Society for
Pediatric
Interventional
Radiology

6th International Meeting Maui, Hawaii October 23 – 26 2018

Dear Colleagues,

On behalf of the Board of Directors for your Society for Pediatric Interventional Radiology, I want to welcome you to the beautiful Andaz Maui at Wailea Resort for our 6th International Meeting. This Annual Meeting promises to be perhaps the greatest educational opportunity yet provided in the field of pediatric interventional radiology. Its “Morbidity and Mortality” theme will no doubt create an intense, positive, and enriched learning environment, with everyone benefiting in different ways, and no one leaving without feeling motivated and inspired, and better about their own abilities. This meeting represents a new milestone for our Society, and it would not have been possible without the support and dedication of so many, including our corporate friends and all those on the Board. A special word of thanks to Susan Harned for all that she has done to making this meeting a reality. But it is really you who, through your commitment and sacrifice, that allows us to grow as a collaborative and collective body of pediatric IR specialists, and for us to continue to build on the global IR community looking after our children. You are part of the vibrant and rich fabric that is the SPIR.

So enjoy your time here. Share your knowledge with those around you, and embrace the opportunity to meet old friends, and make new ones. Rest and relax. Take in the beach, the sea, the sun, and the surf. I want to thank you, personally, and on behalf of your Board, for coming and being a part of this unique and wonderful experience.

Let’s all Learn Together – The Aloha Way.

Manraj “Raju” K S Heran


EMBOLIZATION SYSTEM
Large Volume Coils
Ruby® Coil
Frame & Fill
LANTERN®
High-Flow Microcatheter
POD® System
Anchor & Pack
INDIGO® SYSTEM
Get the Clot Out with Power Aspiration
CAT8
CATD
CAT6
CAT5&3
Pump MAX™
Penumbra

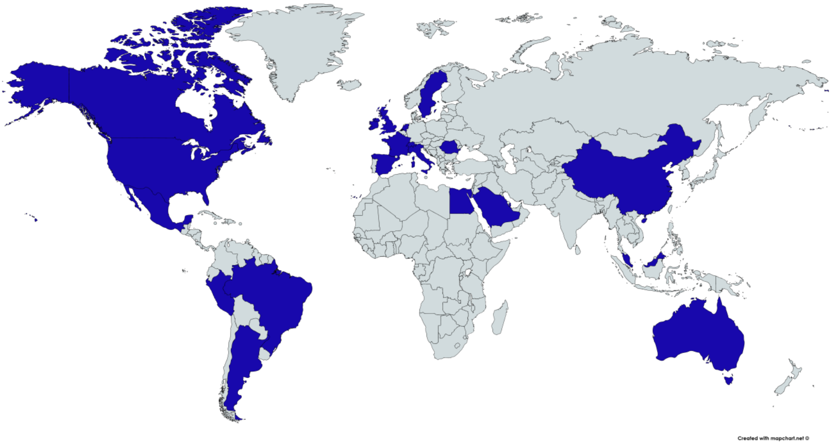
Society for Pediatric Interventional Radiology
6th International Meeting
October 23 – 26, 2018
Maui, Hawaii

www.spir.org.
Follow us on Twitter @socpedsir

SPIR BOARD OF DIRECTORS

President	**Manraj K S Heran, MD** British Columbia Children’s Hospital
President-Elect	**Manish Patel, DO** Cincinnati Children's Hospital Medical Centre
Secretary	**Alex Barnacle, BM** Great Ormond Street Hospital for Children
Treasurer	**Anne Marie Cahill, MD** Children’s Hospital of Philadelphia
Past-President	**Roger Harned, MD** Children’s Hospital Colorado
Members-at-Large	**Kari Hayes, MD** Children’s Hospital Colorado
	Leah Braswell, MD Nationwide Children's Hospital
	G. Peter Feola, MD Primary Children’s Hospital
	Sergio Sierre, MD Hospital de Pediatría Garrahan
	Francis Marshalleck, MD Riley Hospital for Children Indiana University Health

THE SPIR COMMUNITY



2018 EMERITUS MEMBERS

Congratulations to the following SPIR members who are retiring this year. Thank you for your many years of service to Pediatric Interventional Radiology.

Pat Burrows Children's Hospital of Wisconsin

Mark Finkelstein Alfred I. duPont Hospital for Children

Marc Keller Children's Hospital of Philadelphia

Glen Seidel Lucille Packard Children's Hospital

Richard Towbin Phoenix Children's Hospital

ACCREDITATION & EVALUATION

CME

This activity has been planned and implemented in accordance with the Essentials and Standards of the Accreditation Council for Continuing Medical Education (ACCME) through joint providership of the Society of Interventional Radiology (SIR) and the Society for Pediatric Interventional Radiology (SPIR).

SIR is accredited by the ACCME to provide continuing medical education for physicians. SIR designates the live activity for a maximum of *16 AMA PRA Category 1 Credits™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Using a QR Code Reader app please complete the following evaluations. Apps can be found in the the Google Play Store and Apple's App Store. Some camera phones can also scan the QR code. The web address is also provided should you rather access the evaluation that way.

SPIR Meeting Evaluation
(mandatory for CME credits)
https://goo.gl/YCqAea

Speaker Evaluation
Wednesday Sessions
https://goo.gl/FSpNS2

Speaker Evaluation
Thursday Sessions
https://goo.gl/Bq4bzh

Speaker Evaluation
Friday Sessions
https://goo.gl/jFCx7F

FACULTY

Alex Barnacle, BM Great Ormond Street Hospital

Stephen Brown, MD Boston Children's Hospital

Anne Marie Cahill, MD Childrens Hospital of Philadelphia

James S Donaldson, MD Lurie Children's Hospital

Josée Dubois, MD CHU Sainte-Justine

G Peter Feola, MD Primary Children's Hospital

Roger Harned, MD Children's Hospital Colorado

Manraj K S Heran, MD British Columbia Children's Hospital

Charles James, MD Arkansas Children's Hospital

Robin Kaye, MD Phoenix Children's Hospital

Kamlesh Kukreja, MD Texas Childrens Hospital

David Lord, MB BS FRANZCR Children's Hospital at Westmead

Manish N Patel, DO Cincinnati Children's Hospital Medical Center

Derek Roebuck, MB BS Great Ormond St Hospital

Dennis Shaw, MD Seattle Children’s Hospital

Luke Toh, MB BS KK Women's and Children's Hospital

Nghia-Jack Vo, MD Children’s Hospital of Wisconsin

SCIENTIFIC COMMITTEE

Michael Acord, MD Children's Hospital of Philadelphia

Shellie Josephs, MD Lucile Packard Children's Hospital Stanford

Ralph Gnannt, MD Children's Hospital Zurich

Anne Gill, MD Children's Healthcare of Atlanta/Emory University

Leah Braswell, MD Nationwide Children's Hospital

AGENDA

Tuesday, October 23, 2018

15:00 - 17:00	Registration Check-in (Solarium)
18:00 - 20:00	Welcome Reception (Laule'a 2)

Wednesday, October 24, 2018

07:00 - 08:00	Registration Check-in (Solarium)
07:00 - 08:00	Continental Breakfast (Exhibit Hall)
08:00 - 08:15	Presidential Welcome: Manraj Heran
08:15 - 09:15	**Workshop 1: Angiography Outside the Head and Neck** *(Abstracts on pages 16 to 22)* Moderators: Anne Marie Cahill
09:15 - 10:00	**Workshop 2: MSK – From Biopsy to Ablation** *(Abstracts on pages 24 to 28)* Moderator: G. Peter Feola
10:00 - 10:30	Refreshment Break (Exhibit Hall)
10:30 - 11:30	**Invited Lecture: The Art of Communicating Bad News: A Video-based, Interactive Approach** Speaker: Stephen D. Brown, MD.
11:30 -13:00	**Workshop 3: Pitfalls of treating Vascular Anomalies and Interventional Oncology** *(Abstracts on pages 30 to 40)* Moderators: Josee Dubois, Kamlesh Kukreja
13:00	Afternoon Break
16:45	SPIR Private Sunset Cocktail Cruise (optional) Meet in the Andaz Hotel Lobby

AGENDA

Thursday, October 25, 2018

07:00 - 08:00	Continental Breakfast (Exhibit Hall)
08:00 - 09:00	**Invited Lecture: Communicating about errors with patients and families** Speaker: Stephen D. Brown, MD
09:00 - 10:00	**Workshop 4: Complications of the GU system, from angiography to percutaneous procedures** *(Abstracts on pages 42 to 48)* Moderator: James Donaldson
10:00 -10:30	Refreshment Break (Exhibit Hall)
10:30 - 12:00	**Workshop 5: Vascular Access and Potpourri** *(Abstracts on pages 50 to 58)* Moderators: Luke Toh, Alex Barnacle
12:00 - 13:00	**Workshop 6: Essentials of Neurovascular Intervention: Pitfalls and Problems** *(Abstracts on pages 60 to 66)* Moderator: Manraj Heran
13:00 - 13:15	SPIR Group Photo (Laule'a 2) – All attendees please join us.
13:15 - 14:00	SPIR Business Meeting and Lunch *Box lunches available in the Solarium*
14:00 - 15:00	**Scientific Paper Session 1** *(Abstracts on pages 98 to 102)* 5 papers (8-minute presentations, 4 minutes of discussion) Moderators: Charles James, Robin Kaye
15:00 - 15:15	Refreshment Break (Exhibit Hall)
15:15 - 16:15	**Workshop 7: GI – Managing bleeding, bowel rupture and perforation** *(Abstracts on pages 68 to 74)* Moderator: Jack Vo
19:00-22:00	SPIR Annual Grand Banquet (Laule'a 2)

Friday, October 26, 2018

07:00 - 08:00	Continental Breakfast (Exhibit Hall)
08:00 - 09:00	**Keynote Speech: The Devil in the Kitchen and Other Stories** Speaker: Derek Roebuck
09:00 - 10:30	**Workshop 8: Cardiovascular and Thoracic Complications** *(Abstracts on pages 76 to 86)* Moderator: Roger Harned
10:30 - 11:00	Refreshment Break (Exhibit Hall)
11:00 - 12:00	**Scientific Paper Session 2** *(Abstracts on pages 103 to 107)* 5 papers (8-minute presentations, 4 minutes of discussion Moderators: Dennis Shaw, David Lord
12:00 - 13:15	**Workshop 9: Really? You did that??** *(Abstracts on pages 88 to 96)* Moderators: Manraj Heran, Manish Patel
13:15	SPIR Pioneers Award, Meeting Adjourns

SPIR 2018 MEETING-AT-A-GLANCE

TUESDAY, OCTOBER 23, 2018	
15:00 - 17:00	Registration Check-in
18:00 – 20:00	Welcome Reception

WEDNESDAY, OCTOBER 24, 2018	
07:00 - 08:00	Continental Breakfast
08:00 - 08:15	Presidential Welcome
08:15 - 09:15	Workshop 1: Angiography Outside the Head and Neck
09:15 - 10:00	Workshop 2: MSK – From Biopsy to Ablation
10:00 - 10:30	Refreshment Break
10:30 - 11:30	Invited Lecture: The Art of Communicating Bad News
11:30 - 13:00	Workshop 3: Pitfalls of treating Vascular Anomalies and Interventional Oncololgoy
13:00	Afternoon Break
16:45	SPIR Sunset Cruise Departure

🟧 Angiography
🟩 MSK
🟪 GI
🟪 Cardiovascular
🟥 M&M
🟪 Oncology
🟥 GU
🟫 Vascular
🟦 Scientific Sessions

