University of Saskatchewan, Department of Medical Imaging

Resident Research Day 2019

Book of Abstracts

Friday June 7th, 2019

Acknowledgements:

Thank you again to everyone who has worked to make this a successful research day. This includes the quality research produced by residents, radiologists, and affiliated researchers. Our department administrative assistants Prachi Bandivadekar, Patricia Young and Kristin Atkinson organize the details. Finally, three local radiology groups (Associated Radiologists, University Medical Imaging Consultants, and Saskatoon Medical Imaging) have donated funds for motivational prizes to keep the whole thing interesting.

We are fortunate to have Dr. Marco Essig joining us from the University of Manitoba as our distinguished guest. He has completed fellowship programs in both Neuroradiology and Interventional radiology. He is currently the chair of the Radiology Department of the University of Manitoba, and Medical Director of the Diagnostic Imaging Program with the Winnipeg Regional Health Authority. He is an active researcher with over 200 published papers. We look forward to his insights and comments on the projects this year.

This year we will again be awarding the 'Stuart Houston Award for Medical Imaging Research at the University of Saskatchewan'. Dr. Houston practiced medical imaging at the University of Saskatchewan for 32 years, publishing extensively on medicine and the history of medicine. Dr. Houston is also an Officer of the Order of Canada and a member of the Saskatchewan Order of Merit.

There will also be a prize awarded for the best Quality Assurance project.

On behalf of the University of Saskatchewan residency program and the department of medical imaging I would like to sincerely thank everyone who has contributed to today. We look forward to an excellent day!

Dave Leswick

Research Director

Financial sponsors for today include:

UMC
University Medical Imaging Consultants

SMI
SASKATOON MEDICAL IMAGING

Department of Medical Imaging Research Day

Friday June 7th, 2019

8:30-8:40	D Leswick • Introduction	
8:40-8:50	Atieh Najafi Semnani • Implementation of Haptic Force Feedback to a 5DOF Robot in a Virtual Reality Environment for Tele-operated Sonography	Research
8:50-9:00	A Shafe • Development of a Robotic System for Guiding a Surgical Needle-based on Fluoroscopy Imaging	Research
9:00-9:10	N Ton • Developing a Contrast Agent for X-ray Phase Contrast Molecular Imaging	Research
9:10-9:20	U Goncin • Quantitative T_2 MR Imaging of Fibrosis in a Rat Model of Inflammatory Bowel Disease (IBD)	Research
9:20-9:30	G Bell • Implementation of a Tailored MRI Stroke Protocol	PQI
9:30-9:40	R Navqi • The Effect of Coordinated Investigations for Rural Lung Cancer Patients on Traveling and Time to Staging Completion	PQI
9:40-9:50	L Lanford • Determining Residual Gastric Volume in Healthy Children using Ultrasound	Research
9:50-10:10	---- COFFEE BREAK ----	
10:10-10:20	S Pike • Physeal Spurs: A Potential Association with Femoral Acetabular Impingement (FAI)	Research
10:20-10:30	S Pike • A Comparison of Complication Rates Associated with Totally Implanted Venous Access Devices (TIVADs) in the Arm versus Chest: Work in Progress	Research
10:30-10:40	S Adams • Patient Perspectives and Priorities regarding Artificial Intelligence in Medical Imaging	Research
10:40-10:50	R Naqvi • Computed Tomography (CT) on Call: An Online, Interactive Curriculum to Prepare Medical Imaging	Research

Residents for After-Hours CT image Interpretation

10:50-11:00	R Naqvi	
	• Comparison of Surgical Intervention for Knee MRIs Ordered by General Practitioners and Orthopedic Surgeons	Research
11:00-11:10	Y Du	
	• Use of FABS Positioning in the Evaluation of Triceps Injury on Elbow MRI: A Retrospective Study	Research
11:10-11:30	---------- COFFEE BREAK ----------	
11:30-11:40	M Wright	
	• Evaluation of Med-Comp, Dignity, Power Injectable Port at Royal University Hospital	Research
11:40-11:50	K Kanga	
	• Evaluation of Current Femoral Neck Version Measurement Techniques in MRI	Research
11:50-12:00	M Du Rand	
	• Coracoclavicular Bursitis: A Forgotten Diagnosis?	Research
12:10-12:10	G Watson	
	• Dual Energy CTA in the Setting of Acute Ischemic Stroke	Research
12:10-12:20	J Wang	
	• Fleischner Criteria Web App	Research
12:20-12:30	S Melendez	
	• Research on Research: How Many Resident Presentations at Canadian Medical Imaging Research Days Go on to Publication?	Research

