET 2022-1

External Tamponade of Pseudoaneurysm

B.C. Anamah, M.B. Torres, B.J. Rose, J. Huang

PURPOSE. This case provides an example of a patient who developed hemobilia after placement of a percutaneous biliary catheter. Because of the patient's reduced liver reserve, embolization was not a feasible option, and a different technique was used to remedy the problem. This unconventional approach involved placing a balloon into the biliary tree to tamponade the bleed.

MATERIALS AND METHODS. A 54-year-old man with a large hepatic neuroendocrine tumor underwent extended right hepatectomy, wedge resections, ablations, and biliary reconstruction. This was complicated postoperatively by esophageal and duodenal ischemia related to COVID-19 coagulopathy, subsequently requiring a total gastrectomy, partial duodenal resection, and delayed reconstruction. His treatment included placement of percutaneous biliary catheters into the left medial and lateral bile ducts. During his recovery, he presented with bright red blood in the left biliary catheter drain bag and a hemoglobin drop from 10.1 to 6.8 g/L over 6 hours. Interventional radiology was then consulted to perform a cholangiogram, angiogram, and possible embolization. Over-the-wire cholangiogram was performed demonstrating a clot within the left biliary tree. A hepatic angiogram was performed demonstrating a pseudoaneurysm (PSA) with active extravasation into the left biliary tree, and a 2.8 Fr Progreat microcatheter (Terumo) was used to subselect the segment 4 branches that gave rise to the PSA.

RESULTS. Because of the patient's diminished liver reserve, the surgeon specifically requested no regional embolization, and the decision was made to externally tamponade the PSA with a 32 mm/120 cm CODA balloon (Cook Medical) placed into the left biliary tree through the catheter site. Completion angiogram demonstrated persistent PSA without extravasation. Over the course of the next 3 days, the patient required no additional transfusions; however, on postoperative day 2, the patient spiked a low-grade fever; the balloon was removed on postoperative day 3, and the patient was without incident on 1-month follow-up.

CONCLUSIONS. Intrahepatic arterial damage can cause significant harm and possibly loss of life. Being aware of clinical signs and use of unique ways to treat the problem is crucial to stabilize the patient.

ISET 2022-2

Endovascular and Percutaneous Management of a Distal Abdominal Aortic Pseudoaneurysm

K. Wattamwar, P. Goyal, J. Cynamon

PURPOSE. Endovascular embolization of an aneurysm or pseudoaneurysm (PSA) may be challenging because of sac geometry or difficult super-selective catheterization. Percutaneous techniques may offer a direct approach to embolization.

MATERIALS AND METHODS. A 74-year-old man with a right iliopsoas abscess underwent a series of abdominal computed tomography angiograms (CTAs) revealing phlegmonous changes surrounding the right common iliac artery (CIA), an occluded right CIA stent, and a patent left CIA stent with a 1 cm to 2 cm expanding and possibly mycotic PSA arising from the distal abdominal aorta or a lumbar vessel just above the aortic bifurcation.

RESULTS. An aortogram demonstrated a bilobed PSA either arising directly off the distal aorta or a lumbar artery. During attempted lumbar artery catheterization, the selective catheter entered the PSA, demonstrating its origin off the distal aorta. A lumbar artery was noted arising off the PSA. A stent graft was considered, but because of the lumbar artery and the possibility of underlying infection, it was decided to attempt exclusion with embolization. A 2.7 Fr Progreat microcatheter (Terumo) was advanced into the left lobe of the PSA, and a 6-mm × 10-cm Azur coil (Terumo) was detached after the stability of the coil was confirmed. Attention was then directed toward embolizing the right lobe of the PSA, which demonstrated persistent filling. Because of concern that further manipulation may dislodge the existing coil, a percutaneous approach to the right lobe was chosen. A 21-gauge needle was advanced percutaneously to access the right lobe under fluoroscopic guidance. A 6-mm × 20-cm Azur coil was deployed within the right lobe of the PSA. A small portion of the right-sided coil was noted to prolapse into the left CIA, which was of concern. Using the coil mass as scaffolding, 0.3 mL of Onyx 34 (Medtronic) was carefully injected into the PSA to avoid nontarget embolization. To secure the coil and prevent migration, a 10-mm × 4-cm SMART stent (Cordis) was deployed in the left CIA. Cone-beam CT showed exclusion of the PSA. Left lower extremity arteriograms were performed to rule out distal nontarget embolization.

CONCLUSIONS. Percutaneous embolization of an aneurysm or PSA may be suitable instead of or in conjunction with an endovascular approach when there is complex sac geometry or risk of disturbing a partially completed embolization.

ISET 2022-3

Use of Intravascular Lithotripsy for Severe Calcification in Endovascular Aortoiliac Reconstruction*R. Virdee, M. Leshen, S.R. Kapoor, D. Butani, S.S. Virdee*

PURPOSE. Arterial calcification is common in peripheral arterial disease, often resulting in suboptimal clinical outcomes after angioplasty and stent placement. The use of intravascular lithotripsy (IVL) to create microfractures within the calcification may increase luminal patency and prevent stent underexpansion. We detail usage of IVL in the distal abdominal aorta (AA) during an endovascular aortoiliac (AI) reconstruction of Trans-Atlantic Inter-Society Consensus Document (TASC) D lesions.

MATERIALS AND METHODS. A 62-year-old woman with rest pain and left lower extremity claudication presented for percutaneous transluminal angioplasty of the iliac artery. The first attempt was prematurely terminated 1 month earlier because of severe back and knee pain, requiring general anesthesia for the second attempt. Right brachial retrograde access (RA) was performed followed by placement of a sheath in the infrarenal abdominal aorta. An aortogram revealed a 3- to 4-cm occlusion of the distal AA, extending into the bilateral common iliac arteries (CIAs) and the left external iliac artery. Collateral circulation was provided by hypertrophied iliolumbar and inferior mesenteric vessels. Calcified plaque was seen in the right common femoral artery (CFA), resulting in 85% stenosis. Chronic occlusion of the right superficial femoral artery (SFA) was present, and the right CIA was conventionally cannulated. A Shockwave IVL device was initially used in the right CFA to allow safe non-flow-limiting RA via the proximal right SFA. A loop-snare was then used to pass a wire from the right SFA access point into the AA across the right CIA occlusion. Subintimal cannulation of the long segment left distal AA, CIA, and EIA occlusion via the brachial sheath was successful. Intravascular ultrasound (IVUS) ensured reentry into the EIA true lumen above the inguinal ligament crossover. Kissing Shockwave balloon (SB) angioplasty was used in the distal AA and CIAs. SBs were also used in the left EIA. Significant luminal gain was noted after SB angioplasty; however, kissing-covered stents at the AI bifurcation and left EIA were needed based on angiography and IVUS.

RESULTS. Significantly decreased flow through collaterals and excellent luminal patency were seen angiographically and on IVUS. Pulses were palpable, and the patient reported immediate relief in symptoms.

CONCLUSIONS. IVL can serve as a useful tool in modifying normally resistant calcified plaque morphology to improve angiographic results and ultimately clinical outcomes. This has been documented in other lower-extremity vessels but less so in AI occlusive disease.

ISET 2022-4

Chest Procedure Complications: Case Series*S. Bockhorst, V. Dayaram, H. Jones, B. Glaenzler, S. Contractor*

PURPOSE. Interventional radiologists must be familiar with the various complications of chest procedures and how to manage those complications.

MATERIALS AND METHODS. Most institutions monitor patients with continuous oxygen saturation and obtain a chest radiograph at 1 and 3 hours after the procedure to evaluate for pneumothorax. This complication generally presents as acute dyspnea and pleuritic chest pain. Whereas asymptomatic patients with small pneumothoraces can be observed, symptomatic patients and those with large pneumothoraces require chest tube thoracostomy. Bleeding complications should be suspected if patients become unstable and have rapid reaccumulation of fluid within the pleura or soft tissue spaces. Many medications (warfarin, heparin, clopidogrel) or physiological factors (elevated international normalized ratio, thrombocytopenia, uremia) increase the risk for bleeding. Frequently, these medications are withheld or transfusions are performed to normalize physiological parameters before a procedure. Management by placement of chest tube alone depends on hemodynamic stability, the volume of evacuated blood, and the occurrence of persistent blood loss. If conservative treatment is insufficient, a surgical approach is indicated to prevent subsequent complications. The true incidence of air embolism may never be known, and many cases are subclinical. Large air embolisms can lodge into the heart or vessels and occlude blood flow, which can present as tachyarrhythmias, chest pain, coughing, dyspnea, hypoxemia, and cardiovascular collapse. If this complication is suspected, placing the patient in Trendelenburg and left lateral decubitus positions can trap the air embolism in the right heart and prevent further complications. These patients require supportive treatment, including fluids and 100% oxygen. Re-expansion pulmonary edema is a rare but potentially fatal complication that presents similarly to air embolism complication. To reduce the risk of this complication, guidelines recommend draining less than 1.5 L of pleural fluid at a time. Treatment is generally supportive with oxygen supplementation and ventilation.

RESULTS. In our case series, only the re-expansion pulmonary edema case resulted in death. Patients with complications in the other categories responded to standard management and were promptly discharged.

CONCLUSIONS. Pneumothorax, bleeding, air embolism, and re-expansion pulmonary edema complications can be successfully managed.