SPIR 2018 MEETING-AT-A-GLANCE

THURSDAY, OCTOBER 25, 2018	
07:00 - 08:00	Continental Breakfast
08:00 - 09:00	Invited Lecture: Communicating about errors with patients and families
09:00 - 10:00	Workshop 4: Complications of the GU System, from angiography to percutaneous procedures
10:00 - 10:30	Refreshment Break
10:30 - 12:00	Workshop 5: Vascular Access and Potpourri
12:00 - 13:00	Workshop 6: Essentials of Neurovascular Intervention: Pitfalls and Problems
13:00 – 13:15	SPIR Group Photo
13:15 - 14:00	SPIR Business Meeting & Lunch
14:00 - 15:00	Scientific Paper Session 1
15:00 - 15:15	Refreshment Break
15:15 - 16:15	Workshop 7: GI – Managing Bleeding, Bowel Rupture and Perforation
19:00 - 22:00	SPIR Annual Grand Banquet

FRIDAY, OCTOBER 26, 2018	
07:00 - 08:00	Continental Breakfast
08:00 - 09:00	Keynote Speech: The Devil in the Kitchen and Other Stories
09:00 - 10:30	Workshop 8: Cardiovascular and Thoracic Complications
10:30 - 11:00	Refreshment Break
11:00 - 12:00	Scientific Paper Session 2
12:00 - 13:15	Workshop 10: Really? You did that??
13:15	Meeting Adjourns

GOLD MEDAL RECIPIENT

Philip Stanley, MD

I was born during an air raid in a maternity home close to London in the early 1941. I received education locally before winning a scholarship to a "public school." During the vocations I worked on farms and at the local blacksmith. The school had a cadet force with a firing range and gliders. On assignments to Royal Air Force I learnt to fly and represented my air force station at the seven a side county rugby championships. I spent five years at St Bartholomew's Medical College before staying on for two years in orthopedics,cardiology and thoracic surgery. A rotation at Brompton Hospital was followed by a year at the National Hospital for Nervous Diseases which piqued my interest in neuroradiology which consisted of plain images, direct stick carotid and vertebral arteriography, pantopaque myelography and ventriculography and air encephalograms. I went back to St Bartholomew's Hospital to complete radiology training. This included rotation through the National Orthopedic Hospital and Great Ormond Street Hospital where I worked with the greats, John Sutcliffe and Richard Hoare. My training included catheter angiography and air myelography via midline sub occipital puncture. During this rotation I won a scholarship to study spinal arteriography with Rene Djindjian at Larboisiere in Paris.

Following this I worked for a year at UCLA spending a day a week at Children's Hospital Los Angeles. On my return to London, John Gwinn Radiology chief at CHLA invited me to join the staff where I have been since 1974. He was very supportive of my expanding the interventional procedures. I presented the importance of these procedures at the keynote address at the inaugural meeting of the society emphasizing that "pediatric interventional radiology makes a difference"

Penny and I live in the Hollywood Hills with two dogs. We have a daughter who lives in Alexandria Virginia. I have been blessed by the education and love given to me by my parents and the support from my colleagues during my professional career. I could not have had the great family and social life and been professionally successful without love of my wife Penny.

KEYNOTE SPEAKER

Derek Roebuck, MB BS

Derek Roebuck was educated in Tasmania, graduating from medical school in 1984. He has subsequently worked on four continents, including fellowships in pediatric radiology in Sydney and Los Angeles, and three years in Hong Kong. For the last 19 years he has specialized in pediatric interventional radiology at Great Ormond Street Hospital, London, where he was until recently Head of Clinical Service (Radiology). In December this year he will start work at the Perth Children's Hospital and the University of Western Australia.

Derek's medical interests include interventional oncology in childhood liver tumors, airway intervention, and arterial disease in childhood.

FEATURED SPEAKER

Stephen Brown, MD

Dr. Brown is Director of the Boston Children's Hospital Institute for Professionalism and Ethical Practice (IPEP), which trains medical professionals to communicate with patients and families with more compassion and confidence. A graduate of the University of Pennsylvania School of Medicine, Dr. Brown completed a Diagnostic Radiology residency at Massachusetts General Hospital and fellowships in Pediatric Radiology and Pediatric Interventional Radiology at Boston Children's Hospital. A diagnostic radiologist at Boston Children's Hospital, he is also an Associate Ethicist in its Office of Ethics, and a Senior Scholar in its Academy for Teaching and Educational Innovation and Scholarship. Dr. Brown is an Associate Professor of Radiology at Harvard Medical School, where he serves on the faculty of its Center for Bioethics. At IPEP, he leads the development of communication training programs used in diverse clinical domains and medical specialties, addressing issues such as disclosure and apology, brain death, and informed consent.

PAST MEETINGS

2009 Napa Valley, California

2011 Scottsdale, Arizona

2013 Santa Fe, New Mexico

2015 London, United Kingdom

2017 Denver, Colorado

7th International SPIR Meeting
October 2 - 4, 2019

Where in the world will it be?

Locale to be announced
at Thursday's Business Meeting

SPIR PAST PRESIDENTS

Jim Donaldson, 2009

Manrita Sidhu, 2010, 2011

Charles James, 2012

Mark Hogan, 2013

Derek Roebuck, 2014

John Racadio, 2015

Manraj Heran, 2016

Roger Harned, 2017

M&M SESSIONS

Workshop 1: Angiography Outside the Head and Neck

Wednesday, October 24
08:15 - 08:30
A benign ovarian cyst?
Thomas-Chaussé F, Ghali R, Rypens F, Dubois J

We present the case of a 2-day-old baby with a prenatally diagnosed ovarian cystic lesion. After birth, an US was done to control the cystic lesion. A color Doppler US revealed the presence of flow in the cystic lesion.

The baby was asymptomatic without any leg perfusion deficiency. Familial history and genetic screening were negative.

CTA demonstrated a giant pseudoaneurysm arising from the right common iliac artery with the hypothesis of a congenitally absent external iliac artery. The angiography was performed by an axillary approach and revealed a partially progressive thrombosis of the pseudoaneurysm. The vascularization of the right leg was done through collaterals from the right and left internal iliac arteries.

Considering the progression of the thrombosis, we decided to observe the patient. At 2½ months, a residual pseudoaneurysm was still present and was treated percutaneously with the injection of 0.3 ml (150 IU) of Thrombin without any complication.

A follow-up Doppler 24 hours after the procedure showed a persistent flow in the pseudoaneurysm.

M&M SESSIONS

Workshop 1: Angiography Outside the Head and Neck

Wednesday, October 24
08:30 - 08:45
Trans-Splenic Approach: Not a big deal until it becomes a BIG deal
Burch K, Brown J, Chau A, Hernandez JA

A 6 year-old female with history of prematurity, twin birth, and chronic portal vein (PV) thrombosis believed secondary to infantile UVC placement, subsequent portal hypertension on propranolol, and multiple episodes of GI bleeding requiring endoscopy, banding, and sclerotherapy. Hepatology referred patient to IR to evaluate for PV recanalization. On initial outpatient exam patient was small-for-age, no significant thrombocytopenia, and US showed PV thrombosis and splenomegaly. Given multiple GI bleeds requiring intervention, and the patient's home in distant proximity to a pediatric hospital, IR recommended PV recanalization, discussed the risks with the parents who agreed. Initial procedure used a trans-splenic approach to recanalize the PV and the right intra-hepatic portal system, was unable to recanalize the left intra-hepatic PV, with minimal post-operative bleeding not requiring transfusion. At 1 month follow-up visit patient denied GI bleed and US showed patency of previously recanalized PV system. Plan made to recanalize the left intra-hepatic portal system. 1 month later IR used a trans-splenic approach revealing tortuous splenic vein requiring multiple different manipulations of the guidewire and ultimately resulted in splenic vein rupture causing hemoperitoneum. Surgery was called emergently, massive transfusion protocol initiated, patient became bradycardic and decompensated so quickly there was not sufficient time to perform an arteriogram, CPR initiated, and patient transferred to the OR with blood already visible in the ETT. Surgery performed ex-lap, splenectomy, and tamponade with packing, with ongoing CPR. Despite multiple interventions patient was unable to recover from massive hemorrhage and ultimately resuscitation efforts ceased after 2 hours.

M&M SESSIONS

Workshop 1: Angiography Outside the Head and Neck

Wednesday, October 24
08:45 - 09:00
Percutaneous management of a neonatal intra-hepatic vascular mass resulting in death
Gill A, Hawkins CM

HPI: 37w 6d transferred secondary to intrahepatic vascular mass (original diagnosis: arteriovenous malformation), coagulopathy (INR 3.5) and double outlet right ventricle.

Workup included echocardiogram, abdominal MRI, and Chest/abdomen CTA. Findings showed a 2.9cm x 3.1cm x 2.5cm vascular mass predominantly supplied by the left internal mammary artery (LIMA), central venous lakes which emptied directly into the right atrium, and numerous low-flow channels in the lesion's periphery. Significant lab values: elevated BNP, LFTs, INR, and hyperbilirubinemia. Physical exam revealed multiple, subcutaneous hemangiomas. Diagnosis favored an intrahepatic congenital hemangioma.

Timeline: Propanolol started DOL 9. Over a month, bilirubin continued to rise and the liver's synthetic function worsened. Due to the impending liver failure, and anatomical preclusion from surgical resection, IR was asked to embolize the lesion.

Procedure/Complication: Percutaneous access into the LIMA achieved, angiography performed. Transhepatic access into a venous channel with subsequent coil embolization (0.035" detachable coils). During the final coil embolization of the venous channels, there was an unanticipated course of the coil which likely disrupted the liver capsule. Distal LIMA was embolized with 0.018" pushable coils. The transhepatic tract was embolized with gelfoam pledgets. While evaluating the gelfoam tract, an enlarging hematoma was noted. The hematoma was aspirated and hypovolemic shock ensued. Massive transfusion protocol was started, a code was called, surgery was urgently consulted, and the decision was made to put in a percutaneous drain. Baby was stabilized and transferred back to the NICU and expired ~4 hours later.

M&M SESSIONS

Workshop 1: Angiography Outside the Head and Neck

Wednesday, October 24
09:00 - 09:15

Fatal complication of angiography in a patient with Ehlers-Danlos Syndrome

Tomihama R, Kiang SC, Smith JC, Patel ST

14 -year-old male with Ehlers Danlos syndrome and recent evaluation at an OSH returns to the OSH ED for worsening abdominal pain. A repeat CT demonstrated an SMA pseudoaneurysm with surrounding hematoma and hemoperitoneum. Patient was actively resusictated and transferred to LLUCH. Vascular Surgery and Interventional Radiology consulted for management with consideration for angiography and possible endovascular treatment.

A diagnostic arteriogram of the SMA confirmed the presence of an 3.1 x 1.2 cm pseudoaneurysm near the origin of the SMA with distal occlusion. However, on repeat angiography, without any guidwire or catheter interrogration, there was new evidence of SMA rupture and contrast extravasation. The patient's hemodynamic status began to deteriorate and the patient was emergently transferred to the operating room for surgical management.

According to the operative report, there was extreme frailty of connective tissues related to Ehlers-Danlos syndrome. The origin of this celiac artery and supraceliac aorta appeared disrupted during the visceral manipulation. Evaluation of the aortic wall was notable to be friable and without integrity. Upon attempts to place repair sutures, the aortic wall disintegrated and was transected. The patient then lost his pulse. Cardiac massage was then intiated. The patient was coded for 15 minutes before he expired.

The literature reports inherent dangers in performing angiographic procedures in patients with Ehlers-Danlos Syndrome due to such frailty of the connective tissues and blood vessels. This case example demonstrates a large mesenteric vessel injury with simple angiography.