---------- END OF PRESENTATIONS ----------

Implementation of Haptic Force Feedback to a 5DOF Robot in a Virtual Reality Environment for Tele-operated Sonography

Atieh Najafi Semnani[1], Reza Fotouhi[2], QianWei Zhang[2], Scott Adams[3], Haron Obaid[3]

Division of Biomedical Engineering[1], Department of Mechanical Engineering[2] and Department of Medical Imaging[3], University of Saskatchewan

Research Project

BACKGROUND/OBJECTIVE: A teleoperated sonography system allows a medical expert to perform an ultrasound examination on a patient remotely from an expert site. With a teleoperated sonography system, the motion of a master manipulator (such as a joystick carrying a virtual probe) is controlled by a medical expert and remotely reproduced at the patient site by a slave-robot carrying an ultrasound probe. Due to the remote application of the system, experts currently have no feedback of the force that the ultrasound probe applies on the patient. A better understanding of the force that a sonographer or radiologist applies on a patient is critical for safety when using a tele-operated sonography system. As a potential solution, we plan to evaluate forces acting on the patient body; such forces can be simulated in the master/expert site.

METHODS: In this research, we have presented a virtual reality haptic force feedback simulator compatible with a 5DOF haptic wand to implement haptic force feedback in the expert site. The calculation of haptic force feedback is based on collision detection between two objects using the Gilbert- Johnson-Keerathi (GJK) algorithm. We imported a 3D scan of the object in a 3D-viewer. In order to calculate the approximate amount of force, we developed a collision detection engine in MATLAB based on the GJK algorithm.

RESULTS: We found that the collision engine can efficiently detect a collision between a wand (representing an ultrasound probe) and a flat surface, providing promising results for future implementation of a virtual reality haptic force feedback simulator into a teleoperated sonography system.

Development of a Robotic System for Guiding a Surgical Needle-based on Fluoroscopy Imaging

Alireza Shafe[1], Alireza Amin Sharifi[2], Atia Najafi Semnani[1]

Division of Biomedical Engineering, University of Saskatchewan
Department of Urology, Shiraz University of Medical Sciences, Iran[2]

INTRODUCTION: In Laparascopic and Percutaneous Nephrolithotomy (PCNL) surgeries, fluoroscopy imaging is widely used to guide a surgical needle towards a specific target. In PCNL surgery, the fluoroscopy device is used for 60 seconds on average. A fluoroscopy device will capture 30 images per second. Some parts of surgeon's body such as head, neck and legs are not covered during an operation.

OBJECTIVE: The objective of this research is to advance the needle towards a specific target using fluoroscopy 2D images. To address the proposed objective, a robotic arm can be used along with a fluoroscopic device. Comparing with conventional methods, only few fluoroscopy images per second is required, that being said the reduction of the exposure time is one of the prominent contribution of this research.

METHODS: The fluoroscopy arm is adjusted, so that the target can be exposed by X-ray radiation. The desired target can be observed in the fluoroscopy monitor. Then the desired target (pixel) will be selected by the surgeon. In case of any possible movement of the patient body, an image processing algorithm can be developed to track the coordination of the selected target with respect to the center of fluoroscopy image. The robotic arm holding the surgical needle, will always use the real-time coordination of the target to align the needle towards the target, while gradually advancing the needle.

RESULTS: The research is currently ongoing, and the methodology is currently being established.

CONCLUSION: A reduction in fluoroscopy exposure time is expected compared to commonly used methods.

Developing a Contrast Agent for X-ray Phase Contrast Molecular Imaging

Ngoc Ton[1], Una Goncin[2], Arash Panahifar[2], Dean Chapman[2,3], Sheldon Wiebe[4] and Steven Machtaler[4]

Departments of Health Sciences College of Medicine[1], Canadian Light Source[2], Department of Anatomy and Cell Biology[3] and Department of Medical Imaging, University of Saskatchewan

Research Study

OBJETCIVE: Our objective is developing a contrast agent, based on ultrasound microbubbles (MBs) that can be detected using X-ray Phase Contrast (XPC) imaging. Our goal is to use this contrast agent to specifically identify small, developing breast tumours.

METHODS: Our approach was to determine what MB size and shell material gives the highest XPC signal. Lipid MBs were prepared by sonicating solubilized lipids while flushing with perfluorobutane. These polydisperse MBs were size separated using differential centrifugation. PVA microbubbles were constructed with two size distributions: 2-3 um and 3-4 um. The surface of 3-4 um PVA-MBs was modified to include charged polymers and/or iron oxide nanoparticles (SPIONs). MBs were embedded in 0.5% agar at 5x107 MBs/ml and imaged by X-ray micro-computed tomography at the Canadian Light Source. The number of visible MBs in a ROI (10 slice projection: 6.2 mm x 6.2 mm) was determined using ImageJ.