ISET 2022-5

Three-Year Results from the MIMICS-3D European Union Study*M. Lichtenberg*

PURPOSE. The BioMimics 3D Vascular Stent System (Veryan Medical) delivers a nitinol stent designed to provide optimal radial support, flexibility, durability, visualization, and delivery accuracy for femoropopliteal intervention. BioMimics 3D's unique 3-dimensional (3D) helical centerline provides biomechanical stability and compatibility, promotes swirling blood flow, and beneficially elevates wall shear stress. The MIMICS-3D European Registry investigated outcomes through 3 years in a real-world population with more challenging, complex lesions than were enrolled in earlier MIMICS studies. We present 3-year outcomes.

MATERIALS AND METHODS. MIMICS-3D enrolled 507 participants treated with BioMimics 3D at 23 sites. Mean age was 70 years; 66% were male, and 37% had diabetes. Rutherford 0 to 1, 2 to 4, and 5 to 6 were 1%, 82%, and 17%, respectively. Mean lesion length was 126 mm; 57% occlusions; lesion calcification according to the Peripheral Arterial Calcium Scoring System was grade 0, 18%; 1, 29%; 2, 24%; 3, 15%; and 4, 14%. BioMimics 3D placement followed atherectomy in 8% of lesions. A drug-coated balloon was combined with BioMimics 3D in 50% of lesions treated. The technical success rate for the BioMimics 3D procedure as assessed by the operator was 99%. An independent clinical events committee adjudicated major adverse events (MAE), including death and potential device-related events. The primary safety endpoint is a composite of MAE, comprising death, major index-limb amputation, or clinically driven target lesion revascularization (CDTLR) through 30 days. Primary outcome measure for effectiveness is freedom from CDTLR through 12 months.

RESULTS. Kaplan-Meier (KM) estimates of freedom from CDTLR at 1, 2, and 3 years in the intent-to-treat (ITT) population were 89%, 82%, and 78%, respectively. KM estimates of freedom from loss of primary stent patency (PSVR >2.4) at 1, 2, and 3 years in the ITT population were 87%, 79%, and 70%, respectively.

CONCLUSIONS. Three-year data from the MIMICS-3D European Union Study are consistent with those of earlier MIMICS studies and demonstrate that by promoting swirling blood flow and increasing wall shear stress, BioMimics 3D clinical outcomes are comparable to those of drug-eluting devices, even in challenging lesions.

ISET 2022-6

Prospective, Multicenter, CEC-Adjudicated Registry to Evaluate Safety and Efficacy of Radial to Peripheral Interventions*M. Shishehbor*

PURPOSE. Radial arterial access has been shown to reduce vascular bleeding, complications, cost, length of stay, and mortality rate in patients undergoing intervention.

MATERIALS AND METHODS. This was a prospective, multicenter, core-lab reviewed, clinical event committee (CEC)-adjudicated registry to evaluate the safety and efficacy of dedicated radial devices in complex peripheral vascular disease. A total of 120 patients at 8 US centers were enrolled from June 2020 to June 2021 and followed for 30 days, with a subset of stented participants followed for 12 months. The primary safety endpoint included evaluation of transradial access-related complications (bleeding, hand ischemia, hematoma, nerve damage, perforation, pseudoaneurysm, retinal artery occlusion, embolic stroke, or transient ischemic attack). The primary efficacy endpoint was procedural success, defined as successful completion of the intended procedure without transradial access complications during the procedure and conversion from radial to femoral access.

RESULTS. A total of 224 lesions were treated. Initial access to radial artery was achieved in 120 of 120 (100%) of patients, with 1 patient requiring conversion to femoral access to complete the procedure. Twenty-nine of 120 (24.2%) patients required 1 or more additional access sites to facilitate crossing or to complete the planned treatment algorithm (femoral, 5 [4.2%]; tibial, 6 [5.0%]; pedal, 17 [14.2%]; and other, 3 [2.5%]). Primary safety events defined as serious transradial access site-related adverse events occurred in 1 in 120 (0.8%). Twenty-four of 120 (20.0%) patients had nonserious transradial access site complications (minor hematoma, bruising, access site bleeding) requiring manual compression, longer transradial band application, or no further intervention. The primary efficacy endpoint (successful completion of the intended procedure without transradial access complications at procedure and conversion from radial to femoral access) was achieved in 115 of 120 (95.8%). The mean procedure time was 74 minutes, and the time to ambulation was 3 hours, 31 minutes.

CONCLUSIONS. This is the first prospective, multicenter study with core-lab and CEC adjudication to show the safety and efficacy of radial access in treating complex endovascular lesions in the lower limbs. A radial approach allowed 92.3% discharge on the day of the procedure with only 1 serious access site-related adverse event. Future randomized trials should examine the clinical and cost effectiveness of this approach over femoral access for patients with peripheral artery disease.

ISET 2022-7

Standardizing Endovascular Ligation of Venous Side Branches in Failing Dialysis Fistulas Using Mathematical Physics*T.S. Harmon, J. Matteo*

PURPOSE. Small branching veins that arise from the outflow of arteriovenous fistulas (AVFs) are seen during fistulograms performed to evaluate for poor function. The mechanism leading to the disruption of AVFs by small branching vessels was unknown until now. Tenets of mathematical physics in electrical circuitry are used to describe how small branching veins cause diverting flow in AVFs.

MATERIALS AND METHODS. The diversion of total venous flow caused by escape veins and subsequent restoration of flow by exclusion can be calculated using Kirchhoff and Ohm laws. Small branching veins function as “escape” currents in a circuit, where they divert physiologic flow from an AVF. According to Kirchhoff’s current law, current is subtracted from the total current in a circuit and equally distributed branching currents. Similarly, the measured total venous flow decreases distal to branching escape veins. As currents move across resistors in a circuit, escape veins decrease the total venous flow across AVFs, reducing AVF function. Patients with malfunctioning AVFs were observed for changes in total venous blood flow before and after exclusion of escape veins by various interventional methods. The observation of intravenous pressure differentials proximal and distal to escape veins in patients with AVF disfunction were compared in the pre- and postinterventional periods. Escape veins with a threshold gradient of 5 mm Hg were treated.

RESULTS. The 10 patients presented underwent routine fistulograms to determine the reason for AVF malfunction during hemodialysis (HD). The patients had prominent escape veins arising from the main venous outflow track of their native AVFs, with pressure differentials that ranged from 5 to 23 mm Hg. The flow potential differences in 100% of the patients’ small branching escape veins were reduced to 0 mm Hg, as measured in the 1-month surveillance period. AVFs were salvaged, and blood flow rates increased in 100% of the patients treated with malfunctioning AVFs.

CONCLUSIONS. Small branching escape veins have been shown to cause inadequate venous flow in patients who rely on AVFs for HD. Escape veins function analogously to resistors in electrical circuits. Early intervention in impaired AVFs with escape veins causing a pressure gradient of at least 5 mm Hg can restore function. We demonstrate a 100% restoration of function to patients with malfunctioning AVFs.

ISET 2022-8

Cecal Perforation Leading to Lumbar Artery Mycotic Pseudoaneurysm*A-R.F. Fadi, I.M. Ibrahim, M. Baghal*

PURPOSE. Mycotic pseudoaneurysm (PSA) is an infectious arteritis leading to the destruction of the arterial wall. To our knowledge, no case of lumbar artery mycotic PSA after bowel perforation has ever been reported in the literature. Only 2 cases of internal iliac artery mycotic PSA after bowel perforation have been reported in the literature. We report a case of lumbar and internal iliac artery PSAs after cecal perforation complicating a neglected cecal volvulus.

MATERIALS AND METHODS. A 46-year-old woman with a history of pulmonary embolism (taking enoxaparin) and cecal perforation 5 months before this admission presented to the emergency department with shortness of breath, altered mental status, and right lower quadrant abdominal pain of 2 days’ duration. She was hypotensive, with abdominal skin bruises and abdominal distension. Laboratory studies revealed azotemia, lactic acidosis, severe anemia, and coagulopathy.

RESULTS. Computed tomography of the abdomen and pelvis with contrast showed massive retroperitoneal hemorrhage. Abdominopelvic angiography revealed bleeding PSAs of the right and left internal iliac arteries and the right fourth lumbar artery. Gelfoam (Pfizer) embolization was successfully performed, with cessation of bleeding. The patient was admitted 5 months earlier with bowel obstruction secondary to cecal volvulus, complicated by cecal perforation. Laparotomy revealed a copious amount of pus in the abdominopelvic area, and abdominal wash of the purulent fluid, diverting ileostomy, and cecal repair were done.

CONCLUSIONS. Neglected cecal perforation with free pus in the abdominopelvic cavity can rarely lead to vascular wall infection of the nearby arteries, producing PSAs, which can be complicated by massive hemorrhage. In this case, in addition to the iliac arteries, the lumbar artery was also involved, which was not described before in the literature in the setting of bowel perforation.

ISET 2022-9

Hemoperitoneum From Gallstone Erosion*C. O'Sullivan, W. Diwan, J. Bittle, K. Blake, A. Farag*

PURPOSE. Hemoperitoneum and hemobilia are exceedingly rare, life-threatening conditions that require rapid diagnosis and treatment. The main sources of intra-abdominal bleeding are the visceral organs, especially the liver and spleen, and vascular injuries such as aneurysms or pseudoaneurysms (PSAs). The inciting trigger for rupture is typically anticoagulation, pregnancy, or trauma. There are few documented reports of spontaneous hemoperitoneum from cystic artery rupture, especially without underlying disease. We present a case of cystic artery bleeding likely caused by gallstone erosion in a patient without cholecystitis.