M&M SESSIONS

Workshop 2: MSK - From Biopsy to Ablation

Wednesday, October 24
09:15 - 09:30

Neurophysiologic Monitoring during Cryoablation of Musculoskeletal Tumors in Children

Hawkins, CM, Prologo JD, O'Dell MC, Griffith S, Gill AE

Case 1:
A 9yo male presented to the ED with lower back pain. MRI revealed an aneurysmal bone cyst (ABC) in his L4 vertebral body without fracture. IR consulted for cryoablation and sclerotherapy.
Intra-procedural neurophysiologic monitoring (IPNM) was utilized to assess for nerve injury during cryoablation. 3 10G cannulas were places within the lesion through which Doxycycline foam was evenly distributed. 3 IceSphere cryoprobes were positioned in the tumor. Two 10-minute freeze cycles each followed by a 5-minute thaw cycle ensued.
After the 2nd freeze cycle, there was loss of motor-evoked potentials (MEPs) in the L4/L5 distribution. Somatosensory evoked potentials (SSEPs) were unchanged throughout the procedure. In recovery, all motor/sensory function of the left lower extremity was lost and he had bowel/bladder incontinence.

Case 2:
A 6yo male presented with a pathologic fracture of his left femur. Open-reduction-internal-fixation with curettage ensued and the patient was diagnosed with a unicameral bone cyst (UBC). The UBC recurred, and IR was consulted for percutaneous ablation.
IPNM was utilized to assess for nerve injury during cryoablation. 3 IcePearl cryoprobes were positioned in the tumor. A 10-minute freeze cycle was then performed.
At the end of the freeze cycle there was complete loss of MEPs in the L5 distribution with transient loss in the L4 distribution. SSEPs were unchanged/ preserved throughout the freeze cycle. The area was actively thawed with partial return in MEPs in the L4 distribution. In recovery, all motor and sensory function in the L5 distribution was lost resulting in foot drop.

M&M SESSIONS

Workshop 2: MSK - From Biopsy to Ablation

Wednesday, October 24
09:30 - 09:45
Skin burn following Radio Frequency ablation of Osteoid Osteoma
Krishnamurthy G, Srinivasan A, Cahill AM, Acord M

An 8 year old girl was referred from orthopedics for a recurrent osteoid osteoma in the mid shaft of right tibia. Previously, the girl had undergone an open surgical excision by an orthopedic surgeon at an outside hospital.
Axial and coronal CT scan images showed the lesion in the mid third shaft of the right tibia with extensive adjacent sclerotic reaction. The nidus measured approximately 2 to 3 cm in length.

CT guided RF ablation of the lesion was undertaken under general anesthesia. At the time of procedure, paucity of subcutaneous tissue overlying previous surgical scar over the shin region was noted. Significant amount of local anesthesia was instilled just below scar tissue to build up the subcutaneous region. 14 F Bonopty needle was used to access the lesion. In spite of sclerosis, coring through the cortex, into the nidus was not hard. Once nidus was accessed, RF ablation was performed. Attempts to withdraw the outer guiding needle made the RF probe very unstable and hence the needle was not adequately withdrawn. Following the procedure, patient was free of pain symptoms. However, next morning, change of skin color progressing to skin burn was noted. Patient was treated for burn and the lesions completely healed on follow up.

RF ablation over the shin region can sometimes be challenging related to paucity of subcutaneous tissue. In this case, previous surgery also contributed to the complications. Care must be taken to adequately withdraw the outer needle to prevent transmission of heat during RF ablation.

M&M SESSIONS

Workshop 2: MSK - From Biopsy to Ablation

Wednesday, October 24
09:45 - 10:00
Stunned But Not Shunned: Nerve Injuries In Cryoablation
Shaikh R, Chewning R, Chaudry G, Padua H, Alomari A

Four patients (n=2 vascular malformation; n=1 aneurysmal bone cyst; n=1 desmoid) experienced nerve injuries following cryoablation in different anatomical locations. Neurological damage was motor or sensory or both, and occurred immediately following therapy. These complications were managed conservatively. Prevention and management of neurological damage occurring from cryoablation will be discussed.

M&M SESSIONS

Workshop 3: Pitfalls of treating Vascular Anomalies and Interventional Oncology

Wednesday, October 24
11:30 - 11:45

Bowel Perforation Complicating Sclerotherapy of Extensive Abdominal Lymphatic Malformation

Durand R, Srinivasan A, Cahill AM, Heye P

A 3 year-old girl with worsening abdominal distention, pain and bladder incontinence found to have a large complex mixed micro-and macrocystic abdominal lymphatic malformation was admitted for trans-catheter doxycycline sclerotherapy (multi-day course). Eight smaller cysts were treated with a total of 2100 mg via direct injection with six drains placed in the larger cysts for repeat Doxycycline administration. On treatment day two, she received an additional 2000 mg of doxycycline without event. Overnight, the patient had two episodes of coffee ground emesis; therefore the third sclerotherapy session was cancelled. Gastroenterolgy consultation attributed emesis to stress gastritis.

That evening, she developed hypotension, tachycardia and acidsosis with elevated procalcitonin and lactate. She was subsequently transferred to the PICU and received fluid resuscitation, initiated cultures and broad-spectrum antibiotics for presumed sepsis. Two of 6 cultured drains were positive for gram-negative rods and fungus. The remaining drains were removed and she continued on antibiotic and antifungal medication. Consistency of drain output was identical across all drains, and was serous/lymphatic fluid. However, fever was ongoing and a CT scan of the abdomen/pelvis was performed demonstrating bowel obstruction, lymphatic malformation, and no free air. Given an unimproved clinical course after 6-days, she had an exploratory laparotomy revealing intestinal perforation and extensive mesenteric lymphatic malformation which extended transmurally to the level of bowel mucosa, but fortunately was localized to 72 cm of small bowel. The lymphatic malformation with associated small bowel was completely resected, with primary anastomosis. Her post-operative course was uneventful and she was discharged post-operative day 8.

M&M SESSIONS

Workshop 3: Pitfalls of treating Vascular Anomalies and Interventional Oncology

Wednesday, October 24
11:45 - 12:00

Burn Following Endovenous Laser Treatment

Alomari AI, Alomari MH, Lillis A, Cindy C, Shaikh R, Chewning R, Chaudry G, Alomari AI.

Endovenous laser treatment (EVLT) for anomalous veins in the lower extremities was performed in 4 patients (2 M, 2 F, age range 15 mo-10 years) using diode laser via 600 um bare fibers of 2 laser systems (AngioDynamics VenaCure [wavelength 980 nm] and Dornier Medilas D FlexiPulse [wavelength: 940 nm]). Laser setting included power of 15 watt and continuous wave mode following tumescent saline under sonographic guidance.

The treated lower extremity veins were superficial with a depth range of 1.5-3 mm beneath the skin and treated length of 20-40 cm. The range of laser energy delivered was 3540- 5115 joules (dose 75- 150 joules/cm) per procedure. Three patients had one superficial subcentimeteric burn each while the fourth developed 3 similar burns along the course of the treated vein.

All burns were evident immediately following laser treatment and healed with conservative care.
The proposed mechanism of these burns is the direction of the tip of the stiff laser fiber pointing toward the skin as the fiber is retracted within a curved course of the vein [Figures]. We recommend that laser energy is temporarily stopped when the fiber is retracted and the tip is expected to assume an angle or a location closer to the skin.

The risk of burn related to EVLT was not related to initial depth of the treated vein with appropriate application of perivenous (subcutaneous and/or intradermal) tumescent fluid. The risk was also not related the length of treated vein, total energy or laser dose or age.

M&M SESSIONS

Workshop 3: Pitfalls of treating Vascular Anomalies and Interventional Oncology

Wednesday, October 24
12:00 - 12:15

Coil Embolization of Multifocal Intrahepatic ArterioPortal Fistulas

Rinzler E, Patel M

16 month-old female presenting from an OSH with multiple hepatic hemangiomas, portal hypertension and esophageal varices. Imaging showed hemangiomas decreasing in size, as well as reversed portal venous flow and some reversal of main hepatic arterial flow. Patient was discharged home after variceal banding. Subsequently she had worsening diarrhea and failure to thrive. MRI showed diffusely edematous bowel/mesentery, attributed to elevated portal pressures. The hemangiomas had further involuted. Review of prior CT suggested an arterial-portal shunt in the right liver.

Angiography visualized a complex arterial-portal fistula with retrograde portal filling and no hepatic venous outflow. Hepatic arterial ligation was performed during exploratory laparotomy, which was complicated by compartment syndrome. She continued to deteriorate, and follow up imaging showed persistent arterial-portal shunting.

Repeat angiogram was performed with coil embolization of hepatic and gastroduodenal collaterals. There was improved flow on imaging but the patient's clinical condition remained tenuous. Follow up angiogram one week later showed abundant collaterals, including hepatic, GDA, right inferior phrenic, right gastric, and SMA. Multiple vessels were embolized with improvement in flow post-embolization; collaterals from the SMA were spared for potential liver transplantation.

The patient underwent liver transplantation due to ongoing evidence of portal hypertension. Venous congestion and diarrhea improved but she subsequently developed rejection and biliary stricture; both of which have been appropriately managed.

Ultimately extensive embolization was unsuccessful in managing her portal hypertension, and delayed her transplantation.

M&M SESSIONS

Workshop 3: Pitfalls of treating Vascular Anomalies and Interventional Oncology

Wednesday, October 24
12:15 - 12:30
Sclerotherapy of Neonatal Neck Mass
Harned R, Annam A

Female born at outside hospital found to have right neck mass with mass effect on trachea. Respiratory distress resulted in intubation and immediate transfer to Children's. MRI interpreted as mixed macro and microcystic venolymphatic malformation. After discussion in multidisciplinary vascular anomaly clinic it was decided to attempt sclerotherapy in order to decrease mass effect with the goal of extubation. Catheters were placed in the 2 largest cysts and doxycycline sclerotherapy performed x 3. Additional lacing of smaller cysts and channels with doxycycline performed during 2 of these procedures. After 3 sessions over 10 days the patient remained intubated. A tracheostomy was performed. Two weeks later it was opted to proceed with surgical resection. Pathology of mass revealed an immature teratoma with focal yolk sac tumor.

M&M SESSIONS

Workshop 3: Pitfalls of treating Vascular Anomalies and Interventional Oncology

Wednesday, October 24
12:30 - 12:45

Skin pigmentation associated with bleomycin sclerotherapy: a preventable phenomenon

Barnacle A, Newton R

Two boys underwent bleomycin sclerotherapy under general anaesthesia for facial venous malformations (VMs). Both had had previous STS sclerotherapy and surgery. After his first bleomycin procedure, patient A (aged 15) reported prominent chest wall skin markings correlating to electrocardiogram lead attachment sites, which had appeared after his previous bleomycin procedure. Patient B (aged 11) was noted to have similar markings at multiple chest wall sites when he attended for his fourth bleomycin sclerotherapy procedure; he could not recall when they had developed. Previously 12 patients had undergone bleomycin sclerotherapy without skin marking; all had microcystic lymphatic disease.

The IR departmental bleomycin sclerotherapy protocol was changed to include measures to protect the skin from trauma during injection of bleomycin and implemented with immediate effect. Following this protocol, Patient A underwent a further five bleomycin procedures and Patient B a further three procedures. Neither patient developed further similar skin markings. Patient A still had the original skin markings evident at 2.8 year follow up, as did Patient B at 4.2 years.

A further 79 patients were treated with bleomycin using this protocol. 43 patients had lymphatic malformations, 34 had VMs, two had other soft tissue lesions. No patients developed skin marking during their course of treatment.

Learning point: Intravascular bleomycin injection is known to be associated with flagellate hyperpigmentation. Every effort should be made to protect the skin from minor trauma when bleomycin is circulating in the bloodstream. The precautions used in our patient cohort appear to protect against this risk.