RESULTS: Lipid-MBs (6-10 um) generated the largest XPC signal (12981 MBs detected/6.2 mm2), that decreased as the diameter decreased, 4-6 um (1308), till they were no longer detectable. Uncoated PVA-MBs were not detectable at both size distributions (2-3 um: 1, 3-4 um: 38). An increase in the number of polymer-coated PVA-MBs was detected (320), with the highest number detected from SPIONs-coated PVA-MBs (2889) (Figure 1).

CONCLUSION: 6-10 um lipid MBs is the top candidate for future XPC-molecular imaging.

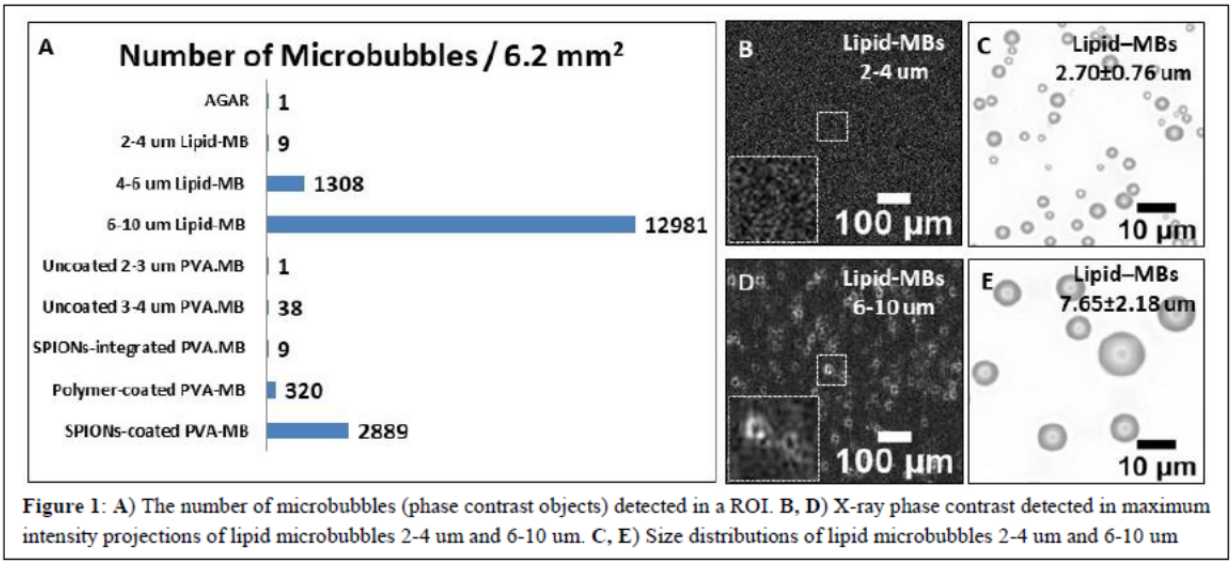


Figure 1: **A)** The number of microbubbles (phase contrast objects) detected in a ROI. **B, D)** X-ray phase contrast detected in maximum intensity projections of lipid microbubbles 2-4 um and 6-10 um. **C, E)** Size distributions of lipid microbubbles 2-4 um and 6-10 um

Quantitative T_2 MR Imaging of Fibrosis in a Rat Model of Inflammatory Bowel Disease (IBD)

Una Goncin[1], Lumeng Cui[2], Emily McWalter[2], Steven Machtaler[3]

Departments of Health Sciences[1], Mechanical Engineering[2], and Medical Imaging[3], University of Saskatchewan

Research Study - In Progress

OBJECTIVE: We aim to test the effectiveness of T_2 relaxation times to quantify bowel fibrosis using a rat model of chronic IBD. Our goal is to develop a fast, 3D clinical imaging measure of bowel fibrosis that can be used for assessing disease progression, response to therapy, and development of strictures.

METHODS: Bowel fibrosis was induced in rats (n=6) using 3, one-week cycles of 4% dextran sodium sulfate (DSS) in their drinking water, separated by 14 days of normal drinking water. Control rats (n=4) received normal drinking water. Following final DSS administration (>14 days), rats were anesthetized and imaged on Siemens 3T Skyra MRI. T_2 relaxation time maps were generated for each animal to obtain T_2 relaxation time estimate. Mean T_2 value (ms) was calculated from ROIs in slices of the descending colon (excluding lumen) and averaged. Animals were euthanized and bowels excised for histology.