MATERIALS AND METHODS. A 58-year-old man with hepatitis C and alcohol-induced cirrhosis after transjugular intrahepatic portosystemic shunt placement was brought to the emergency department by emergency medical services after being found down. While being evaluated for diabetic ketoacidosis, he deteriorated, requiring intubation and blood transfusions. Computed tomography of the abdomen and pelvis was concerning for hemorrhagic gallbladder perforation with gallstones seen in the right paracolic gutter. No PSA or aneurysm was identified. Interventional radiology was consulted for emergent angiography and potential intervention.

RESULTS. Digital subtraction angiography (DSA) was performed in the common hepatic artery using a Progreat microcatheter (Terumo). This revealed active extravasation from a distal branch of the cystic artery with filling defects noted in the abdominal cavity, suspected to be gallstones. No hypervascular tumor or hepatoma was seen. The distal branch was selected and embolized using Gelfoam (Pfizer) followed by two Nester coils (Cook Medical). DSA revealed continued extravasation, and a third Nester coil was deployed followed by additional Gelfoam. Final DSA showed complete stasis of the cystic artery. After the procedure, the patient continued to have metabolic derangements and shock requiring pressors. His family transitioned him to a do-not-resuscitate order, and he passed away that night.

CONCLUSIONS. Spontaneous hemoperitoneum is nontraumatic hemorrhage into the peritoneal cavity, with the most common sources being gynecologic, hepatic, splenic, and vascular. Massive hemobilia and hemoperitoneum from a normal cystic artery is a rare entity with few reports in the literature. Our case demonstrates that although not without risk, the cystic artery can be embolized if identified as the source of bleeding. Further studies are needed to help determine rates of gallbladder necrosis in patients who do not undergo cholecystectomy after celiac artery embolization.

ISET 2022-10

Variations in Case Mix Among Private and Academic Interventional Radiology Practices*L.K. Oladini, M. Rezaee, A. Ganesh, S. Dybul, R. Hofmann*

PURPOSE. National benchmarking data on percentage case mix between academic and private interventional radiology (IR) practices help better anticipate needs for practice building in different practice environments.

MATERIALS AND METHODS. A 60-question descriptive survey was distributed to 3159 self-identified interventional radiologists listed on the Society of Interventional Radiologists doctor finder, with 194 responses (6.1% response rate). A total of 181 unique practices were represented across 33 US states, with 176 (66 academic and 110 private practices) providing information on case mix.

RESULTS. Between academic and private practices, there was significant variation in reported case mix. The average estimated contribution of peripheral artery disease (PAD) to the procedure mix was significantly greater among private practices (7%) than among academic practices (3%) ($P=.006$; $n = 176$), with a similar difference for musculoskeletal intervention (6% vs 3% among private and academic practices respectively; $n = 174$; $P<.001$). Dialysis circuit evaluation comprised a larger percentage of private IR practices than academic IR practices (10% vs 6%; $n = 175$; $P<.001$). Meanwhile, the opposite was true for interventional oncology work in private compared with academic practices (10% vs 22% for private and academic practices, respectively; $n = 174$; $P<.001$).

CONCLUSIONS. PAD intervention, along with musculoskeletal and dialysis circuit intervention, made up significantly more private practice IR case mix than academic IR case mix. There may be opportunities for practice building in both academic and private practices where practice composition significantly differs from the average, if local politics and infrastructure allow. Furthermore, increased training exposure to PAD, musculoskeletal, and dialysis interventions could benefit future IR physicians interested in pursuing private practice.

ISET 2022-11

Pseudoaneurysm of a Left Lower Lobe Segmental Pulmonary Artery Branch Following Two Metachronous Septic Events*A-R.F Fadi, I.M. Ibrahim, M. Baghal*

PURPOSE. Mycotic pulmonary artery pseudoaneurysms (PAPs) form in the context of sepsis, septic pulmonary embolization (SPE), or adjacent pneumonia. SPE can be classified depending on the embolic source as cardiac (caused by infective endocarditis) or noncardiac (caused by sepsis). Noncardiac SPE-induced PAP is extremely rare; only few cases have been reported. We report a case of ruptured noncardiac SPE-induced PAP after 2 contributing metachronous septic events.

MATERIALS AND METHODS. A 79-year-old man presented with urosepsis after a traumatic urethral catheter insertion at a nursing home. The patient's sepsis was managed appropriately, and blood and urine cultures yielded *Klebsiella pneumoniae* pathogen. Three days later, the patient developed hemoptysis and respiratory failure and was intubated. Bronchoscopy revealed blood-tinged mucus plugs, which were removed by suction and cryotherapy. Computed tomography angiography revealed findings consistent with active bleeding. Pulmonary angiography revealed a large pseudoaneurysm (PSA) arising from a left lower lobe segmental pulmonary artery branch, which was successfully embolized. History dated back to 2 months earlier, when the patient had *Staphylococcus aureus* sepsis that was followed by septic pulmonary emboli, one of which was a very prominent left lower lobe embolism. The site of this embolism matches exactly the site of the PSA at the current presentation.

RESULTS. An infected aneurysm, by definition, includes primary infection of an artery and infection of a preexisting aneurysm. In other words, a preexisting aneurysm may become infected through hematogenous seeding. In our case, the 2 components of this definition existed in a metachronous fashion because there were 2 septic events preceding rupture. The first event formed the PAP, and the second triggered its rupture by seeding it. To our knowledge, this case is the first of its kind to describe PAP rupture after 2 contributing metachronous septic events.

CONCLUSIONS. Hemoptysis after PAP rupture is seriously life threatening because it carries a 50% risk of death. Therefore, even though mycotic PAP is extremely rare in patients without infective endocarditis, PAP must be ruled out for a patient having postsepsis hemoptysis without any preceding respiratory issues, even when no clinical or imaging findings suggestive of infective endocarditis are present.

ISET 2022-12

Large Saccular Renal Artery Aneurysm Reduced With Stent-Assisted Coil Embolization: A Case Report*T. Mourad, T. Brady*

PURPOSE. Renal artery aneurysms (RAAs) are rare, with an incidence of about 1%, and are associated with significant morbidity and mortality. RAAs, like other aneurysms, are caused by weakening of the vessel wall, which may lead to life-threatening rupture. RAAs have traditionally been treated surgically, although endovascular therapy may be offered in a subset of patients meeting anatomic criteria. Here, we report a case of a saccular wide-necked RAA successfully treated with stent-assisted coil embolization. Follow-up imaging 7 and 18 months after treatment showed complete thrombosis of the aneurysm.

MATERIALS AND METHODS. A 66-year-old man on warfarin therapy for a mechanical aortic valve was found to have a 2.2-cm right renal artery aneurysm on a computed tomography (CT) of the abdomen and pelvis study performed for gross hematuria. The aneurysm arose from the distal right main renal artery at the hilum and extended beyond the bifurcation into the anterior and posterior divisions. The aneurysm was thought to be amenable to transcatheter coiling, either with or without a retaining stent. Alternatives included referring the patient to our vascular center for open bench repair and reimplantation. However, the latter option was not recommended for a distal artery aneurysm measuring 2 cm or greater.

RESULTS. Selective angiography of the right renal artery, including cone-beam CT angiography, confirmed a large bilobed saccular aneurysm. Endovascular treatment required placement of 2 vascular stents (4.5-mm × 30-mm Neuroform Atlas [Stryker] and 4-mm × 39-mm Enterprise [Codman Neuro]) across the wide neck of the aneurysm. Using a microcatheter placed in between the interstices of the stents, multiple Penumbra coils were deployed until the sac was completely packed. Completion angiography demonstrated successful embolization of the aneurysm without residual flow into the sac. Additionally, the self-expanding stents across the neck of the aneurysm were widely patent with no evidence of thrombosis or dissection. All segmental and peripheral arteries of the right renal artery were patent with normal parenchymal perfusion. Follow-up CT of the abdomen and pelvis 7 and 18 months after treatment showed complete thrombosis of the aneurysm, adequate perfusion, and no evidence of infarction.

CONCLUSIONS. Stent-assisted coil embolization is a promising and feasible alternative method for treating large RAAs and should be offered to patients meeting the appropriate criteria.

ISCT 2022-13

Klein Infiltration Pump for Irrigation During Percutaneous Biliary Endoscopy Using SpyGlass Discover Digital Catheter

T. Garg, J. Shaikh, M. Payne, I. Latich, D.R. Elwood, N. Nezami

PURPOSE. Direct visualization and management of complex biliary pathologies by percutaneous endoscopy is becoming more common in current interventional radiology practice because of its minimally invasive nature. However, intraprocedural visualization during cholecystoscopy is critically limited in part because of the current technique of manual irrigation during endoscopy.

MATERIALS AND METHODS. In this retrospective bi-institutional study (N = 36), we examined the safety, feasibility, and efficacy of using an infiltration pump during percutaneous endoscopy using the SpyGlass Discover digital catheter (Boston Scientific) compared with the use of manual irrigation using the LithoVue single-use digital catheter (Boston Scientific).

RESULTS. The technical success was 100% in both groups, but the clinical success was 76.48% in the manual irrigation group compared with 100% in the pump irrigation group. The intraprocedural time and total number of procedures needed were also lower in the pump irrigation group. No minor or major complications were observed in either group.

CONCLUSIONS. The Klein high-volume infiltration pump (Medline) for intermittent saline irrigation is effective, feasible, and safe with our study, demonstrating increased clinical success and procedural efficacy with similar safety profile compared with the manual irrigation group.

ISCT 2022-14

Evaluation of Research Contributions to Vascular Group of Cochrane Systematic Reviews: 13-Year Analysis From 1998 to 2021

T. Garg, A. Som, J. Huang, M.S. Makary

PURPOSE. Cochrane systematic reviews are widely considered to be among the highest level of evidence available, with their conclusions often impacting medical policy and practice. Some countries are reported to have a disproportionately higher representation in their authorship, but it is unclear which regions have contributed the most. This study aims to evaluate authorship patterns in the vascular group of Cochrane systematic reviews.