M&M SESSIONS

Workshop 3: Pitfalls of treating Vascular Anomalies and Interventional Oncology

Wednesday, October 24
12:45 - 13:00
Skin Injury Post Cryoablation of a Desmoid
Rajeswaran S, Green J, Donaldson J

Clinical History: 4 year old female in 2013 underwent resection of an osteochondroma arising from the left scapula and in 2017 presented within a 5.6 cm palpable mass in the surgical bed. Given concern for malignancy, an IR guided biopsy was performed, which was consistent with a desmoid. During a multidisciplinary oncology conference, it was decided to cryoablate the lesion given the high recurrence rates associated with traditional surgical resections.

Procedure: Using a combination of ultrasound and CT guidance, 4 x Galil Ice Rods were placed through the lesion and 2 Freeze thaw cycles were utilized. The lesion was within 1cm of the dermis; thus, saline was infused into the subcutaneous tissue and hot-packs were utilized.

Course of complication: Towards the end of the second cryoablation cycle, the skin became cold and blanched; however, this resolved during the thaw cycle. In the PACU the patient denied any discomfort or sensory loss over the cryoablation zone.
The following day, painless blisters formed and a keloid like reaction formed over the site over the next few days. The patient denied any pain at the site. Conservative management with Neosporin and Aquafor was administered and the site slowly healed over the course of 6 weeks. One year later, there is minimal discoloration of the overlying skin. In addition, on follow up imaging there has been a favorable response as the desmoid continues to shrink and appears non viable.

M&M SESSIONS

Workshop 4: Complications of the GU system, from angiography to percutaneous procedures

Thursday, October 25
09:00 - 09:15

Complicated surgical and percutaneous renal transplant biopsies resulting in graft injury and subsequent non-target embolization

Minhas K, Patel P, Roebuck D

A 15-year-old male underwent renal transplant. Intra-operatively the graft showed poor perfusion and surgical biopsy was performed.

Subsequent US showed hydronephrosis and an AV fistula, a sequela of the surgical biopsy. A nephrostomy was placed and nephrostogram showed no contrast passing beyond the PUJ.

Percutaneous biopsy was requested for delayed graft function. Repeat nephrostogram showed unimpeded passage of contrast to the urinary bladder. The drain was removed over a guidewire, a blunt needle introduced to the renal capsule under US guidance, advanced into the graft using a trocar and biopsies obtained with a 16G needle. The tract was plugged with gelfoam. The patient became hemodynamically unstable. US demonstrated a large perinephric hematoma. Angiography showed a pseudoaneurysm and small AV fistula at the site of percutaneous biopsy, treated successfully with coil embolization. The AV fistula from the surgical biopsy was identified and an attempt was made to embolize this. A 3mm coil was deployed but was too small, as the fistula was much larger than suggested by angiography. A 4mm coil delivered behind this pushed the first coil through the fistula and it embolized to the left lung. Furthermore, there was malfunction of the second coil and/or pusher as it did not adequately deploy. Attempted withdrawal of this coil into the guiding catheter was unsuccessful and it was necessary to retrieve it with a snare.

The patient did return for successful embolization of this AV fistula but ultimately, due to graft failure, underwent embolization of the graft followed by surgical nephrectomy.

M&M SESSIONS

Workshop 4: Complications of the GU system, from angiography to percutaneous procedures

Thursday, October 25
09:15 - 09:30
Gelfoam embolization of high-flow priapism
James C, Lewis S, Moore M, Pezeshkmehr A, Canon S

An 8-year-old boy presented with perineal ecchymosis and priapism 1 week following a monkey bar fall with straddle injury. Semi-rigid erection (80%) was noted on exam and intraoperative needle aspiration of the dorsal right penis revealed bright red blood with pH 7.34, pO2 144, and pCO2 46 consistent with nonischemic high-flow priapism. 2 weeks post injury persistent 80% erection remained. Doppler ultrasound revealed localized turbulent flow in the proximal right penile shaft. Pelvic angiography and selective right iliac angiography were performed via left common femoral artery access and right penile branch traumatic A-V fistula was detected. Microcatheter embolization of 2 adjacent right penile artery branches was performed injecting small aliquots of Gelfoam/ contrast solution under roadmap fluoroscopic guidance until slowing of flow in the A-V fistula occurred. 30% erection was noted immediately following the procedure and no penile ischemic changes were seen. At 2 week IR clinic follow-up the father reported 3 days of 30-40% erection before the erection completely resolved. Prior normal morning erections before the injury were not present for 1 month following embolization (transient erectile dysfunction). At 2 month Urology clinic follow-up, there was no priapism and normal morning erections had returned. We consider this case a near miss for permanent erectile dysfunction as permanent embolic agents were initially considered pre-procedure. Subsequently Urology societal guidelines were provided to the IR primary operator which reported an erectile dysfunction rate of 39% with permanent embolic agents compared to 5% erectile dysfunction rate with temporary embolic agents.

M&M SESSIONS

Workshop 4: Complications of the GU system, from angiography to percutaneous procedures

Thursday, October 25
09:30 - 09:45
How to Circumvent Large Staghorn Calculi: Pearls & Pitfalls of Percutaneous Nephroureteral Access
Hendi A, Cahill AM, Krishnamurthy G

Intra-operative percutaneous access to the right lower pole renal collecting system was performed for lithotripsy of staghorn calculi in a 10 year old under general anesthesia. Once access was gained with a micropuncture set using dual 0.018” nitinol wire technique, the system was upsized to a 0.035” urology hydrophilic guidewire provided by the urology team.
Resistance was met while navigating the urology wire with a 5F guiding catheter which could not be advanced further than the ureteropelvic junction. Contrast injection through the catheter showed extravasation and inadvertent perforation at the ureteropelvic junction.

Lithotripsy was aborted and a percutaneous nephroureterostomy was placed using an interventional radiology-specific hydrophilic guidewire. The proximal loop of the catheter was left unformed due to bulk of the staghorn calculus. Subsequently, the patient underwent several nephrostograms and nephrostomy exchange. Delayed lithotripsy and internalization of the stent was performed uneventfully after 1.5 months under general anesthesia. Aside from ureteral injury and delayed lithotripsy, this complication led to two additional anesthesia events, long-term maintenance of a drainage catheter, repeat hospital visits and negative impact on quality of life.

It was felt that decreased familiarity with the urology-specific wire led to ureteral perforation. In addition, the ureteropelvic junction could have been traumatized by excessive manipulation during use of 0.018” nitinol wires and due to difficulty manipulating the hydrophilic wires and catheter beyond the large stone burden in the accessed lower pole calyx. Alternatives in technique will be discussed as preventative and problem-solving measures.

M&M SESSIONS

Workshop 4: Complications of the GU system, from angiography to percutaneous procedures

Thursday, October 25
09:45 - 10:00
Ureteric Injury during CT-guided Percutaneous Tumor Biopsy
Durand R, Hendi A, Cahill AM

11-year old girl with refractory high-risk neuroblastoma, diagnosed 8 years prior, presented with a new MIBG-avid retroperitoneal left para-aortic mass just above the aortic bifurcation. The mass underwent biopsy as part of an institutional "NEPENTHE" trial to obtain tissue for genomic profiling and potential targeted therapy. Under CT-guidance, a 17-gauge-trocar introducer needle was positioned along a trajectory medial to the identified ureter as the ureter was not identifiable on all levels, likely due to compression. An 18-gauge automated needle biopsy was used to obtain four 2.3cm cores Contrast-enhanced CT post biopsy showed extravasation of contrast in the region of the visualized ureter, consistent with a ureteral injury. Cystoscopy confirming perforation of the ureter and double-J ureteral stent placement was performed under the same anesthesia. The ureteral stent was removed six weeks later without incident. The biopsy was diagnostic for recurrent neuroblastoma.
In term of planning, non-visualization of the ureter with contrast during CT guided biopsy while in the prone position was not anticipated, as there had been no hydronephrosis to suggest severe compression/obstruction.

Unanticipated minor adjustments in the trocar needle angle in this case resulted in a major complication as the ureteric trajectory was not possible to fully define by contrast. The fixation bumper stabilizing the trocar needle at the skin and gauze padding does not quite cut it!

Discussion includes the choice of placing a double J stent in the ureter pre biopsy, as a localization marker for ureteric course with planned removal post procedure all under the same anesthesia.

M&M SESSIONS

Workshop 5: Vascular Access and Potpourri

Thursday, October 25
10:30 - 10:45
Hole turned Fibrin sheath on HD line
Wong K, Aria D, Kaye R, Schaefer C, Abbruzo T, Towbin T

The patient is a 19 year old male who presents with chronic kidney disease stage 5 secondary to polycystic kidney disease.
A 14 french double lumen, 23 cm tip to cuff hemodialysis catheter was placed via the right internal jugular vein, with the tip in the right atrium.

47 days later the patient was seen for replacement of his malfunctioning hemodialysis catheter with exposed cuff.
8 days later the patient was seen again secondary to excessive bleeding from the tunnel site during hemodialysis. A dye study was performed which showed what was thought to be a hole in the catheter just distal to the venotomy site. The catheter was then replaced. The old catheter was injected after it was removed and no hole was identified.

13 days later the patient was seen again for the same reason as before. A second dye study was performed which showed contrast tracking abnormally from the short lumen in a retrograde fashion, extending out of the venotomy. At this point a fibrin sheath was suspected and the next day the catheter was replaced. This time the new catheter was placed deeper than before and follow up dye study showed no retrograde flow of contrast.

The patient was some what non compliant and felt to have some sort of fibrin producing issue causing fibrin sheath formation. The patient will be placed on peritoneal dialysis.

M&M SESSIONS

Workshop 5: Vascular Access and Potpourri

Thursday, October 25
10:45 - 11:00

Superior vena cava syndrome: a dreaded complication of long term central venous access in a child with intestinal failure

Gans J, Jagust M, Cynamon J, Golowa Y

A 4-year-old male with a history of premature birth at 24 weeks gestation, short bowel syndrome associated intestinal failure secondary to necrotizing enterocolitis, total parenteral nutrition dependence by left subclavian central venous catheter, and multiple prior catheter associated infections presented in septic shock with disseminated intravascular coagulation secondary to Klebsiella bacteremia. Echocardiography demonstrated the catheter tip in the superior vena cava (SVC) with an associated echogenic focus suggesting thrombus or vegetation (Figure 1A). Line salvage was attempted with long term antibiotics and therapeutic anticoagulation due to limited venous access. The patient recovered, however presented with worsening facial swelling 3 months later. Echocardiogram severe SVC stenosis with a 21 mmHg gradient. Magnetic resonance venography revealed narrowing of the distal SVC and left subclavian vein (Figure 1B). Venogram demonstrated severe focal stenosis at the site of termination of the catheter which was treated with drug coated balloon angioplasty to prevent restenosis (Figure 1C-D). The catheter was exchanged with the new catheter tip placed at the cavo-atrial junction to minimize trauma to the SVC. Repeat angioplasty was required during catheter exchange 5 months later. One year subsequently, the patient presented with severe facial swelling and catheter occlusion (Figure 1E). Venography demonstrated complete SVC occlusion (Figure 1F). Given re-occlusion after angioplasty, a balloon expandable stent graft was used to treat the venous occlusion as it was felt to be a more durable solution (Figure 1G). This case highlights the morbidity and management of chronic vascular access in a child with intestinal failure.

M&M SESSIONS

Workshop 5: Vascular Access and Potpourri

Thursday, October 25
11:00 - 11:15
Postprocedural alopecia
Alomari AI, Alomari MH, Kerr C, Chaudry G, Orbach D.

Postprocedural Alopecia.
PURPOSE: To describe the development of postprocedural alopecia in young patients following interventional procedures.
METHODS: The clinical records, procedural details and photographs of patients who developed alopecia following procedures performed in IR were retrospectively reviewed.