RESULTS: Rats with DSS-mediated bowel fibrosis had a decrease in mean T_2 values (18.19± 3.42 ms) in comparison to control rats (29.48±3.47 ms). This correlated well with histological findings, which showed loss of normal mucosal architecture, mucosal and submucosal thickening, and increased collagen deposition.

CONCLUSIONS: There was a decrease in mean T_2 relaxation time in fibrotic rat bowels that correlated well with increased collagen deposition. These data suggests we can quantitatively identify and monitor fibrosis progression in patients with IBD.

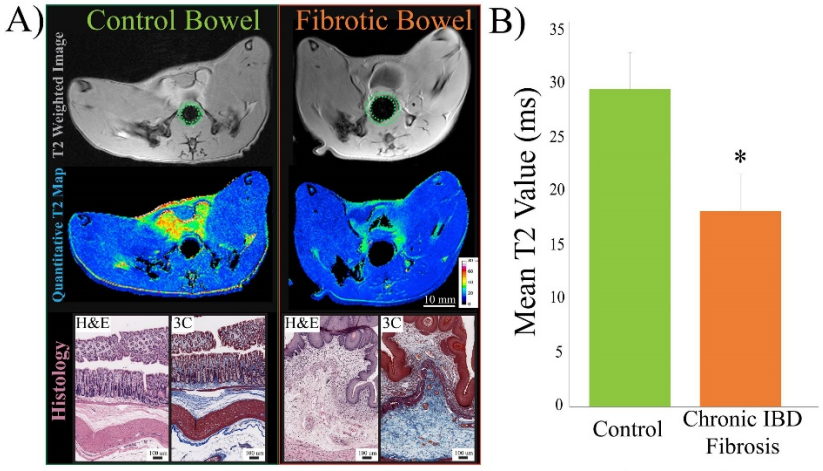


Fig. 1. Quantitative T2 MR imaging of bowel fibrosis in Sprague-Dawley rats. A) Control (left) and chronic IBD-induced fibrosis (right) rats imaged with quantitative T2 MRI. *Top*: T2 weighted images (bowels are highlighted with green dotted lines); *Middle:* quantitative T2 maps from the corresponding rats; *Bottom:* corresponding histology (H&E and Masson Trichrome [3C], scale bar = 100 um). B) Mean T2 values (ms) for control (n=4) and chronic-IBD induced fibrotic bowels (n=6).

Implementation of a Tailored MRI Stroke Protocol

Graeme Bell and Kyle Moulton

Department of Medical Imaging, University of Saskatchewan

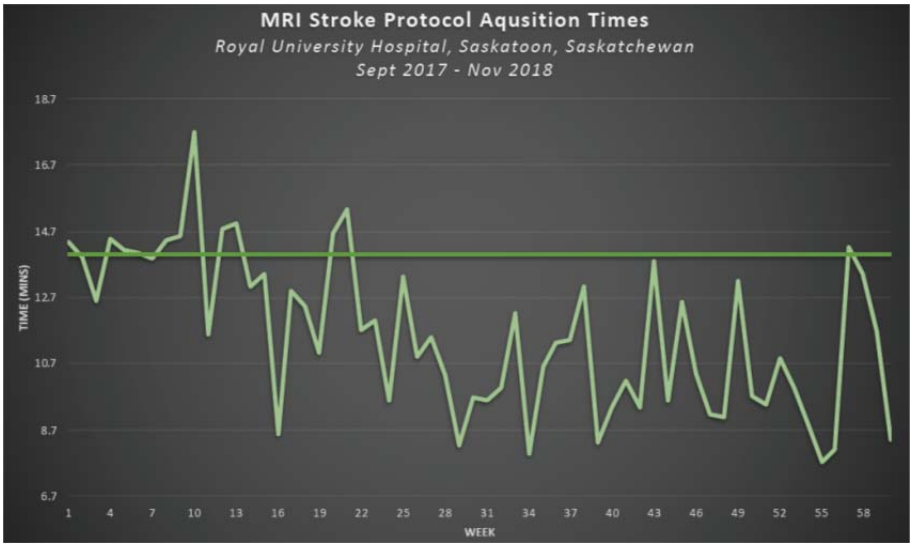
Quality Assurance Project

OBJECTIVE: Patients with acute stroke benefit from prompt diagnosis and treatment. Frequently used MR protocols at our institution contain sequences that add time but do not routinely contribute clinical information in the setting of stroke. There is growing recognition that a core set of specialized MR sequences (DWI, FLAIR, and SWI) is sufficient for making the diagnosis. Through local implementation of a dedicated "stroke" protocol, this initiative aims to achieve reduction in MR acquisition times. A secondary objective assesses for associated reduction in patient wait times.