MATERIALS AND METHODS. Metadata from the Cochrane Database for Systematic Reviews published under the Cochrane Vascular Group from October 1998 to October 2021 were extracted and analyzed. Both active reviews and withdrawn reviews were evaluated in the analysis. The data collected included year of publication as well as the country of origin of all coauthors and the corresponding author.

RESULTS. A total of 181 eligible reviews were found, authored by a total of 749 authors. Coauthors disproportionately belonged to the United Kingdom (43.5%) followed by the Netherlands (8.9%), Brazil and China (7% each), Canada (5.2%), Italy (4.1%), and the rest. Lead authors belonged to United Kingdom (50.8%) followed by Brazil (7.7%), the Netherlands (7.1%), China (5%), and Italy (4.4%). Countries or regions that otherwise contribute actively to the vascular literature but otherwise had little to no representation included all of Africa, Pakistan, Russia, Mexico, and France. Authors from the United States had a very small contribution to the vascular group (2.6%) of Cochrane reviews compared with other groups such as urology (30.5%).

CONCLUSIONS. Researchers from the United Kingdom are the biggest contributors to the highest quality evidence in vascular disease (approximately 6 times more than the next highest contributing region), consistent with citation analysis of the vascular literature. Capacity-building efforts are needed in other countries for improving global vascular specialist involvement with Cochrane systematic reviews and presenting widely representative data.

ISET 2022-15

6-Month Results From the PATHFINDER Registry Evaluating the Safety and Efficacy of the Auryon Laser*J. Rundback*

PURPOSE. The purpose is to report the safety and efficacy of the Auryon Laser Atherectomy System (AngioDynamics) in a postmarket study treating infrainguinal lesions and occlusions.

MATERIALS AND METHODS. In 104 patients (62.5% male; age 68.4 years \pm 10.21 years; 53.8% with diabetes; 8.7% with chronic kidney disease; 46.1% with critical limb ischemia), 109 lesions were analyzed by an angiographic core lab. The average length was 13.54 cm (0.51–52.00 cm). There were 22.0% in-stent restenosis, 45.0% chronic total occlusions (CTOs), 43.1% tibial lesions, and 37.6% moderate to severely calcified. Outcomes were reported up until 6 months after the procedure.

RESULTS. All the lesions were crossed. The stenosis percentages were 87.2% \pm 16.47%, 60.7% \pm 21.12%, and 24.2% \pm 15.43% at baseline, post laser, and post procedure, respectively. There were no procedural perforations, amputations, or deaths. Five (4.1%) bail-out stentings were required after adjunctive therapy (not laser related), and 2 (1.7%) distal embolization events occurred and resolved intraprocedurally without complications. At 30 days (n = 103), 1 (1.0%) amputation, 1 (1.0%) clinically driven target lesion revascularization (CD-TLR), and 1 (1.0%) target vessel revascularizations (TVRs) were reported without relation to Auryon. At 6 months (n = 89), the freedom from major adverse events was 94.4%, with 3 (3.4%) CD-TLRs, 1 (1.1%) amputation, and 1 (1.1%) TVR reported. Rutherford, ankle-brachial index, and WIQ improved at 6 months (n = 69, 48, and 67, respectively) compared with baseline (3.69 \pm 0.92 vs 1.68 \pm 1.57; 0.73 \pm 0.28 vs 0.86 \pm 0.22; and 22.32 \pm 22.50 vs 43.82 \pm 27.99, respectively).

CONCLUSIONS. Initial postmarket data on real-world cases with Auryon in a variety of complex infrainguinal lesions demonstrate excellent safety and outcomes. Low CD-TLR rates with improved clinical presentation were consistent with prior data and stable out to 6 months.

ISET 2022-16

Hemorrhoids and Rectal Artery Embolization for Acute Gastrointestinal Bleeding With Negative Imaging*D.T. Kim, M.U. Shahid, A.B. Siegel, M. Jagust, J. Cynamon*

PURPOSE. The etiology of acute lower gastrointestinal bleeding (GIB) is often not evident on computed tomography angiography (CTA) because of its intermittent nature. Embolization of the rectal artery (emborrhoid procedure) should be considered in patients with negative CTA results for acute lower GIB in patients with clinical or imaging evidence of hemorrhoids.

MATERIALS AND METHODS. A 65-year-old woman presented with multiple episodes of bright red blood per rectum with hemodynamic instability requiring transfusions. The emergency department ordered CTA, which demonstrated no evidence of active bleeding. However, enlarged or tortuous rectal vessels were noted, compatible with hemorrhoids. Interventional radiology was consulted. Given a history, physical examination, and CT findings consistent with hemorrhoids and significant blood loss, the decision was made to proceed with catheter angiography and rectal artery embolization.

RESULTS. Via the right common femoral artery access, the inferior mesenteric artery was selected with a 5 Fr SOS Omni 2 catheter (AngioDynamics). No active extravasation was noted. Branches of the superior rectal arteries (SRAs) were selected using a 2.7 Fr Progreat (Terumo) microcatheter, which demonstrated rectal hyperemia without extravasation. The SRAs were embolized with multiple 3–2 mm Tornado microcoils (Cook Medical). Repeat angiograms demonstrated decreased vascularity of the rectal tissues. Angiography of the bilateral internal iliac arteries demonstrated normal middle and inferior rectal vasculature. The patient had no further episodes of GIB and was discharged 2 days later. At 6-month follow-up, the patient remained asymptomatic without recurrent lower GIB.

CONCLUSIONS. In the setting of hemorrhoidal disease and acute lower GIB with negative imaging results, empiric rectal artery embolization should be considered as a feasible and safe intervention.

ISET 2022-17

Endovascularly Implantable Cerebrospinal Fluid Shunt: Can We Simplify Communicating Hydrocephalus Treatment?*D. Agrawal, T. Garg, I. Mandal*

PURPOSE. To do an educational review of the eShunt system (CereVase) and the novel ETCHES I Study (Endovascular Treatment of Communicating Hydrocephalus With an Endovascular Shunt).

MATERIALS AND METHODS. The first in-human trial on endovascular treatment of communicating hydrocephalus is underway. The ETCHES I is a single-center prospective pilot study. The first successful percutaneous implantation of the eShunt system using a catheter-based endovascular approach was recently described. We review the approach, benefits, and outlook of this novel system.

RESULTS. Why do we need a shift from conventional ventriculoperitoneal shunt (VPS) systems? VPS surgery is presently the most common approach for the treatment of communicating hydrocephalus. However, postoperative complications are common, with a high rate of central nervous system infections and VPS revisions: 21.3 complications per 100 patients per year in the first year after VPS surgery. This summons an innovation in the currently accepted approach for treatment of patients with communicating hydrocephalus. The ETCHES I study has been designed to study the outcomes and potential reduction in complications from VPS surgery. The eShunt system being used is percutaneously deployed in the cerebellopontine angle cistern under fluoroscopy guidance and works by mimicking the function of arachnoid granulations in allowing the drainage of cerebrovascular fluid from the arachnoid space to the venous system. Results from the first in-human experience have been recently published and demonstrate reduction in intracranial pressure levels after the endovascular treatment. This positive outcome could signal a revolution in the treatment of patients with communicating hydrocephalus.

CONCLUSIONS. Percutaneous endovascular treatment could reduce the need for invasive surgery and rates of postoperative complications. Outcomes from the first described case have been positive; however, we look forward to complete dataset from the ETCHES I trial.

ISET 2022-18

Sirolimus as Salvage Therapy for Recurrent Fibroadipose Vascular Anomaly*R. T. Le, A. Majumdar, C. Johnson*

PURPOSE. Fibroadipose vascular anomaly (FAVA) is a recently described complex vascular malformation associated with PIK-3CA mutation, commonly affecting the extremities, and resulting in debilitating pain and reduced mobility in otherwise healthy children. Management is focused on alleviating patients' symptoms. Surgery is the only established potentially curative option but is generally a last resort to spare patients from morbidity or limb loss, especially if effective interventional procedures (sclerotherapy, cryoablation) have not been attempted. Systemic medical management has been considered for cases refractory to localized treatment, which includes the off-label use of sirolimus, an mTOR (mammalian target of rapamycin) inhibitor typically used for oncologic tumors, lymphatic malformations, and renal transplant rejection prevention. We report 2 cases of recurrent FAVA in which treatment with sirolimus resulted in dramatic reductions of pain and improved quality of life.

MATERIALS AND METHODS. Patient A initially presented with right gluteal pain secondary to a mass with classic imaging characteristics of FAVA. Management with sclerotherapy was complicated with sclerosant extravasation, resulting in soft-tissue ulceration and necrosis, and requiring multiple surgical debridements. Sclerotherapy provided symptom relief for 4 years. However, when the FAVA lesion recurred in the same location, the patient opted for sirolimus given previous sclerotherapy complications. Patient B presented with difficulties walking secondary to a right leg mass, with classic imaging characteristics compatible with FAVA. She was treated with sclerotherapy, which resulted in persistent pain and paradoxical increase in lesion size. The patient was subsequently started on sirolimus, which she took for more than 2 years.

RESULTS. Both patients tolerated medical therapy, noting a reduction in the tumor burden and pain, allowing them to maintain their quality of life. Patient A did not report any adverse reactions to sirolimus. Patient B experienced mucositis 1 month after treatment initiation, which self-resolved with supportive care.