RESULTS: Four patients developed focal alopecia localized to the posterior scalp following lengthy IR procedures done under general anesthesia with image guidance. The hair loss was well demarcated square or rectangular, centered over the weight-bearing part of the scalp and healed over time.

CONCLUSIONS: A well-demarcated alopecia following lengthy IR procedures can be confused with radiation-related hair loss. Alopecia is rarely reported in the interventional radiology literature. The incidence of this preventable complication was eliminated with a strict policy of scheduled repositioning intervals of the head throughout the procedure and improved head support devices.

M&M SESSIONS

Workshop 5: Vascular Access and Potpourri

Thursday, October 25
11:15 - 11:30
TPN pericardial effusion
Toh L

A term neonate was transferred to our hospital on Day 2 of life for surgical management of bowel atresia. Following exploratory laparotomy, bowel resection and primary anastomosis on Day 3 of life, based on post-surgical review decision was made to initiate total parenteral nutrition and PICC insertion was performed by IR on D5 of life. There was no resistance to infusion nor aspiration. On D8 of life the infant had acute desaturation after oral feeding. Code blue was activated and demonstrated pericardial effusion. Bedside pericardiocentesis was performed yielding milk-consistency fluid in keeping with TPN effusion.

M&M SESSIONS

Workshop 5: Vascular Access and Potpourri

Thursday, October 25
11:45 - 12:00
Spinal cord ischaemia following central venous catheter placement
Barnacle A

A critically unwell 5 month old was referred for central venous access. His history included hypoplastic left heart syndrome post Norwood stage 2 surgery, precluding upper limb access. During the procedure, his cardiac output was suboptimal and resuscitation measures were required. Both common femoral veins (CFVs) were occluded. Attempts at right groin collateral access and direct left CFV recanalisation failed. The patent left superficial femoral vein was cannulated at the knee, allowing successful left CFV recanalisation. The iliac veins were occluded. A guidewire was advanced to the right atrium via complex retroperitoneal/paravertebral collaterals. Several difficult guidewire exchanges were required to place a 4Fr PICC. The line was difficult to aspirate but flushed well. The PICC was used the next day for CT angiography but image opacification was poor. Subsequent MRI demonstrated spinal cord ischaemia. Review of the CT confirmed the tip of the PICC to be in the spinal canal

M&M SESSIONS

Workshop 6: Essentials of Neurovascular Intervention: Pitfalls and Problems

Thursday, October 25
12:00– 12:15
Trans-arterial and Trans-venous Vein of Galen Treatment in a Symptomatic Newborn
Hasham H, Kirkpatrick D, Madarang E, Reeves A

The approach to this case was difficult due to limited available research and no set standard of care. A stepwise approach was taken for treatment to limit procedure time and to allow for the patient's intracranial vasculature to adapt to the changes of treatment. First treatment consisted of evaluation of the arterial vasculature and coil embolization of the dominant arterial pedicles. This resulted in 30-50% decrease in flow to the malformation. Second treatment consisted of coil embolization of additional arterial pedicles with marked reduction in flow. The patient developed mild IVH and SAH after the procedure. The patient was discharged, however his high output cardiac failure continued to progress. Upon resolution of the intracranial hemorrhage the third treatment was performed, which consisted of femoral and venous access with placement of a numerous venous coils with in the vein of Galen malformation. This resulted in complete embolization of the AVM. After the third procedure the patient developed intraparenchymal hemorrhage with massive interventricular extension and hydrocephalus. Bilateral ventriculostomy catheters were placed for decompression, however the massive hemorrhage resulted in death. The acute catastrophic hemorrhage was likely due to inability of the intracranial vasculature to compensate for the increased in flow after occlusion of the large AVM.

M&M SESSIONS

Workshop 6: Essentials of Neurovascular Intervention: Pitfalls and Problems

Thursday, October 25
12:15 - 12:30
Out of the frying Pan, into the fire
Lord D

A six month old girl presented for elective embolization of a vein of Galen aneurysmal malformation. She had undergone two previous embolisations with success and was no longer in cardiac failure. Neurological milestones were normal for age. At angiogram the malformation was seen to be mostly ablated however there was still filling posteriorly from the posterior pericallosal artery. This could not be accessed from the posterior circulation so it was determined to approach this from the anterior pericallosal artery. The events that followed will be described.

M&M SESSIONS

Workshop 6: Essentials of Neurovascular Intervention: Pitfalls and Problems

Thursday, October 25
12:30 - 12:45
Less is more…
Heran M

An 11 year old boy (weight: 13 kg) with Hutchinson-Gilford progeria and known severe cerebrovascular disease and TIAs in both hemispheres was considered for urgent endovascular revascularization. He had a known left vertebral artery stenosis in the high cervical region, extreme left ICA string sign, and right skull base ICA stenosis.

He was intubated and ventilated by Paediatric Anaesthesia. Dual arterial access was used. Selective catheterization of the left vertebral artery again demonstrated the high grade (>90%) focal stenosis of the high cervical left vertebral artery, at the C1-2 level. Contrast filling of the anterior circulation was quite attenuated, especially on the right. There was a request made for 1300 units of Heparin to be administered intravenously (100 units per kilogram) prior to advancement of the 5 French catheter into the high cervical portion of the left vertebral artery. However, this medication was not administered by Paediatric Anaesthesia, with repeat biplane angiography just prior to planned crossing with a microguidewire demonstrating non-occlusive filling defects within the vertebral artery immediately downstream from the high grade stenosis. This was recognized immediately as intraluminal thrombus, with the patient immediately given 1300 units of Heparin intravenously. Repeat biplane angiography of the high cervical left vertebral artery, as well as posterior fossa intracranial circulation no longer demonstrated the intraluminal thrombus, with no evidence of focal vascular cut-off to suspect acute embolic stroke.

Uneventful pre-stenting dilation and subsequent placement of a 2 x 10 mm BioDivYsio balloon expandable coronary stent was done, with post-dilation done using a 2.5 mm diameter Maverick balloon. There was marked improvement in the lumen of the stented portion of the vertebral artery, with profound improvement in intracranial flow, in all territories. The patient was transferred back to the Children's Hospital ICU for continued observation and monitoring. He was discharged neurologically well.

M&M SESSIONS

Workshop 6: Essentials of Neurovascular Intervention: Pitfalls and Problems

Thursday, October 25
12:45 – 13:00
Onyx the wonder drug
Lord D

A ten year old boy presents with an ophthalmic artery arteriovenous malformation. He was treated with Onyx casting of the draining vein. Initial good outcomes were complicated by a series of unfortunate events.

M&M SESSIONS

Workshop 7: GI - Managing bleeding, bowel rupture and perforation

Thursday, October 25
15:15 – 15:30
Appendiceal abscess drainage complicated by bowel injury
Lewis P, James CA, Moore MB, Pezeshkmehr A

11 year old male presented to the emergency department with 1 week of abdominal pain, nausea and vomiting. CT of the abdomen and pelvis with IV and oral contrast was performed which showed a loculated, periappendiceal abscess and appendicolith. Multiple loops of bowel overlaid the abscess. Patient was brought to interventional radiology and ultrasound evaluation showed the abscess with multiple overlying loops of bowel. A narrow window was identified with an interposed, echogenic, nonperistalsing structure felt to be omentum. Access was obtained with a micropuncture kit and a small amount of bloody, purulent fluid was aspirated. An 8.5 French drain was placed and location was confirmed with contrast injection.

Day 1 - 35 mL of thick serosanguinous fluid was drained and the patient had a small amount of blood in his stools. 10 mL normal saline flush TID. No relief of abdominal pain.
Day 2 - 80 mL of thick serosanguinous fluid was drained and there was no further blood in the bowel movements. 10 mL normal saline flush TID. No relief of abdominal pain.
Day 3 - Patient returns to the OR due to persistent abdominal pain. Pigtail was located within a loop of jejunum. Drain was removed and the hole was closed with 2 interrupted sutures. No residual abscess was identified. Appendix was removed piece-meal.
Day 4 – Significant improvement in abdominal pain.
Day 5 – Patient discharged home.

M&M SESSIONS

Workshop 7: GI - Managing bleeding, bowel rupture and perforation

Thursday, October 25
15:30 - 15:45
Bowel perforation after gastrojejunostomy tube placement
Agrawal V, Maller V, Prajapati H, Gold R

17 month old male with Bohring-Opitz syndrome, developmental delay, congenital hyperinsulinemia, G-tube dependency due to dysphagia requiring conversion to gastrojejunostomy catheter due to delayed gastric emptying. He underwent G tube to gastrojejunostomy tube conversion under fluoroscopy by interventional radiology without immediate complication.

The child decompensated on post procedure day 1, with fever and abdominal distension. CT scan of the abdomen revealed perforation of the small bowel by the tip of the GJ tube. Patient was immediately taken to surgery, and findings were confirmed. The bowel perforation was repaired, and GJ tube was left in situ. However, patient continued to deteriorate, and was found to have a large abdominal collection, which was drained by IR. Follow up contrast study through the drain catheter revealed fistulous communication of the abscess with the small bowel at the site of perforation. The GJ tube was replaced with a G tube, and patient improved on conservative management with small bowel rest and antibiotics. UGI contrast study after few days no longer showed a leak, and the abscess drain was removed. Patient’s hospital stay was prolonged due to this event.

M&M SESSIONS

Workshop 7: GI - Managing bleeding, bowel rupture and perforation

Thursday, October 25
15:45 – 16:00
Inferior Vena Cava Injury Related to Transjugular Liver Biopsy
Ma G, Amaral J

Background: Transjugular liver biopsy (TJLB) is performed in cases of severe coagulopathy and/or ascites for diagnosis of liver disease. Complication rates have been reported to be approximately 7%. Known complications include hemoperitoneum, capsule perforation, arrhythmia, intrahepatic and neck hematoma.

Case Description: We report the case of a 12-day-old girl (born at 39 weeks), weighing 2.3kg, who had an inferior vena cava (IVC) injury related to TJLB. The patient presented with liver failure after birth and was referred for TJLB due to ascites and coagulopathy: platelets of 50x10^9/L, INR 2.2 and PTT 50s. Procedure was performed under general anaesthesia. A 9F sheath was inserted into the right IJ. A wedged venogram performed from a branch of the right hepatic vein demonstrated no abnormalities. A 19G, 2cm-throw, Quick-Core biopsy needle introduced through a curved metallic catheter was positioned under fluoroscopy and ultrasound. The needle was partially deployed inside the metal cannula due to small patient size. Three passes and two cores were obtained. Patient remained stable throughout the procedure, however, post biopsy venogram showed contrast extravasation into the peritoneal cavity. The patient required blood products overnight but remained clinically stable the next day. Histopathology revealed giant cell hepatitis. Patient subsequently underwent a successful left-lobe liver transplant.

Conclusion: IVC injury is a rare complication of TJLB. This case may be helpful for future pre-procedural planning.

M&M SESSIONS

Workshop 7: GI - Managing bleeding, bowel rupture and perforation

Thursday, October 25
16:00 - 16:15

Hemothorax requiring embolization after percutaneous liver biopsy in a coagulopathic patient

Vo J

Description: A 13-year-old boy with hepatitis, jaundice, and positive ANA was scheduled and approved for percutaneous liver biopsy. Pre-procedure lab studies were significant for INR 1.43, PT 17.8 (12.4-14.7) and PTT 41 (24-36). After 2 units FFP transfusion, the biopsy was performed using ultrasound guidance and standard coaxial technique. A 15 Ga - 16 Ga system was chosen. Two adequate core samples were obtained, and gelfoam embolization of the tract was performed. After one needle pass, a small volume of perihepatic fluid was visible. This was a transient finding that did not persist. Hemostasis was obtained, and no perihepatic fluid was visible on immediate follow up images in the procedure room.