METHODS: The formalized stroke protocol was implemented in January 2018. Our RIS database was searched for MR brain exams performed for stroke, collecting and reviewing five months of pre-intervention and ten months of post-intervention data, from Sep 2017 – Nov 2018. Two-sided t-tests were performed to test for differences between groups.

RESULTS: Of 477 total MR stroke exams preformed, 393 met inclusion criteria. The fast stroke protocol was used in 115/264 (56.4%) cases post-intervention compared to 8/129 (6.2%) pre-intervention. This resulted in significantly reduced acquisition times, with mean pre- and post-intervention acquisition times of 13.47 and 10.79 minutes, respectively ($p<0.001$). No difference in the rate of non-diagnostic studies between groups was observed. There was no significant difference in turnaround time ($p=0.935$).

CONCLUSIONS/IMPLICATIONS: Introduction of a specialized stroke protocol decreased MR acquisition times thereby improving the stroke imaging pathway at a primary stroke centre. Efforts will be made to further increase local adoption of the new protocol. Dissemination of these findings will encourage similar quality and throughput initiatives.



The Effect of Coordinated Investigations for Rural Lung Cancer Patients on Traveling and Time to Staging Completion

Raza Naqvi[1], Steven Bharadwaj[2], Renee Kennedy[2], Richard Bigsby[2],
Paul Babyn[1], C (Anderson) Tyan[3]

Department of Medical Imaging[1], Division of Thoracic Surgery[2], Division of Respirology, Critical Care and Sleep Medicine[3], University of Saskatchewan

PQI Project

INTRODUCTION: In Saskatchewan, the initial diagnostic and staging of the lung cancer patient's journey requires multiple specialized investigations to be completed in Saskatoon. With rural population making up a third of the Saskatchewan's total population, many lung cancer patients are expected to travel long distances. In this study, we aimed to assess the effect of coordinated investigations for rural lung cancer patients on the number of trips to Saskatoon and time to staging completion.

METHODS: In consultation with the thoracic surgery group, we identified grouping diagnostic and staging investigations on a single day as a driver for change. We then approached multiple departments to assess their limitations in completing their prospective testing. Inclusion criteria included patients with high suspicion of lung cancer and those who live more than 100 km away from Saskatoon. A lung cancer diagnostic form (Figure 1) was created to assist with inter-departmental communication. The intervention was implemented in March 2018 and prospective data was collected till March 2019.

RESULTS: 48 biopsy-proven lung cancer patients were included in our baseline data. In the post-intervention period, 43 lung cancer cases were identified. The pre and post-intervention days to staging completion reduced from 37 to 20 days (p=0.001). The pre and post-intervention unique number of trips to Saskatoon reduced from 3.4 to 2.9 trips (p=0.012).

CONCLUSION: The improved inter-departmental communication has resulted in a shift for the better in the number of trips made to Saskatoon and days to staging completion.

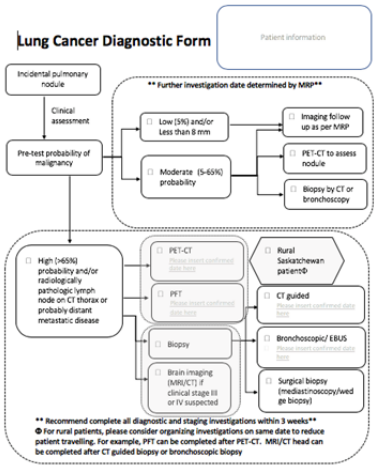


Figure 1: Lung Cancer Diagnostic Form

Determining Residual Gastric Volume in Healthy Children using Ultrasound

Leanne Langford[1], Krissie Urmson[2], David Leswick[1], and Tara Sander[2]

Departments of Medical Imaging[1] and Anesthesiology[2], University of Saskatchewan

Research study

OBJECTIVE: Fasting guidelines currently recommend clear fluids up to 2 hours before a procedure in order to reduce pulmonary aspiration risk. It is known that gastric volumes of <1.5mL/kg do not present an increased risk of pulmonary aspiration. Do current fasting guidelines correlate with safe gastric volumes or can fasting times be decreased?

METHODS: This was a prospective study using healthy volunteers aged 1-14 years, who followed ASA fasting guidelines prior to data collection. Gastric ultrasound was performed to determine the antral cross-sectional area. Following baseline measurements, participants consumed 250mL of a clear fluid and gastric volumes were then calculated at 30, 60, 90 and 120 minutes using the formula: Volume (mL) = -7.8 + (3.5 x RLD CSA) + (0.127) x age (months). The primary outcome was to determine the mean gastric volume/weight at 30, 60, 90, and 120 minutes.