CONCLUSIONS. Sirolimus can be effective in ameliorating pain for recurrent FAVA lesions that were not amenable to definitive initial interventions.

ISET 2022-19

Angioembolization of a Ruptured Dorsal Penile Artery Pseudoaneurysm Following Perineal Ballistic Injury: A Case Report

M. Uhouse, B. Taber, S. Kantharia, T. Arusoo, M. Whalen, S. Sarin, D. Scher

PURPOSE. Pseudoaneurysm (PSA) involves disruption of an arterial wall, causing an outpouching or sac that communicates with the vessel lumen, and is often seen in the setting of trauma. Early recognition is key because PSA rupture is associated with high morbidity and mortality rates. Historically, surgical repair was required, but with the rise of image-guided endovascular interventions, angioembolization has become a recognized and established treatment for symptomatic PSAs, particularly when the donor artery is accessible and expendable. Risks of nontarget embolization can be mitigated with selective embolization of the distal artery.

MATERIALS AND METHODS. A 19-year-old man with recent history of a single gunshot wound to the right perineum seen at an outside hospital presented 3 weeks later with acute onset of urethral bleeding and severe anemia. Computed tomography angiography showed a 14-cm perineal hematoma with intramuscular extension, as well as a 2.2-cm PSA with surrounding hematoma near the left penile shaft. Given the severe anemia and active bleeding, he was taken to interventional radiology (IR) for angiogram and selective angioembolization of a suspected ruptured PSA.

RESULTS. IR performed a selective angiography of the left internal iliac artery, which demonstrated a large PSA of the dorsal penile artery. Selective angiography of the terminal branch of the left dorsal penile artery confirmed active extravasation of a bleeding PSA. Coil embolization was performed with 2-mm coils without further filling of the PSA on subsequent ipsi- and contralateral internal iliac angiograms. After stabilization, cystoscopy, suprapubic catheter exchange, and surgical evacuation of the large ischioanal fossa hematoma were performed. The patient was discharged home with outpatient follow-up.

CONCLUSIONS. If an asymptomatic PSA is detected, elective therapy is beneficial because untreated PSAs carry a high risk of rupture with associated increases in morbidity and mortality. This case demonstrates an example of successful selective angioembolization of a symptomatic PSA of the dorsal penile artery. By avoiding nonspecific embolization of the internal iliac arteries, the risks of long-term erectile dysfunction or buttock claudication are reduced.

ISET 2022-20

Single Pedal Access for Treatment of Ipsilateral Superficial Femoral Artery and Anterior Tibial Artery

N.E. Santana Sr., M.V. Troncoso

PURPOSE. Peripheral artery disease is a common condition that affects about 200 million people in the world. Treatment options include balloon angioplasty, bare-metal stents, drug-eluting stents, atherectomy, and distal tibial bypass surgery. Single retrograde access in the posterior tibial artery allows for precise deployment of self-expanding stents at the origin of the superficial femoral artery (SFA) when there are ostial lesions; however, it is challenging when it is necessary to also treat the ipsilateral anterior tibial artery. We present a successful case of angioplasty of the SFA and anterior tibial artery through a single access in the posterior tibial artery.

MATERIALS AND METHODS. A 60-year-old woman with a history of hypertension and smoking for more than 15 years complained of rest pain in the left lower limb. Physical examination showed an absence of anterior and posterior tibial artery pulses of the left lower limb. Computed tomography angiography revealed ostial occlusion of the SFA and stenosis of 90% of the anterior tibial artery. After the patient signed informed consent, she was taken to the catheterization laboratory. Ultrasound guidance access of the left posterior tibial artery was performed with a micropuncture kit (Cook Medical). A 6 Fr sheath was placed. Command 0.018-inch wire (Abbott Vascular) and Sergeant 0.018-inch catheter (iVascular) were used to cross the lesion in the SFA. Oceanus Balloon Pro 3 mm × 200 and 5 mm × 150 mm (iVascular) were used for vessel preparation. Then a 5-mm × 150-mm Supera stent (Abbott Vascular) and 5-mm × 200-mm iVolution stent (iVascular) were deployed proximal and distal, respectively, in the SFA. A hydrophilic vertebral catheter and Asion blue wire 0.014 × 300 cm (Asahi) were used to cross the anterior tibial artery lesion, and plane balloon angioplasty was performed.

RESULTS. Final arteriography showed satisfactory results with adequate blood flow. The patient left the catheterization laboratory with an anterior tibial artery palpable pulse.

CONCLUSIONS. Single retrograde access in posterior tibial artery allows precise deployment of a self-expanding stent in the ostium of the SFA and ipsilateral anterior tibial artery angioplasty in the same intervention, decreasing surgical time and use of contrast.

ISET 2022-21

Effect of Student-Run National Organizations*C. Tenewitz, S. Gutti, E. Barnard, A. Farag, S. Bittle, G. Vatakencherry*

PURPOSE. Medicine is a rapidly evolving field that requires an outlet to distribute newly discovered scientific findings. National medical organizations have become a prominent component in the dissemination of medical knowledge to medical professionals, medical trainees, and patients. Many of these organizations are solely run by residents and physicians with minimal medical student involvement. The purpose of this study is to demonstrate how to incorporate medical students in national organizations and provide evidence of this method's effectiveness.

MATERIALS AND METHODS. The Society of Interventional Radiology (SIR) Residents, Fellows, and Students (RFS) has an established Medical Student Council (MSC). This medical student group is made up of 9 subcommittees, which are Biodesign & Innovation, Education, IR Interest Group, Patient & Family-Centered Care, PR & Communications, Research, Diversity & Inclusion, Web & Technology, and Women in IR. These committees set up webinars, create infographics, and develop podcasts and videos specifically tailored to their committees' objectives with the intent to increase awareness of IR in the medical field and provide helpful information about IR. The data were exported from the SIR RFS Twitter account.

RESULTS. From 2019 to 2020, there was a notable increase in the total number of tweets published (115%), impressions (237%), engagement (388%), retweets (149%), replies (252%), likes (182%), and user profile clicks (270%). There was an even further increase in all these statistics in 2021, including tweets published (441%), impressions (596%), engagement (525%), retweets (241%), replies (796%), likes (261%), and user profile clicks (433%).

CONCLUSIONS. The SIR MSC and the methods to incorporate medical students in the organization have proven to be highly effective in increasing awareness of IR. As the number of medical organizations increases and the medical field continues to evolve, it will be profoundly beneficial for these organizations to implement a similar system to SIR MSC. This in turn will create a more well-informed medical community, ultimately providing better patient care.

ISET 2022-22

Office-Based Peripheral Artery Disease Evaluation and Supervised Exercise Therapy Covered by Medicare (Michigan/Ohio Model)*R.R. Ross*

PURPOSE. Supervised exercise therapy (SET) for symptomatic peripheral arterial disease (PAD) is now a Medicare-covered benefit.

MATERIALS AND METHODS. Key points in the 2014 clinical evidence update included (1) management of intermittent claudication (IC) exercise program; (2) supervised exercise is associated with increases in maximal walking distance compared with home-based or other unsupervised exercise programs; (3) supervised exercise is associated with greater increases in walking distance in people with aortoiliac disease than either stenting or optimum medical care; and (4) supervised exercise appears to be more cost effective than either angioplasty alone or supervised exercise plus angioplasty in people with IC caused by femoropopliteal occlusion.

RESULTS. The Centers for Medicare & Medicaid Services has determined that the evidence is sufficient to cover SET for beneficiaries with IC for the treatment of symptomatic PAD. Up to 36 sessions over a 12-week period are covered if all of the following components of a SET program are met: the SET program must be (1) conducted in a hospital outpatient setting or a physician's office, and (2) under the direct supervision of a physician (as defined in 1861(r)(1)), physician assistant, or nurse practitioner or clinical nurse specialist (as identified in 1861(aa)(5)), who must be trained in both basic and advanced life support techniques.

CONCLUSIONS. PAD affects 12% to 20% of Americans aged 60 and older, and the incidence of PAD increases considerably with age. SET has been demonstrated to be an effective therapy to lessen the symptoms of claudication and improve walking distance in patients with PAD in numerous trials. Stakeholders such as the American Heart Association have long recommended SET as a first-line, noninvasive, low-risk therapy for individuals with PAD with claudication. Despite the disease burden and the substantial evidence supporting SET as a safe and effective treatment for PAD, it is currently covered by Medicare.

ISET 2022-23

Biodegradable Materials Available for Transarterial Embolization*T. Garg, A. Khalil, P. Gowda, A.J. Gong, R. Weinstein, C.R. Weiss*

PURPOSE. To review all available novel biodegradable occlusion technologies for vascular embolization and compare their properties and preclinical data to provide a reference for interventional radiologists interested in this field.

MATERIALS AND METHODS. Over the past decade, there has been increased interest in the development of biodegradable embolic agents for transarterial embolization (TAE) procedures. The goal of degradable embolic agents is to provide effective embolization on a transient basis. These embolic agents are removed from the body after achieving the intended clinical outcome without interfering with the function of other organs. Removing these agents will potentially minimize long-term sequelae of permanent embolic agents such as alternations in histologic architecture, vascular capacitance, and injury to tissue caused by “on-” or “off-” target deposition.