On the evening of PPD 0, the patient developed chest pain and respiratory distress. 4-hour hemoglobin dropped from 14.8 to 10.0, and vitals were stable. Chest radiograph demonstrated an opaque right hemithorax; ultrasound confirmed large pleural collection. Emergent bedside chest tube placement was performed by the pediatric surgical service. After transfusion of FFP, Vitamin K, 2 units PRBCs, and close clinical monitoring in the PICU, the patient stabilized and did very well. On PPD 7, the patient was discharged.

On PPD 20, the patient presented with gradually worsening chest pain and fever. CT showed vascular irregularity at the posterolateral 10th intercostal space. Angiogram demonstrated the pseudoaneurysm arising from intercostal artery. Coil embolization was performed, and no effusion or pain recurred.

M&M SESSIONS

Workshop 8: Cardiovascular and Thoracic Complications

Friday, October 26
09:00 – 09:15

Stable to Scary: Re-Expansion Pulmonary Edema Following Pleural Drain Placement

Brown J, Gardner G

IR was consulted on a 14 year-old female with T-cell lymphoma and multiple co-morbidities, including invasive fungal infection of the head and neck, with new onset tachypnea and labored respiratory effort. An updated chest radiograph revealed near complete opacification of the entire right hemithorax, and follow-up ultrasound confirmed a large right pleural effusion without significant septations or internal debris believed secondary to lymphoma and/or infection. IR performed aspiration of the right pleural effusion and pigtail drain placement under general anesthesia. Approximately 600 mL pleural fluid was removed intra-procedurally, pigtail drain placed and connected to waterseal, and the patient discharged to the PACU in stable condition. Approximately 1 hour later the patient became agitated with labored breathing and productive cough, requiring humidified oxygen via facemask. CXR showed significantly decreased pleural effusion and extensive right-sided patchy opacities. An unanticipated additional 950mL pleural fluid had drained post-operatively in the PACU, for a total output of 1550mL. The drain was clamped, patient intubated/ventilated, and transferred to the ICU where diuresis was initiated. The large volume pleural fluid removal, acute respiratory distress, and radiographs were consistent with re-expansion pulmonary edema.

Re-expansion pulmonary edema is a rare but serious complication following large volume removal of pleural fluid and rapid lung re-expansion. The exact pathophysiology remains unclear, and pediatric studies show varied times to symptom onset following re-expansion. Awareness is important so that intra-procedural measures, such as limited volume thoracentesis and/or clamping the pleural drain, can limit the volume and control the rate of pleural fluid removal.

M&M SESSIONS

Workshop 8: Cardiovascular and Thoracic Complications

Friday, October 26
0915 - 09:30
Abdominal parenchymal injury due to a limited window bedside inferior lateral approach chest tube placement.
Cao J, Collard, M., Kang, L.

11-year-old female with asthma presented with multifocal pneumonia and respiratory failure requiring ECMO. Her pneumonia was complicated by formation of bilateral loculated pneumathoraces. Chest tubes were requested in preparation for ECMO decannulation. There was no significant hemodynamic compromise related to the pneumothoraces. Initial surgically placed chest tubes were nonfunctional and complicated by hemothorax on the left. IR was then consulted for bilateral chest tube placement.

The position of the surgically placed chest tube and the persistent left lower air/fluid collection required an inferior approach. Patient's condition prevented repositioning and precluding a posterior approach. An 18 G needle was advanced below the existing chest tube under bedside c-arm guidance. Neither air nor fluid was able to be aspirated. A wire was advanced through the needle using C-arm guidance and appeared to coil within the air/fluid collection. The tract was dilated and a 10.2 Fr pigtail drain was placed with C-arm fluoroscopy. Immediate follow up radiographs were taken revealing sub-diaphragmatic pigtail catheter position. Although vitals had been initially stable, they soon destabilized after the drain was removed. Follow-up ultrasound revealed hemoperitoneum. The patient's hemoglobin and hematocrit continued to decline, requiring emergent laparotomy. An estimated 1.5 liters of fresh and old blood products and active bleeding from the lateral spleen was found and an emergent splenectomy was performed. Left renal injury was packed. The patient was stabilized, but eventually passed from DIC and hemorrhage one month later.

M&M SESSIONS

Workshop 8: Cardiovascular and Thoracic Complications

Friday, October 26
09:30 – 09:45

Glue Migration into Coronary Sinus during Thoracic Duct Embolization of Neonate

Srinivasa R, Chick JF, Gemmete JJ

Migration of glue during a neonatal thoracic duct embolization on a 2 week old (4 lbs 7 oz) neonate. Glue migrated into coronary sinus resulting in embolization to the right atrium. Glue was partially removed using a snare. Some glue unfortunately migrated into pulmonary artery requiring thromboembolectomy.

M&M SESSIONS

Workshop 8: Cardiovascular and Thoracic Complications

Friday, October 26
09:45 - 10:00
Post-thrombectomy Pulmonary Embolism
Durand R, Srinivasan A, Acord A, Cahill AM, Jablonka D, Janos A

A 17 year-old female with recent diabetic ketoacidosis (DKA) and right femoral venous catheter developed extensive right iliofemoral deep venous thrombosis. On day 5 of admission, she underwent IR guided manual suction thrombectomy followed by rheolytic thrombectomy with pulse spray technique. Venography of the IVC was clear. Within 3 minutes of initial infusion of 4mg of TPA, she developed sudden loss of end-tidal capnography and tachycardia, concerning for massive pulmonary embolism; this progressed to pulseless electrical activity, and cardiopulmonary resuscitation was initiated, with administration of epinephrine and chest compressions. A joint effort by IR, anesthesia, and the code team enabled the emergent conversion to pulmonary angiography and embolectomy in the IR suite. Angiography demonstrated occlusive right upper and middle lobar pulmonary emboli. Suction embolectomy followed by local infusion of 4 mg of TPA was performed, with continued resuscitation and systemic TPA infusion. Final pulmonary angiography demonstrated reduction in central pulmonary clot burden. Final LE venography demonstrated almost complete LE clot resolution. She was successfully stabilized, and transferred for ICU care for 3 days. Local resuscitation femoral arterial access was complicated by a femoral artery pseudoaneurysm treated with local thrombin injection. No long-term sequelae or evidence of clinically significant post-thrombotic syndrome after completion of anticoagulation treatment.

M&M SESSIONS

Workshop 8: Cardiovascular and Thoracic Complications

Friday, October 26
10:00 – 10:15
Bronchial artery embolization complicated by multifocal cerebral infarcts
Monroe E

An 18-year-old female with a history of cystic fibrosis and history of two prior bronchial artery embolizations presents with recurrent massive hemoptysis. Bronchial arteriography was performed during which two left sided arteries were catheterized and embolized to near stasis using a combination of 300-500 micron and 500-700 micron embospheres.

During recovery, the patient reported diplopia as well as significant dizziness and imbalance when standing. Physical exam revealed a left third nerve palsy. Urgent brain MRI demonstrated multiple acute ischemic infarcts within the left cerebellar hemisphere, bilateral basal ganglia, left caudate nucleus, left posterior temporal lobe, and in the left medial midbrain. She was not anticoagulated due to recent hemoptysis and stable neurologic symptoms. Hemoptysis ceased. Third nerve palsy and imbalance nearly resolved within two days. Diplopia gradually improved over several weeks. At last follow-up, three years post procedure, she reported rare diplopia only when very fatigued and no other neurologic symptoms.

The patient's stroke was initially attributed to unseen bronchial artery to pulmonary venous shunting. Retrospective review, however, revealed misidentification of the left supreme intercostal artery as an accessory left bronchial artery which like gave rise to vertebral collateralization at the apex.

M&M SESSIONS

Workshop 8: Cardiovascular and Thoracic Complications

Friday, October 26
10:15- 10:30
A Failed Bronchopleural Fistula Embolisation
Gibson C

12 yo male with a history of myelodysplastic syndrome treated with a maternal stem cell transplant which was complicated by GVHD and recurrent angioinvasive pulmonary aspergillosis. After treatment was left with multiple pulmonary cavities, one of which connected to several large bronchopleural fistula resulting in a refractory pneumothorax. Patient condition deteriorated. Weight was 5 kg below the requirement for a lung transplant and pleurodesis considered undesirable due to planned transplantation. Minimally invasive treatment considered the only option. Dual ETT used to separate lung ventilation. Planning bronchography performed to map out the fistulas. Selective embolisation of the fistulas performed using 70% glue only. Initially encouraging results however ultimately unsuccessful due to the calibre of the fistula with glue layering in the channels rather than occluding them. Thoracotomy 2 months later did resolve the leaks but condition had deteriorated so much by that time that the patient dies. Was embolisation the right choice here? Should scaffolding have been used as an adjunct to the glue?

M&M SESSIONS

Workshop 9: Really? You did that??

Friday, October 26
12:00 – 12:15
Non-Target Glue Embolization of the Thoracic Duct to the Pulmonary Arteries
Collard M, Cao J, Kang L

15-month-old female with pre-B cell ALL on chemotherapy recovering from labial necrotizing fasciitis developed high-output chylothorax. After failing low triglyceride diet, she was referred for lymphangiogram and thoracic duct embolization. Lymphangiogram showed a leak at the level of the diaphragm. The thoracic duct was successfully embolized with coils and NBCA glue (2:1 concentration lipiodol to glue).

Glue was injected as the catheter was withdrawn to seal the thoracic duct puncture. During this maneuver, glue embolized into the IVC and right heart. Interventional cardiology was emergently consulted and right common femoral vein access was obtained. An angled pigtail catheter was then used to obtain pulmonary angiograms which showed markedly diminished flow to the left lower lobe as well as decreased flow to smaller areas of the right lung. The patient was then anticoagulated with heparin (50 U/kg). A snare and balloon were used to break up and tack down the large left pulmonary artery component as little glue could be removed. This resulted in improved flow to the left lower lobe. The patient remained hemodynamically stable throughout the procedure with unchanged oxygen requirements. She was admitted to the intensive care unit for close overnight observation.
Post procedure echocardiogram was unremarkable. CT angiogram of the chest the following day showed residual saddle embolus of glue material and multifocal occlusion of distal small branches with associated small infarctions bilaterally. Chylous chest tube output decreased dramatically and was removed 5 days later. The patient was placed on prophylactic dose enoxaparin for one month.

M&M SESSIONS

Workshop 9: Really? You did that??

Friday, October 26
12:15—12:30
Vertebrobasilar Stroke after Percutaneous Doxycycline Sclerotherapy of a Cervical Spine Aneurysmal Bone Cyst
Chengazi H, Gill AE, O'Dell MC, Hawkins CM

A 12-year-old male patient presented with neck pain in February 2018. Imaging demonstrated a large, expansile, cystic mass in the C4 vertebral body with a pathologic compression fracture that was surgically stabilized with anterior fusion of C3-C5. Pathologic specimens obtained at the time of surgery confirmed an aneurysmal bone cyst (ABC).

The patient was referred to Interventional Radiology for percutaneous sclerotherapy of the ABC and underwent percutaneous sclerotherapy with doxycycline foam (5 mL of 40 mg/mL doxycycline + 5 mL 25% Albumin + 5 mL air, + 2mL contrast) in March 2018, without complication and was discharged following overnight observation, per protocol. The patient returned for a second, planned treatment session in April 2018.