RESULTS: Thirty healthy children participated in this study. The mean gastric volume/weight (ml/kg) at baseline was 0.51 mL/kg. The mean gastric volume was 1.55mL/kg at 30 minutes, 1.17 mL/kg at 60 minutes, 0.76 mL/kg at 90 minutes, and 0.59 mL/kg at 120 minutes.

CONCLUSION: Our results confirm that a healthy child's gastric contents are < 1.5mL/kg after 60 minutes, suggesting that current fasting guidelines could be liberalized.

Physeal Spurs: A Potential Association with Femoral Acetabular Impingement (FAI)

Samuel Pike[1], Mark Pearce[1], Ian Lutz[2], Rhonda Bryce[3], Prosanta Mondal[3], David Leswick[1] and Haron Obaid[1]

Departments of Medical Imaging[1], Orthopedic Surgery[2], and Community Health and Epidemiology3, University of Saskatchewan

Research study – In Progress

BACKGROUND: Physeal spurs (PS) are developmental spurs that form at the edge of the closed physis, a possible epiphyseal remnant. Although considered incidental normal variants (Keats), there are no data on the possible association between PS and FAI.

OBJECTIVES:
(1) To determine the prevalence of PS on MRI.
(2) To identify a potential association between PS and labral and cartilaginous changes on MRI.

METHODS: A retrospective review of hip MRI scans performed on the 3T MRI at the Royal University Hospital using the FAI protocol from 2016 to 2018. Data were collected on age, sex, presence or absence of PS, labral and cartilaginous injury. The images were reviewed by two MSK radiologists and PS were considered present if there was a focal bony protrusion extending beyond femoral head best fit circle as drawn on MRI images, but not meeting criteria for cam type morphology. We calculated the percentage of patients with a potential PS. Potential associations with labral and or cartilaginous injury as well as inter-reader agreeability is being assessed for.

RESULTS: Of the 112 patients identified, the mean age was 29.8 ± 7.1 years. Gender was 55% male and 45% female. Preliminary assessment identified sixteen patients with possible PS on MRI (14%), although on this preliminary assessment inter-rater correlation was very low (Kappa 0.06).

DISCUSSION: Physeal spurs may be present in 14% of our patient population, although inter-rater correlation was low. Moving forward consensus reads and a potential association between PS and labral or cartilaginous injury will be assessed for.

A Comparison of Complication Rates Associated with Totally Implanted Venous Access Devices (TIVADs) in the Arm versus Chest: Work in Progress

Samuel Pike[1], Brent Burbridge[1], Kiat Tan[2]

Department of Medical Imaging, University of Saskatchewan (Saskatoon[1] & Regina[2])

Research Project – In Progress

BACKGROUND: Canadian data on complication rates associated with TIVAD placement in the upper arm versus the anterior chest wall is limited.

OBJECTIVE: Compare complication rates for arm and chest TIVADs in subjects from two centres in Saskatchewan, where TIVAD anatomic implantation site is independent of patient characteristics. Site specific practices, therefore, should reflect device specific complication rates and not be biased by patient/operator preferences.

METHODS: Using locally available EMRs, we identified subjects > 18 years with TIVADs implanted by a radiologist using imaging guidance at: 1) RUH (Saskatoon) in the arm or 2) RGH (Regina) in the chest. The following complications are being compared between the arm and chest TIVADs over the device lifetime:
1) Periprocedural complications - excessive bleeding, arterial puncture, pleural injury, technical issues, implantation failure
2) Mechanical malfunction - occlusion, fracture, embolization (air or catheter), inability to infuse or withdraw blood
3) Line or TIVAD pocket infection
4) Venous thrombosis documented by ultrasound or pulmonary embolism.

Complications will be expressed as frequencies, percentages, and rates/1,000 catheter days.

RESULTS: Between July 2017 and January 2019, 75 subjects with arm and 47 with chest TIAVDs were identified. Three (4%) arm and 1 (2.1%) chest peri-procedural complications were identified.

CONCLUSIONS: This is work in progress and we expect to examine the above complications for approximately 150 - 200 subjects from each site.

Patient Perspectives and Priorities regarding Artificial Intelligence in Medical Imaging

Scott J. Adams[1], Rachel Tang[2] and Paul Babyn[1]

Department of Medical Imaging[1] and Social Sciences Research Laboratories[2],
University of Saskatchewan

Research Project

OBJECTIVE: To better understand patients' perceptions of artificial intelligence (AI) and patients' priorities for AI in medical imaging to inform the development and clinical implementation of AI in medical imaging.