RESULTS. An ideal biodegradable embolic should have tailored degradation time frames, have a variety of tightly calibrated particle size distributions, easily be suspended in physiological solutions, have easy delivery through traditional microcatheters, have full biological compatibility, and have multimodal imageability. The degradation of microspheres can occur because of enzymatic reactions or hydrolysis. When new biomaterials are developed, their preclinical safety and efficacy are evaluated in accordance with the Vascular and Neurovascular Embolization Devices guidance document published by the Food and Drug Administration. In development and currently available degradable occlusion agents are gelatin (Gelfoam), starch (Embocept), polylactic-co-glycolic acid (PLGA, Occlusin 500), cellulose-chitosan (Resosphere), hydroxyethyl acrylate (HEA, Biosphere Medical), polycarbonate, and poly-methyl acrylate (Occlugel). In this exhibit, we discuss their basic chemistry, and mechanism of degradation. We also discuss data on safety, efficacy, and performance as well as the advantages and disadvantages of each agent.

CONCLUSIONS. The materials available for embolization have evolved rapidly in the past few decades from autologous blood clots and muscle tissues to microspheres and gels made up of complex polymers that can be modified for a wide array of functions. The clinical application and development of new agents will continue to expand as the field of endovascular intervention grows.

ISET 2022-24

Percutaneous Embolization of a Portal Venous Pseudoaneurysm*M. Shahid, A. Siegel, D. Kim, M. Jagust, J. Cynamon*

PURPOSE. Portal vein (PV) pseudoaneurysms (PSAs) eroding into the duodenum are rare. Endoscopic, surgical, and endovascular management may be extremely difficult. Here we describe a case in which a percutaneous approach was used to help control the persistent upper gastrointestinal bleed (GIB).

MATERIALS AND METHODS. A 65-year-old man admitted for GIB was found to have a bleeding duodenal ulcer. Endoscopic clipping failed to control the bleed. An angiogram demonstrated a chronic common hepatic artery occlusion and no evidence of bleeding from the superior mesenteric artery or collaterals. Repeat computed tomography (CT) suggested a duodenal ulcer with erosion into the PV. Exploratory laparotomy with ligation of the PV at the liver hilum and a Gore-Tex conduit from the superior mesenteric vein (SMV) to an intrahepatic PV was performed. Because of persistent melena with anemia, a repeat CT angiogram was performed. A PSA at the junction of the splenic vein (SV) and SMV, the site of the ligated PV, was identified. Interventional radiology was consulted for management of this PV PSA.

RESULTS. Selective catheterization of the splenic artery with delayed imaging to visualize the portal venous system was performed. The SV, inferior mesenteric vein (IMV), and SMV with flow noted through the Gore-Tex conduit were identified. The PSA was noted at the confluence of the SV and the SMV. Transsplenic access into the portal system was ruled out because the spleen was atrophic. After a review of the CT, it was decided to attempt direct percutaneous access of the PSA. Under fluoroscopy, a 21-gauge Chiba needle (Cook Medical) entered the SMV (not the PSA). A V18 wire was advanced into the SV, and a 2.6 Fr CXI catheter (Cook Medical) was placed into the SMV. The PSA was identified and cannulated, and an Azure 8-mm × 26-cm coil (Terumo) was used to embolize. However, the coil herniated out of the PSA and lodged at the confluence of the SV and the SMV. An attempt at a direct percutaneous puncture of the PSA using the previously placed coil as a fiducial was made. The Chiba needle entered the SV near the coil. Angiography via this needle confirmed no flow to the PSA and redirected flow to the IMV and the Gore-Tex conduit. The duodenal bleeding abated immediately after this procedure.

CONCLUSIONS. Percutaneous embolization of unusual PSAs due to complex or postsurgical vascular anatomy should be considered in conjunction with, or instead of, an endovascular approach.

ISET 2022-25

Percutaneous Management of a Pancreatitis-Related Pseudoaneurysm*A. Siegel, M.U. Shahid, D. Kim, M. Jagust, J. Cynamon*

PURPOSE. Pancreatitis-related pseudoaneurysms (PSAs) occasionally arise off vessels, which may be difficult to access, leading to prolonged angiography and procedural failure. In these cases, early direct percutaneous access into the PSA should be considered.

MATERIALS AND METHODS. A 59-year-old man with a history of hyperlipidemia presented to the emergency department for syncope and reported 10 days of melena. Laboratory work revealed profound anemia, with hemoglobin of 3.5 g/dL. Computed tomography (CT) angiography revealed acute hemorrhagic pancreatitis with peripancreatic collection and a 1-cm PSA at the level of the pancreatic head. Interventional radiology was consulted for further management.

RESULTS. Via the right common femoral artery, celiac artery, superior mesenteric artery, and right renal artery, angiograms were obtained that revealed no evidence of PSA or hemorrhage. An aortogram was obtained, which did demonstrate the PSA, likely arising from a small branch directly off the abdominal aorta, possibly the right middle adrenal artery. Because of the caliber, tortuosity, and location of the feeding vessel to the PSA and anticipated difficulty of endovascular access, the decision was made to percutaneously access the PSA for purposes of embolization. A review of the CT scan revealed a small calcification near the PSA. This was used as a fiducial for the advancement of a 21-gauge Chiba needle (Cook Medical). After placement of the Chiba needle within the PSA was confirmed with contrast injection, the PSA was embolized with 0.8 mL of Onyx-18 (Medtronic). Cone-beam CT demonstrated the Onyx within the location of the hemorrhagic collection and PSA. The patient tolerated the procedure well and was discharged after 48 hours.

CONCLUSIONS. Early consideration of percutaneous embolization of a visceral artery PSA may be suitable instead of, or in conjunction with, an endovascular approach when there is complex vascular anatomy or difficult endovascular access. This approach should be considered early to avoid excessive radiation exposure to the patient and operator.

ISET 2022-26

Aortic Type B Dissection: How to Promote False Lumen Thrombosis*R.A. Dammrau*

PURPOSE. The surgical treatment of aortic type B dissection is primarily endovascular with thoracic endovascular aortic repair (TEVAR). The aim is to close the proximal entry tear to ensure organ perfusion and prevent aneurysm formation. For the prognosis and further aortic remodeling, the thrombosis of the false lumen is important. Because of the often-multiple entries and reentries, there are different techniques to occlude the false lumen or close endoleaks.

MATERIALS AND METHODS. In case of proximal endoleaks or retrograde flow via the left subclavian artery (LSA), we treat with covered stents in the LSA; with vascular plugs, small endoleaks can be treated with coils. For occlusion of retrograde flow from the distal to the false lumen, there are special so-called candy plugs; we even use normal vascular plugs and volume coils. Treating the thoracoabdominal segment with uncovered nitinol stents may even promote false lumen thrombosis; in some cases, we need additional means.

RESULTS. If we treat type B dissection with TEVAR, we see complete false lumen thrombosis only in selected cases. In most cases, we have to extend TEVAR, and retrograde flow from distal is controlled with plugs and volume coils. Extension of the true lumen with uncovered nitinol stents can reduce false lumen perfusion; some branches need covered stents. Even infrarenal endovascular treatment or branched or fenestrated grafts in the thoracoabdominal segment are sometimes necessary. Endoleaks are sometimes only accessible with direct computed tomography-guided puncture.

CONCLUSIONS. Endovascular therapy is the first choice in aortic type B dissection. In uncomplicated type B dissections with risk constellation, one should be liberal with indication for TEVAR. A perfused false lumen needs close follow-up. The aim of our therapy is to exclude the false lumen from perfusion to avoid late complications. Beside coils, plugs, and occluders, we have dedicated techniques for false lumen occlusion. In chronic dissections, it is often necessary to perform endovascular therapy as a staged procedure with individual concepts even in combination with open and hybrid procedures. However, open surgery still has its place in patients with connective tissue disease.

ISET 2022-27

A New Scoring System for Angiographic Assessment of Embolotherapy Outcome of Peripheral Arteriovenous Malformations*A. Khalil, T. Garg, T. Mehta, A. Gong, P. Gowda, R. Weinstein, B. Holly, C.R. Weiss*

PURPOSE. Studies evaluated angiographic response after arteriovenous malformation (AVM) embolization based on the degree of devascularization in which the percentage of responses did not consistently correlate with clinical outcome, and the overall therapeutic outcome was more dependent on clinical outcome assessment than angiographic response. Additionally, AVMs show variable degrees of AV shunting. We propose a new scoring system to predict therapeutic outcomes based both on degree of nidus and shunt resolution.

MATERIALS AND METHODS. We retrospectively reviewed the baseline and final angiograms of 17 patients (2012–2021) for changes in nidus occlusion and shunt changes, which were scored by 2 independent reviewers using a 7-point scale for each of the nidus and shunt. Final categorization of therapeutic response was based on cumulative scores of both components. Patient-reported average pain before and after embolization was scored on a 0 to 10 scale (with 10 representing maximum improvement). Patients also categorized their pain as improved, no change, or worse. Interobserver reliability was calculated using Cohen's kappa coefficient. For measures of effect, Pearson correlation coefficient (R2) and Kruskal-Wallis rank-sum test were used.

RESULTS. R2 values between nidus and shunt were significant for both reviewers (0.93, 0.86; $P < .001$). Kappa values for nidus, shunt, and final numeric scores were 0.66, 0.41, and 0.40, respectively ($P < .01$). Interobserver reliability for categorical final score was 84% ($P = .0002$). There was moderate correlation between nidus, shunt, final scores, and pain scores (R2 values: 0.50, 0.54, and 0.52, respectively; $P = .10, .07, \text{ and } .08$, respectively; $n = 12$). Kruskal-Wallis values between average nidus, shunt, final scores, and categorical pain scores were 1.29, 1.21, and 1.43, respectively ($P = .53, 0.54, \text{ and } 0.49$; $n = 14$).