At time of second intervention, AP and lateral digitally subtracted cystogram demonstrated a residual ABC cavity without evidence for reflux of contrast into cervical vasculature, or leakage of contrast outside of the lesion. The procedure was performed via a single percutaneous 18G Chiba needle through which the doxycycline-albumin foam (as described above) was slowly infused, without resistance. Post-procedure cone-beam CT was performed showing distribution of foam throughout the lesion. Following the procedure, the patient was slow to recover from anesthesia, disoriented, and complained of abnormal vision. He remained lethargic overnight with unchanged vision and development of weakness in his right lower extremity. An MRI was obtained showing multi-focal areas of acute ischemia in a vertebrobasilar distribution. The patient underwent inpatient rehabilitation for 3 weeks, and has nearly returned to neurologic baseline 3 months following the procedure.

M&M SESSIONS

Workshop 9: Really? You did that??

Friday, October 26
12:30—12:45

Hemorrhagic complication of hepatic vein access for combined IR/ Cardiac Cath procedure.

Green J, Donaldson J, Riaz A, Rajeswaran S

Background
18 year old patient with history of heterotaxy with interrupted IVC, scoliosis s/p spinal fusion, Abernethy malformation s/p repair with severe pulmonary hypertension and right heart failure. Percutaneous hepatic vein sheath placement by IR was requested by Cardiology to facilitate access for atrial septostomy and septal stent placement, with the goal of optimizing cardiac physiology.

Procedure
Successful IR placement of an 8 Fr sheath into a right hepatic vein branch. Successful atrial septostomy and septal stent placement performed by Cardiology. IR attempted transhepatic tract embolization with a 4 mm AVP2, although transhepatic access was lost. Attempts to percutaneously re-access the vein were not successful. Hepatic venograms via existing R IJV access showed no active extravasation, and there was no sign of extravasation on ultrasound, so the procedure was terminated.

Post Procedure
Several hours post procedure, the patient decompensated and was found to be in hemorrhagic shock. Aggressive fluid resuscitation, transfusion, and pressors were initiated. The patient was emergently transported to IR. Transjugular hepatic venograms showed no extravasation. As arteriography was initiated, the patient became pulseless. CPR was initiated, and an emergent laparotomy was performed in IR. No definite bleeding source was localized, and the patient unfortunately expired in the IR suite.

Explanation
Massive peritoneal hemorrhage, presumably from the hepatic vein access site, led to patient demise.

Considerations
Inadequate HV parenchymal tract for embolization

M&M SESSIONS

Workshop 9: Really? You did that??

Friday, October 26
12:45—13:00
Bad Bubbles . . .
Heran M

A 10 year old girl with a known diagnosis of hereditary hemorrhagic telangiectasia was admitted for pulmonary angiography and embolization of multiple pulmonary AVMs in the setting of worsening oxygen saturation levels (mid-80's). She was intubated for the procedure, and given a general anesthetic. The procedure was done via a right common femoral venous approach, with a 6 French 90 cm Destination sheath placed in the MPA. Therapeutic Heparinization was maintained throughout the case. Multiple PAVMs were treated using 0.038" non-detachable and detachable coils, which had been brought over from the adult hospital, given the limited inventory at the pediatric hospital. During the embolization procedure, this inventory was exhausted, and microcoils had to be used to complete the case, requiring the use of microcatheters, and adding to the length of the case. As we were nearing the end of the procedure (oxygen saturations now 98% on room air), Anesthesiology informed us of a sudden change in the patient's ECG, with elevated ST segments. No obvious angiographic complication had occurred, as this was not timed with a run, or with dislodgment of a coil. Shortly afterwords, the patient went into third degree heart block, with hypotension, and suspected acute coronary syndrome. This was felt to be due to an air embolism, source unknown. Aggressive fluid resuscitation was carried out, with administration through the sheath placed in the MPA, with stabilization of the patient clinically. Emergency transthoracic echocardiography was performed, demonstrating intracardiac gas, in all four chambers. The patient was positioned left side down and in Trendelenburg, with arrangements made for emergency transfer to the adult tertiary care center for hyperbaric therapy. Details regarding the source of the gas will be explained.

M&M SESSIONS

Workshop 9: Really? You did that??

Friday, October 26
13:00—13:15
Thinking outside the box
Lord D

A 4 year old boy presented with a venous malformation of the distal left quadriceps. Initial treatment with sodium tetradecyl sulphate sclerotherapy seemed to have no benefit and at follow up appointment other options were discussed. It was elected to use radiofrequency ablation. Under general anaesthesia a metal cannula was advanced into the malformation using ultrasound guidance. Following this digital subtraction contrast study was used to confirm the cannula in the malformation and so a cool tip RF 1cm probe was advanced through the cannula and the cannula withdrawn to expose the tip. Two radiofrequency burns were performed. After the procedure the patient woke in severe pain requiring bolus opiates and then a ketamine infusion by the pain team. His pain settled and he was discharged the following day. A follow up MRI was performed at 3months. This demonstrated subtotal ablation of the venous malformation as well as a large radiofrequency burn/necrosis in the distal femur involving 2/3 of the circumference. At six months the patient had ongoing limp and swelling and he returned to trial more sclerotherapy. Under general anaesthesia initial xray suspected a fracture of the femur and this was confirmed by DynaCT. The patient was transferred to orthopaedic surgery who performed a lateral plate and screws through the uninvolved bone. The patient is still having episodic swelling and pain from the venous malformation

"Never, ever, think outside the box."

SCIENTIFIC SESSIONS

Session One

Thursday, October 25
14:00 - 14:12
Portal Vein Recanalization without TIPS
Rabinowitz D, Dunn S, Aguado A, Sabado J, Johnson C
Presented by: Deborah Rabinowitz

Purpose
Chronic portal vein occlusion, or cavernous transformation, is a complex diagnosis with high morbidity. Traditional therapy is a mesoportal or splenorenal shunt. Endovascular recanalization has been successfully reported, however the majority of the current literature is adult based and usually is accompanied by a TIPS to improve outflow. These approaches are suboptimal in children with otherwise long life expectancy, as none restore native anatomy. We present a case series of 6 patients with chronic portal vein occlusion who underwent attempted native portal vein recanalization without concurrent TIPS creation.

Materials & Methods
This is an IRB-approved retrospective review of 6 patients (1 yr 8 months - 11 yrs 9 months) over a 2 yr period (2015-2017) at one institution who presented with symptomatic complete chronic portal vein occlusion. Each patient underwent a combined diagnostic/therapeutic endovascular attempt at anatomy delineation and percutaneous trans hepatic/transplenic portal vein recanalization without creation of a secondary TIPS. End points were radiologic portal vein patency, platelet count, splenic size, and gastric bleeding episodes.

Results
4/6 (67%) patients had successful recanalization and 2/6 (33%) underwent surgical shunt creation after endovascular failure. One patient had a mesoportal shunt and one had a splenorenal shunt after multidisciplinary evaluation of the diagnostic images. All of the recanalized portal veins have remained patent to date with 2 of the 4 achieving assisted patency.

Conclusion
Chronic portal vein recanalization in children can be achieved and maintained without creation of a TIPS. This restores native anatomy and avoids lifelong TIPS complications and maintenance.

SCIENTIFIC SESSIONS

Session One

Thursday, October 25
14:12 - 14:24

Minimally Invasive Treatment of Head and Neck Dermoids: Percutaneous Drainage and Radiofrequency Coblation

Braswell L/Foo M, Braswell LE, Lubeley L, Murakami JW
Presented by: Madeline Foo

Purpose

Dermoids are benign cysts containing skin elements such as hair follicles, sweat glands, sebaceous glands, and keratinous debris. Standard treatment is complete surgical removal, preferably without any spillage of cyst contents. In hopes of creating a less invasive procedure, we applied routine Interventional Radiology (IR) percutaneous techniques to this clinical entity. We would like to present our results using a combination of cyst drainage and radiofrequency (RF) coblation in treatment of head and neck dermoids in a cohort of pediatric patients.

Materials & Methods

The medical records, imaging, and procedural details were reviewed from a cohort of pediatric patients with dermoids treated at our hospital between 2008-2018. Patients in the study underwent ultrasound guided cyst puncture, sotradecol emulsification of the thick cyst contents allowing complete drainage, and radiofrequency coblation (cauterizing the internal lining of the dermoid). All patients were less than 18 years old with follow-up greater than 3 months.

Results

19 dermoids were treated in 18 different patients (aged 4 months - 14 years, mean 35 months). Dermoids were diagnosed clinically and with imaging in all cases. All dermoids were in the head and neck (cyst diameter between 7mm - 27mm, mean 12mm). Three had intraosseous extension. Treatment success was defined as complete clinical resolution of the cyst at follow-up evaluation (3- 40 months, mean 14 months). 15 dermoids were successfully ablated with 1 treatment, 3 required 2 treatments, and one persisted after 2 treatments for an overall success of 94%.

Conclusion

The combination of cyst drainage using sotradecol as an emulsifying agent and RF coblation is a safe and effective alternative treatment for pediatric patients with head and neck dermoids.

SCIENTIFIC SESSIONS

Session One

Thursday, October 25
14:24 - 14:36
Intrahepatic veno-venous collateralization in pediatric patients with falsely depressed wedged hepatic portal venous pressure gradients.
Monroe E, Shofner Michalsky W, Koo K, Horslen S, Shivaram G
Presented by: Whitney Shofner Michalsky

Purpose
The purpose of this study is to evaluate the incidence of intrahepatic veno-venous collaterals in pediatric patients and the reliability of wedged hepatic portal venous gradient measurements (HPVG).

Materials & Methods
Clinical history, procedural reports, and imaging from cases of all transjugular hepatic venograms (from 2010-2017 at a single institution) with attempted wedged portal venography with HPVG pressure measurements were reviewed. Pressure gradients and the presence of hepatic vein to hepatic vein (HV-HV) collaterals were assessed.

Results
Attempted wedged portogram during portal venography was performed in 16 children. Macroscopic HV-HV collateralization was identified in 11/16 (69%) of patients. Four patients with HV-HV collateralization went on to have additional interventional procedures with direct pressure measurements which confirmed falsely depressed hepatic portal venous gradients with a mean HPVG wedge pressure of 4.75mmHg compared to a mean true HPVG of 13.25mmHg. Median wedged and true HPVG measured 4mmHg and 12mmHg respectively. Additionally, 8 patients with angiographic HV-HV collateralization with "normal" HPVG's were found to have varices by endoscopy (with or without variceal bleeding) indicating portal hypertension.

Conclusion
HV-HV collateralization is frequently encountered in children undergoing attempted wedged portal venography and leads to falsely depressed HPVG's. All patients undergoing HPVG measurement should have wedged venography to identify collaterals, whose presence may signal inaccuracy of measured HPVG. Direct portal pressure measurement via trans-hepatic or trans-splenic access may be useful when the accuracy of the indirect method is called into question.

SCIENTIFIC SESSIONS

Session One

Thursday, October 25
14:36 - 14:48

Transjugular and transfemoral-transcaval transvenous liver biopsy in congenital heart disease

Gans J, Kuc N, Agarwal P, Pass RH, Sutton NJ, Ovchinsky N, Jagust M, Cynamon J, Golowa Y
Presented by: Jared Gans

Purpose

Patients with longstanding congenital heart disease can develop liver dysfunction secondary to congestive hepatopathy. Portal venous pressure and pathologic evaluation for fibrosis is often required to monitor progression of liver disease or prior to heart or combined heart/liver transplantation. Traditional transjugular liver biopsy (TJLB) may be difficult due to Fontan anatomy or necessitate additional venous puncture during transfemoral cardiac angiography. Transfemoral-transcaval liver biopsy (TFTC) has been described and may be suitable in these patients.

Materials & Methods

This was a single center, retrospective review of 24 transvenous liver biopsies which occurred from 2011 to 2018 in 23 patients with congenital heart disease and prior cardiac surgery (median age 26 years, range 12-52, 48% male). 23 (78%) patients had undergone previous Fontan procedures. 21 of 24 biopsies (88%) occurred during cardiac angiography procedures.