METHODS: A patient engagement workshop was hosted with 17 participants from urban, rural, and remote communities throughout Saskatchewan, Canada, representing Indigenous and non-Indigenous perspectives. Facilitated roundtable discussions were conducted to better understand patients' perceptions of AI and patients' priorities for AI in medical imaging. Concepts from roundtable discussions were coded using NVivo 11 and analyzed using thematic analysis.

RESULTS: Patients' perceptions of AI were captured in the following three themes: fear of the unknown, trust (including uncertainty of what and whom to place trust in—AI or radiologists), and the importance of a human connection when using AI. Patients' priorities for improvements in medical imaging included improving communication, shortening time to diagnosis, reducing wait times, increasing diagnostic accuracy, empowering patients, and increasing access to diagnostic imaging and screening. Enthusiasm and willingness for AI to be used in medical imaging were related to patient age, with greater enthusiasm among younger patients. Patients were comfortable with sharing de-identified imaging data for AI development as long as appropriate safeguards were in place.

CONCLUSIONS: Patients' initial perceptions of AI may lead to reluctance for AI to be used in medical imaging, suggesting the need for patient education efforts. Patients identified numerous areas for improvement in medical imaging which could be enhanced through AI, potentially informing the prioritization of AI use cases.

Computed Tomography (CT) on Call: An Online, Interactive Curriculum to Prepare Medical Imaging Residents for After-Hours CT image Interpretation

Raza Naqvi, Neil Kalra and Brent Burbridge

Department of Medical Imaging, University of Saskatchewan

Research Project (Work in Progress)

BACKGROUND: Diagnostic radiology residents begin their overnight CT call shifts in their second year of residency (PGY2), after six months of exposure to medical imaging training. During this initial six-month period of training, residents are exposed to a designated two month clinical rotation in CT at the University of Saskatchewan. Presently, there is a lack of formal curriculum to prepare the residents for CT on-call shifts aside from their designated time in CT.

OBJECTIVES:

1. To implement an online, interactive curriculum that exposes residents to on-call type cases and prevent gaps in their knowledge that may occur related to the variability in clinical cases encountered during their introductory CT rotation.
2. To develop an assessment tool that allows radiology residents to objectively demonstrate their competency.

METHODS:

1. This is an educational project and exempted from Ethics Review as per the REB.
2. Develop a CT on Call Curriculum with interactive CT cases and an Assessment tool on Blackboard that showcase frequent pathologies encountered by residents on CT call.
3. Execute an on-site Pilot among local PGY2 residents
4. Send an invitation to the Diagnostic Radiology Program Directors at the Canadian institutions
5. All participants shall write a pre-test at the start of PGY2 prior to starting their first CT rotation
6. Randomly divide the participants into two groups:

a. Group 1: Exposed to the curriculum
b. Group 2: No exposure to the curriculum

7. All participants shall write a post-test after 1 month of CT rotation

RESULTS: Pending.

CONCLUSION: Pending.

Comparison of Surgical Intervention for Knee MRIs Ordered by General Practitioners and Orthopedic Surgeons

S Raza Naqvi[1], Cole Beavis[2], Prosanta Mondal[3], Rhonda Bryce[3] and David Leswick[1]

Departments of Medical Imaging[1], Orthopedic Surgery[2] and Community Health and Epidemiology[3], University of Saskatchewan

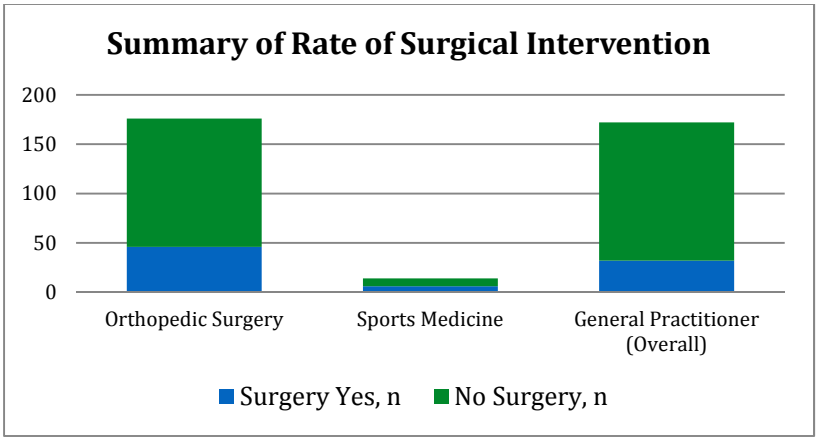
Research Project

INTRODUCTION: Currently in our health region, access to ordering knee MRIs is limited to specialists. However, general practitioners (GPs) can also order knee MRIs by seeking radiologist's approval or by following up on radiologist's recommendations on knee radiographs and/or ultrasound.