CONCLUSIONS. Our proposed scoring system implements a more meticulous assessment of AVM structural details, including changes in both nidus and shunt. Although a limited cohort, correlation between average AVM scores and pain scores was moderate and trended toward significance. Further testing and correlation with clinical outcomes are necessary to validate this system.

ISET 2022-28

Target Lesion Revascularization in Patients With Infrapopliteal Long-Segment Lesions Treated With Overlapping Everolimus-Eluting Coronary Stents*J. Watchmaker, R. Lookstein*

PURPOSE. To evaluate clinical outcomes in patients with critical limb ischemia (CLI) and long-segment (>38 mm) infrapopliteal lesions treated with everolimus-eluting coronary stents (EESs) with prior failed angioplasty (percutaneous transluminal angioplasty [PTA]).

MATERIALS AND METHODS. We reviewed outcomes in patients with long-segment lesions treated with EESs after failed PTA between January 2009 and September 2018. The primary endpoints were a composite of freedom from death from any cause through 30 days and freedom from target limb major amputation and clinically driven target lesion revascularization (CD-TLR) through 12 months analyzed via the Kaplan-Meier method. Log-rank test was used to compare differences between Rutherford groups (Rutherford 4 and 5 compared with Rutherford 6).

RESULTS. Sixty-three patients (age $73.6 \text{ years} \pm 11.2 \text{ years}$; 4 female, 53 male), with 65 treated limbs met inclusion criteria. Thirty-seven Rutherford 4 or 5 limbs were included, and 28 Rutherford 6 limbs were included. Mean lesion length was $103.1 \pm 52.6 \text{ mm}$ (44.0–380 mm). The mean number of stents used was 2.8 (range, 2–10 stents) with a mean stent diameter of 3.4 mm (range, 2.5–4.0 mm). There were 11 deaths, 8 major amputations, and 7 CD-TLRs. Freedom from the composite endpoint was 70.6% for all patients. Patients with Rutherford 4 and 5 had an 84.6% freedom compared with those with Rutherford 6, with a 52.5% freedom from composite endpoint (hazard ratio, 4.0; 95% confidence interval, 1.5–10.6; $P = .0059$).

CONCLUSIONS. In patients with CLI, placement of multiple EESs in long-segment infrapopliteal lesions with prior failed PTA is a durable treatment option, with Rutherford 4 and 5 patients demonstrating markedly better outcomes as measured by freedom from death from any cause through 30 days and freedom from target limb amputation and CD-TLR through 12 months compared with Rutherford 6 patients.

ISCT 2022-29

Multicentre Study of Effectiveness of Manta VCD After Percutaneous Femoral Access for Endovascular Aortic Repair and Thoracic Endovascular Aortic Repair

E.L. Kalmykov, R.A. Dammrau

PURPOSE. To evaluate the safety and effectiveness of Manta vascular closure device (Teleflex) employment after percutaneous femoral access for endovascular aortic repair (EVAR) and thoracic endovascular aortic repair (TEVAR).

MATERIALS AND METHODS. This was a retrospective multicentre study. All 212 patients were treated between April 2017 and October 2021 for abdominal aortic aneurysms and thoracic aortic pathology. There were 33 women and 179 men; the mean age was 68 years \pm 6 years. In all patients, femoral access was used with 9 Fr to 14 Fr sheaths for graft implantation. The primary effectiveness endpoint was technical success, including freedom of acute bleeding and thromboembolic events. After intervention, groin elastic bandages were used in all cases for 24 hours.

RESULTS. Technical success of Manta closure device implantation was 100%. In 2 cases, groin hematoma was detected after 24 hours; no revisions were performed. Computed tomography angiography (CTA) after intervention confirmed no major vascular access site complications requiring surgical treatment. No thrombotic or embolic complications were detected in the first 30 days. After 6- to 12-month CTA, no local aneurysms were detected.

CONCLUSIONS. The Manta closure device is safe and effective for vascular access closure after percutaneous femoral access for aortic graft implantations.

ISCT 2022-30

Transjugular Intrahepatic Portosystemic Shunt in a Patient With Situs Inversus: Transcaval Portal Venous Access for Guidance

A. Zians, M.U. Shahid, J. Gans, M. B. Jagust, J. Cynamon

PURPOSE. Rare and complex variant anatomy complicates routine procedures. The infrequency with which certain anomalies are encountered emphasizes the importance of using alternative assistive techniques. Situs inversus is a rare condition in which the internal organs are a mirror image of the usual anatomy. Endovascular procedures, such as transjugular intrahepatic portosystemic shunt (TIPS), on such patients can be very challenging.

MATERIALS AND METHODS. An 18-year-old man with a medical history notable for situs inversus, biliary atresia status post hepatopertoenterostomy, and liver cirrhosis complicated by portal hypertension and esophageal varices presented with melena and near syncope. Interventional radiology was consulted for urgent TIPS because of refractory esophageal variceal bleeding.

RESULTS. Standard access was obtained in the right internal jugular vein, and a 10 Fr sheath was advanced into a posterior hepatic vein. A 16-gauge TIPS needle (Gore) was advanced into the hepatic vein via the sheath, and multiple anterior passes were made through the hepatic parenchyma without successful cannulation of the portal vein. In review of the cross-sectional anatomy, it was noted that the superior mesenteric vein (SMV) was positioned just anterior to the left-sided inferior vena cava (IVC). The right femoral vein was then accessed, and a 7 Fr stiffened TLAB sheath (Argon Medical Devices) was placed in the infrahepatic IVC. A long Chiba needle (Cook Medical) was passed through the sheath and directed toward the anterior wall of the IVC and into the SMV. A 0.018-inch guidewire was advanced into the portal vein to be used as a target for advancement of the TIPS needle. The relationship between the needle and guidewire was examined in multiple planes to determine the best trajectory. After this assistive maneuver, the TIPS needle was accurately advanced into the portal system. The endograft was deployed and proved to be patent, with venograms demonstrating good flow. No recurrent bleeding or evidence of encephalopathy occurred post procedure. The patient remains well at 6 months of follow-up.

CONCLUSIONS. Rare anatomic variants pose a challenge when performing procedures, and a strong understanding of the anatomy and the assistive techniques available can prove invaluable. In this case, a patient with situs inversus underwent a challenging yet successful TIPS placement through use of a transcaval to SMV fiducial guidewire approach.

ISET 2022-31

Catheter-Directed Thrombolysis in Prevention of Postthrombotic Syndrome After Deep Vein Thrombosis:**A Meta-Analysis***A. Behzadi, B. Amoozgar, M. Prince, H. Mojibian*

PURPOSE. We performed a meta-analysis assessing the benefits of additional catheter-directed thrombolysis (CDT) for the prevention of postthrombotic syndrome (PTS) compared with standard oral anticoagulation therapy in patients with lower extremity deep vein thrombosis (DVT).

MATERIALS AND METHODS. This meta-analysis was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). A search of databases was conducted by 2 researchers independently for clinical trials; Medline, Embase, and Cochrane Central were reviewed. Outcomes of interest included short-term (≤ 12 months) and long-term PTS (≤ 24 months), mortality rate, and bleeding. A random-effects model meta-analysis was performed. Heterogeneity was reported with the I² statistic; greater than 50% of I² was statistically significant.

RESULTS. A total of 315 articles were identified. After further screening the abstracts, 42 articles were then assessed in full for eligibility. Five articles finally met inclusion criteria. Our meta-analysis showed additional CDT does not significantly change the risk of long-term PTS (odds ratio [OR], 0.56; 95% confidence interval [CI], 0.27–1.2; $P=.44$; I², 81.7%). However, CDT was more likely to prevent decreased rates of short-term PTS (OR, 0.59; 95% CI, 0.43–0.81; $P=.001$; I², 81.7%). In addition, an analysis based on 3 articles showed CDT was associated with decreased rates of moderate-to-severe short-term PTS (OR, 0.68; 95% CI, 0.5–0.95; $P=.02$; I², 0.0%). Our meta-analysis showed that additional CDT does not significantly change the incidence of bleeding complications (OR, 1.06; 95% CI, 0.67–3.8; I², 10.0%). The overall death rate in the whole cohort was 1.5% (8 patients in the CDT group compared with 11 patients in the anticoagulation group). No difference was found between the 2 groups (OR, 0.83; 95% CI, 0.3–2.3; I², 86.0%).

CONCLUSIONS. Our meta-analysis showed that CDT does not change the long-term risk of postthrombotic syndrome. However, CDT decreases short-term, moderate-to-severe PTS rates compared with anticoagulation therapy alone when used for the treatment of DVT without incurring a detectable increase in bleeding complications. The decision to use CDT to prevent PTS should be individualized according to patient risk factors for developing PTS.

ISET 2022-32

Interventional Radiology International Outreach*E. Barnard, C. Tenewitz, S. Gutti, A. Farag, S. Bittle, G. Vatakencherry*

PURPOSE. Interventional radiology (IR) is a rapidly expanding field that is becoming an integral component of the US health care system and those of many other countries. As IR continues to have a global impact, it becomes significantly important for national organizations to provide information about this specialty to increase awareness of the field. The Society of Interventional Radiology (SIR) is an organization that has had a lasting impact on the field of IR through its expansion into social media platforms. The purpose of this study is to demonstrate the effect of SIR's Residents, Fellows, and Students (RFS) social media platform and its impact on international outreach.

MATERIALS AND METHODS. The SIR RFS and the SIR RFS Medical Student Council (MSC) have an established collaborative system to disseminate information to help increase IR awareness in the medical community. This collective effort distributes its information through numerous modalities, including SIR.web.org, panel-led webinars, and social media platforms. We exported and reviewed data from the SIR RFS Instagram account and the IR Education YouTube channel.