Results

9 biopsies were TJLB and 15 biopsies were TFTC, yielding 1-5 core specimens. Patient anatomy and pre-existing venous access for concurrent cardiac angiography were the primary determinants for technique. Portal wedge pressures were obtained in 21/24 cases (88%) (7/9 TJLB, 14/15 TFTC). All biopsies were technically successful. 2 biopsies (8%, 1 TJLB and 1 TFTC) were fragmented however all biopsies yielded histopathological diagnoses. One patient required intensive care and blood transfusion for hemorrhage status post TJLB. There were no major complications after TFTC.

Conclusion

Both TJLB and TFTC approaches are feasible in patients with congenital heart disease. TFTC may be advantageous in patients with challenging anatomy or obviate the need for secondary access during concurrent cardiac catheterization.

SCIENTIFIC SESSIONS

Session One

Thursday, October 25
14:48 - 15:00

Endovascular closure of ectatic veins reduces risk of PE in patients with KTS and CLOVES.

Chewning R, Alomari A, Shaikh R, Lillis A, Chaudry G
Presented by: Rush Chewning

Purpose

Persistent embryonic veins and ectatic orthotopic veins are often present in patients with CLOVES and KTS. The presence of these veins conveys a high risk for pulmonary embolism (PE). A recent study conducted by our center demonstrated an 8% incidence of symptomatic PE in this population. As a result, we began closing these veins prophylactically in attempt to reduce the risk of PE. The purpose of this study was to evaluate the effectiveness of endovascular closure of embryonic and ectatic orthotopic veins in preventing PE in patients with CLOVES and KTS.

Materials & Methods

This single center, retrospective review identified patients with a diagnosis of CLOVES or KTS who underwent closure of dilated veins between 2000 and 2017. Outcomes documented included incidence of PE after vein closure and need for retreatment due to recanalization.

Results

81 patients with a diagnosis of KTS or CLOVES underwent closure of ectatic veins. 5/81 (6.2%) had a history of PE prior to venous closure. One patient undergoing staged closure of ectatic veins developed PE in the interim between embolization procedures. One patient with an extensive thrombosis history developed PE in the context of sepsis and a documented DVT in the popliteal vein. No other patients developed symptomatic PE following closure of veins. Minor complications occurred in 8/81 (9.9%). There were no major complications. 10/81 (12.3%) required repeat closure due to recanalization.

Conclusion

Endovascular closure of ectatic veins in patients with CLOVES or KTS significantly reduces risk of PE.

SCIENTIFIC SESSIONS

Session Two

Friday, October 26
11:00 - 11:12

Pediatric clinical applications of Intravascular Ultrasound: Early experience

Shellikeri S, Acord M, Srinivasan A, Cahill AM
Presented by: Anne Marie Cahill

Purpose
To describe our initial experience with the utility of intravascular ultrasound (IVUS) as an adjunctive imaging tool in endovascular interventions in children.

Materials & Methods
Procedures in which IVUS was used as an adjunctive imaging tool for vascular interventions were included under a prospective IRB approved protocol.

Results
Nine procedures using IVUS imaging (Volcano, USA) in 9 patients were identified (6 Male, 3 Female), mean age: 11 years (range: 3-17 years), mean weight: 46 kg (range: 16-98 kg).
Technical success was a 100%. Procedures included i) Renal angioplasty (3/9): to assess vessel size pre and post-angioplasty, reduction in stenosis and to exclude dissection/thrombosis, ii) Venoplasty of portal vein stenosis (2/9) for vessel sizing: In one, IVUS demonstrated an elastic stricture without diameter improvement and no complications, future stent placement is considered. In the second, IVUS demonstrated improvement post-venoplasty without complication, iii) Radial-cephalic arteriovenous fistula angioplasty (1/9): IVUS showed improved diameter of the anastomosis without complication, iv) Popliteal and distal superficial femoral vein thrombectomy (1/9): to confirm clot resolution and procedure completion, v) Paget-Schroetter right subclavian vein thrombectomy and angioplasty (1/9): to confirm clot resolution and persistent moderate vessel compression, vi) Iliofemoral thrombolysis with May Thurner compression (1/9): for vessel sizing and clot burden assessment in iliofemoral system, completion IVUS demonstrated clot resolution and improved common iliac vessel diameter post-angioplasty. No intra-procedural complications occurred with IVUS use.

Conclusion
Our early experience demonstrated IVUS utility in assessing vessel diameter, clot burden, response to angioplasty and thrombolysis in the pediatric population with no intra-procedural complications.

SCIENTIFIC SESSIONS

Session Two

Friday, October 26
11:12 - 11:24
Is Sclerotherapy an Effective Treatment Option for Ranulas or Thyroglossal Duct Cysts in Children?
Wong K, Aria D, Dance L, Schaefer C, Kaye R, Towbin R
Presented by: Kevin Wong

Purpose
To assess the utility of sclerotherapy in the treatment of ranulas and thyroglossal duct cysts.

Materials & Methods
From 2015-2016, 8 patients were referred for sclerotherapy of ranula or thyroglossal duct cyst. Treatments were performed with standard sclerosing agents. With ranulas, sclerotherapy was performed in conjunction with salivary gland botox/ethanol injection. 22-gauge needles were used for US-guided access, with ranula sclerotherapy performed via drainage catheters. Dwell times ranged from 15min-3hrs. Ultrasound-guided salivary gland injection/ablation was performed using 22-gauge needles with injection of central gland or portion abutting ranula. Patients had follow-up ultrasounds at > 8 weeks.

Results
Total of 23 sclerotherapy treatments were performed. Of 8 patients, 2 were lost to follow-up after single sessions. Remaining 6 patients had follow-up ultrasounds after each of remaining 21 sessions. 4 patients showed initial improvement while 2 showed no improvement. 4 patients who initially showed promising response had recurrence on follow-up imaging and ultimately, demonstrated no favorable response after subsequent treatments. In summary, all 6 patients followed show no appreciable response to treatment.

Conclusion
Despite the emergence of clinical requests for sclerotherapy of ranulas and thyroglossal duct cysts, in our case series, sclerotherapy has not proven to be an effective treatment option using our current drug regimen.

SCIENTIFIC SESSIONS

Session Two

Friday, October 26
11:24 - 11:36

Catheter-directed pharmacologic thrombolysis for acute submassive and massive pulmonary emboli in children and adolescents

Shah J, Gill A, Ji D, Durrence W, Paden M, Patel K, Hawkins CM,
Presented by: Jay Shah

Purpose

The standard of care for pulmonary embolism (PE) in adults and children is anticoagulation and systemic intravenous thrombolysis inferring an associated risk of major hemorrhage. Catheter-directed-thrombolysis (CDT) is a relatively safe and effective alternative to systemic thrombolysis in adults with massive/submassive PE while delivering lower doses of thrombolytics; however, existing medical literature assessing safety and efficacy of pulmonary artery (PA) CDT for PE in children is limited.

Materials & Methods

A 16-month retrospective review of EMR and PACS was performed of patients < 21 years-old who presented with massive or submassive PE and were treated with PA-CDT at a tertiary care children's hospital. Multiple parameters were analyzed including indications, technical success, clinical efficacy, and safety of CDT.

Results

Nine-patients (mean 13.9 years-old; range 6-19) with massive/submassive PE who underwent PA-CDT were included. PE was diagnosed by CT-angiography and CDT was technically successful in all cases. At cessation of CDT, follow-up pulmonary-angiography revealed complete thrombus resolution in 4-patients, partial resolution in 5-patients. Mean PA pressures decreased in all patients (mean pre-CDT PA pressure=36.5 mmHg; mean post-CDT PA pressure=28.0 mmHg). CDT alone was clinically successful in 7-patients (78%). One-patient with acute-on-chronic PE with severe pulmonary hypertension required surgical thrombectomy of chronic-thrombus after CDT of acute-thrombus. One-patient died following cessation of CDT for reasons unrelated to CDT procedure. There were no immediate bleeding complications from CDT therapy. All patients who survived were maintained on anticoagulation treatment following CDT.

Conclusion

PA-CDT is a technically feasible and relatively safe therapeutic option for children and adolescents with submassive and massive pulmonary emboli.

SCIENTIFIC SESSIONS

Session Two

Friday, October 26
11:36 - 11:48

A Multidisciplinary Approach to VA ECMO Cannulation in Children

Kukreja K, Cunningham M, Gleeson E, Burgman C, Musick M, Thomas J, Gardner G, Vogel A, Kukreja K
Presented by: Kamlesh Kukreja

Purpose
Extracorporeal membrane oxygenation (ECMO) supports oxygenation and circulation in critically ill patients. The purpose of this study is to describe a multidisciplinary approach to ECMO cannulation using the expertise of interventional radiology (IR) and pediatric surgery (PS), especially percutaneous placement of distal perfusion cannula (DPC) by IR to maintain limb perfusion.

Materials & Methods
Included were non-cardiac, pediatric patients (<18 years) that underwent percutaneous cannulation for peripheral veno-arterial (VA) ECMO by IR and PS from 4/2017 to 5/2018. Excluded were cardiac patients, and children cannulated by PS alone

Results
Five patients were included. Median age was 16[12.5-17] years and 3 were female. Four children underwent cardiopulmonary resuscitation prior to cannulation. Catheters were placed by PS (venous) and IR (arterial) under ultrasound guidance using the Seldinger technique. Median arterial and venous catheter sizes were 19[17-22] Fr and 25[25-28] Fr, respectively. All catheters were placed in the femoral vessels. IR also placed a 6Fr antregradeantegrade DPC in the ipsilateral superficial femoral artery at the time of cannulation (n=5). The median time from procedure start to ECMO initiation was 1.7[1.1-2.1] hours. Upon decannulation, a mechanical arterial hemostasis device was placed at cannula and DPC sites. There was one episode of post-decannulation bleeding that did not require surgical intervention. No patients had loss of limb circulation. Survival to discharge was 60%.

Conclusion
A multidisciplinary approach to peripheral VA ECMO cannulation is feasible and safe. Maintenance of limb perfusion by percutaneous placement and removal of DPC may be an advantage of this collaborative approach.

.

SCIENTIFIC SESSIONS

Session Two

Friday, October 26
11:48 - 12:00

Cryoablation Alone Vs Cryoablation And Bleomycin In Treatment of Fibro-Adipose Vascular Anomaly. Which Is Better?

Shaikh R
Presented by: Raja Shaikh

Purpose
To compare the treatment outcomes in patients with FAVA who were treated with cryoablation alone versus those who were treated with combined cryoablation and bleomycin injection.

Materials & Methods
The study included a cohort of 40 patients with FAVA. 20 pts underwent percutaneous cryoablation only and 20 pts underwent a combined procedure with cryoablation and bleomycin injection. Follow up was performed at 1 month, 2 to 5 months, 6 months and 12 months or more. The outcomes were based on the brief pain inventory scoring (BPI), concurrent symptoms, clinical response and patient satisfaction.

Results
Following the procedure there was significant improvement in pain, concurrent symptoms, and quality of life in both groups. However the time for this response was significantly shorter in the pts who underwent cryoablation with additional bleomycin injection. This response was seen earlier at 1 to 3 months in the latter versus 3 to 6 months in the former group.

Conclusion
Image-guided percutaneous cryoablation with bleomycin is more effective and provides faster response as compared to cryoablation alone in FAVA.

Thank you to the following sponsors for their support of the 6th International SPIR Meeting

Penumbra®

PHILIPS

AVANOS

angiodynamics

AMT
APPLIED MEDICAL TECHNOLOGY, INC.

GALT™

COOK®
MEDICAL

SIEMENS
Healthineers

Medtronic
Further, Together

Boston Scientific
Advancing science for life™

medCOMP®