RESULTS. Data from the Instagram SIR_RFS account revealed that 60.9% of followers are from the United States, with the remaining 39.1% residing outside of the United States. The 39.1% of followers included 5.6% from Brazil, 5.2% from India, 1.7% from Columbia, 1.3% from Mexico, and the remaining 25.3% from a multitude of different countries. From the IR Education YouTube channel, the top 3 countries of viewers are the United States (41.7%), India (11.6%), and the United Kingdom (1.9%). The remaining 44.8% of views are from Europe, North America, South America, Asia, Africa, and Australia.

CONCLUSIONS. As a continuously expanding field that can dramatically change patients' lives, IR has the potential to directly change people's lives throughout the world. An essential step to develop this field is to create an awareness of IR through social media. The success of SIR and its ability to have an international impact demonstrates that with the efforts of SIR and other organizations such as the International Symposium of Endovascular Therapy and the Cardiovascular and Interventional Radiological Society of Europe, IR will thrive as a revolutionary and impactful field in medicine.

ISET 2022-33

Endovascular Approach in Treatment of Hypogastric Artery Pseudoaneurysm, a Rare Condition After Aortobiiliac Bypass*N.E. Santana Sr., M.V. Troncoso*

PURPOSE. Hypogastric artery pseudoaneurysm (HAP) has a rare incidence, and it is usually asymptomatic. It can present with neurologic symptoms such as paresthesia, sciatica, weakness of the lower extremity, drooping foot, and so on. Causes of HAP include penetrating and blunt trauma, infection, connective tissue disorders, inflammation, tumors that erode the arterial wall, and rarely, atherosclerosis with penetrating ulcer leading to pseudoaneurysm (PSA). We present the case of a 61-year-old woman with HAP secondary to aortobiiliac bypass due to aortoiliac disease. The patient was successfully treated with an endovascular approach and deployment of a balloon-expandable stent graft.

MATERIALS AND METHODS. This 61-year-old woman had a history of hypertension, smoking, and severe aortoiliac disease that required aortobiiliac bypass 5 years earlier. She complained of pain in the left iliac fossa of 4 weeks' duration. Computed tomography angiography revealed a PSA of anastomosis in the left external iliac artery with a maximum diameter of 6 cm. After the patient signed consent, she was taken to the catheterization laboratory, and ultrasound-guided puncture of the left brachial artery was performed. Long-sheet 7 Fr \times 70 cm was placed and arteriography was performed, observing bypass occlusion. The common iliac arteries were permeable, with PSA dependent on the left hypogastric artery and bilateral external iliac artery occlusion. A hydrophilic 0.035-inch guidewire was advanced to the superior gluteal artery. A 6-mm \times 37-mm iCover stent graft (iVascular) was deployed at the origin of the PSA in the left hypogastric artery.

RESULTS. The final arteriography showed satisfactory exclusion of the PSA, with permeability of all the collateral branches that originate in the hypogastric artery. The patient was discharged the next day without pain and remains asymptomatic in follow-up 4 weeks after the procedure.

CONCLUSIONS. The endovascular approach is a safe and effective option in the treatment of HAP secondary to aortobiiliac bypass in aortoiliac disease.

ISET 2022-34

"IR Practice Types" Webinar and Video Series: Exposing Trainees to the Diversity of Interventional Radiology Business Models*S. Gutti, P. Acree, E. Sterbis, L. Maciolek, C. Tenewitz, J. Fleming, S. Bittle, A. Farag, G. Vatakencherry*

PURPOSE. The "IR Practice Types" webinar and video series was developed by the Society of Interventional Radiology (SIR) Medical Student Council (MSC) and Resident and Fellow Section (RFS) to foster discussion about the recent diversification of practice types within interventional radiology (IR). For much of its history, the field of IR solely functioned as an inpatient, order-based service involving minimal patient interaction or clinical management. In recent years, IR's scope of practice has vastly expanded into numerous service lines, and its model of practice has expanded into clinical management and longitudinal patient care. Many interventionalists are now also leaving the standard inpatient practice model and entering a variety of practice types including outpatient private practice (office-based labs and ambulatory surgery centers), inpatient private practice with hospital privileges, and hospital and physician joint ventures. These practices can be further stratified into solo vs group, 100% IR vs mixed IR and diagnostic radiology, and 100% IR vs multidisciplinary specialties. Although these practice types have a significant impact on professional considerations relating to caseload, lifestyle, and income, this topic is rarely presented to students or residents during their training.

MATERIALS AND METHODS. IR physicians throughout the United States were invited to speak on an SIR-sponsored live webinar. The discussions were moderated by the MSC/RFS organizers and featured two IR panelists per webinar with a semistructured audience Q&A. Live webinars were advertised via email and social media and were later made available as recordings on YouTube. Follow-up surveys were emailed to attendees to gauge audience feedback. Recordings were transcribed in full and summarized into short infographics by MSC members, which will be made available on SIR online platforms in the future.

RESULTS. Mean audience rating for the webinars was 4.6 ± 0.7 (rated on a 5-point Likert scale, with 5 indicating highest level of satisfaction). Mean attendance for live webinars was 48.7 ± 8.1 . Mean viewership for YouTube recordings was 340.7 ± 255.2 . A mean of 2.7 ± 3.8 new subscribers were gained for each video. Data and feedback will continue to be gathered on this webinar series.

CONCLUSIONS. The "IR Practice Types" series offers students, residents, and fellows important exposure to the vast diversity of practice settings within IR, beyond what is traditionally seen during training.

ISET 2022-35

Utility of the Hybrid Computed Tomography/Angiography Interventional Radiology Suite for Percutaneous Sclerotherapy of an Infiltrative Venous Malformation*A. Khalil, C. R. Bailey, C.R. Weiss*

PURPOSE. To describe our experience on using the Siemens Nexaris (Edge/AXIOM-Artis) hybrid computed tomography (CT) and angiography suite for treating a transspatial head and neck venous malformation.

MATERIALS AND METHODS. A 37-year-old woman presented with a large, infiltrative face and neck venous malformation causing her pain, swelling, difficulty swallowing, and facial pressure. On magnetic resonance imaging, the malformation involved the right masticator, parotid, and parapharyngeal spaces with significant laryngeal narrowing.

RESULTS. Because of the need to treat both superficial and deep pharyngeal lesions, a hybrid CT and angiography interventional radiology suite was used. Pre-embolization noncontrast CT of the head and neck was performed to plan needle placement. Under general anesthesia with nasotracheal intubation, the masticator, posterior mandibular, and parapharyngeal components were accessed percutaneously using five 21-gauge needles under CT guidance. Ultrasound was used to access an additional 4 superficial sites. Pre-embolization digital subtraction venography (DSV) was performed at each site to confirm intravascular location of the needle tip and to assess venous malformation distribution and draining veins. Foaming bleomycin foam was injected using negative DSV. Bleomycin was selected to minimize postsclerotherapy airway edema. After treatment, noncontrast CT (Nexaris) was performed to evaluate bleomycin distribution showing expected coverage. The patient tolerated the procedure well with no complications. She remained intubated for airway protection and admitted overnight to the intensive care unit. She was extubated in less than 24 hours and was able to tolerate an oral diet with no respiratory or pain-control issues. At 3-month follow-up, her pain and morning soreness had resolved.

CONCLUSIONS. This case underscores the utility of combined fluoroscopic and CT systems for treating infiltrative or deep venous malformations without the need for endoscopic or laryngoscopic assistance.

ISET 2022-36

Role of Embolization in Metastatic Carcinoid Syndrome and Other Palliative Treatments*M. Rahimi, S. Gutti, D. Iyer, S. Sarin, D. Scher*

PURPOSE. After undergoing potential surgical resection, chemotherapy, or both, patients are often referred to an interventional radiologist for palliation. The interventional radiologist may perform imaging-guided procedures to allow patients to achieve a more comfortable end-of-life transition. The purpose of this review is to characterize the role of embolization in palliative care.

MATERIALS AND METHODS. A review of the literature was performed using PubMed. Inclusion criteria was limited to articles published from January 2002 to the present and focused on palliative care, metastatic carcinoid syndrome, and symptomatic improvement.

RESULTS. Embolization is a potential treatment for a variety of disease processes (predominantly in the liver) such as metastatic carcinoid syndrome. Recent studies have shown that certain types of liver-directed therapy, such as chemoembolization and bland embolization, are comparably effective in the management of carcinoid syndrome, as well as the metastatic deposits themselves. Schell et al. (2002) reviewed a sample of 101 hepatic artery embolizations from 24 patients. Postoperative hepatic tumor size was shown to reduce in 79% of those treated and remained stable in 17%. Approximately 64% of the patients were regarded as asymptomatic after treatment, and 46% were able to end octreotide treatment completely. The 5-year survival rates were 72% for all patients with carcinoid and unresectable hepatic metastases and 54% for the subset of patients with malignant serotonin syndrome. In addition, embolization is proven to be a successful mode of treatment for patients with functional liver metastasis from islet cell tumors. Hepatic artery embolization for liver metastasis from islet cell tumors has a 16-month average duration of symptomatic relief, as demonstrated by Gupta et al. (2003). This study also found that chemoembolization was more effective than bland embolization in the treatment of patients with islet cell carcinoma metastases. Finally, various endovascular interventions are now used for pain management in patients with cancer. Through embolization, ablation, and combination therapies, patients may gain significant improvement in the quality of remaining life.

CONCLUSIONS. Embolization and other endovascular techniques are highly effective interventions for treatment and management in the realm of palliative care, specifically for metastatic carcinoid syndrome, islet cell tumors, and pain management.