PURPOSE: To compare the surgical outcomes of patients that are referred for MRI directly by orthopedic surgeons versus GPs; and to further analyze the outcomes of subset of patients who attain knee MRIs due to various levels of radiologists' recommendations on prior imaging.

METHODS: Retrospective study of 363 patients referred by GPs (n=173), orthopedic surgeons (n=176), and sports medicine (n=14) for knee MRIs in Saskatoon during 2017. Radiologist recommendations for GP cases were grouped as "verbal discussion" of the case or by comment on previous imaging (follow-up of a specific structure, follow-up of a joint effusion, or general statement to get MRI if concerned). Chi-square testing and multivariable logistic regression were used to compare patients by surgical intervention status.

RESULTS: The intervention rate was higher for orthopedic referrals (26%). Overall intervention rate for GPs referrals was 19%, but by recommendation subgroup (verbal discussions or follow-up of specific findings) were 21% and 24% respectively. Mean patient age was higher in GP referrals (46 vs. 38), and older age was associated with less frequent surgery.



CONCLUSION: Surgical intervention following MRI is highest for patients referred by orthopedic surgeons, but some GP referred subgroups are similar. Lower intervention rates among GP patients appear partly attributable to older patient age.

`

Use of FABS Positioning in the Evaluation of Triceps Injury on Elbow MRI: A Retrospective Study

Yang Du and David Leswick

Department of Medical Imaging, University of Saskatchewan

Research Project - Work in progress.

BACKGROUND: Injury to the distal triceps brachii tendon is reported to be much rarer than that of the biceps brachii tendon and accounts for less than 1% of all tendon tears. There is little literature on the optimal MRI protocol technique for evaluation of distal triceps injury. In 2012 we started using a dedicated triceps imaging protocol including routing (extended position) and Flexed Abducted Supinated (FABS) positioning on the 3.0 Tesla MRI for suspected triceps injuries.

OBJECTIVE: The use of FABS positioning is well studied in the literature for the evaluation of distal biceps injury. We aim to assess the value of FABS in evaluation of distal triceps injury compared to conventional neutral elbow positioning.

METHODS: Montage was used to retrospectively identify patients who had elbow MRI reports which evaluated for distal triceps injury from February 13, 2012 to May 25, 2019 at RUH. The study images will be reviewed to identify those in which both conventional sequences as well as FABS sequences are obtained. Subsequently, two MSK trained radiologists will evaluate the paired sequences for ease of injury identification and extent of injury. Findings will then compared to surgical report where available.

PRELIMINARY RESULTS: Initial montage search returned 319 MRI reports of elbow MRI mentioning the keyword “triceps” in keyword search. 18 of those 319 studies contain description of distal triceps injury in the impression of the report. Review of the images is currently underway.

CONCLUSION: Work in Progress. Preliminary results are expected at the time of research day presentation.

Evaluation of Med-Comp, Dignity, Power Injectable Port at Royal University Hospital

Matt Wright and Brent Burbridge.

Department of Medical Imaging, University of Saskatchewan

Research Project

ABSTRACT: Implanted venous port devices are commonly requested by Oncology, largely for chemotherapy administration. The arm port at Royal University Hospital(RUH) was changed to the Med-Comp, Dignity due to the discontinuation of a previously supplied port. The power injectable Dignity port has an updated design and is made of a light weight polymer. The hypothesized benefits will be: a more comfortable patient experience, fewer complications, and to enable power injection of fluids.

METHODS: All patients who received a Med-Comp arm port at RUH between Oct 2017 and January 2019 will be included. To evaluate for potential complications, Philips Intellispace PACS will be queried to determine the in-situ duration, if the port required imaging assessment (removal, adjustment, contrast injection, or arm venous Doppler ultrasound), and whether the port was used for contrast power injection. Complication rates will be calculated and compared to previously published data.

RESULTS: After collection of data for 47 port insertions, two catheter related arm deep venous thrombosis (4.3%), and two port infections (4.3%) were documented. These complications are on par with meta-analysis data of 2.73% and 4.83% respectively[1]. We will continue to assess for complications to determine if rates fall within the range of previously published data.

DISCUSSION: It is important to assess the performance of this new arm port. Since the polymer based, power injectable design has not been used locally it is important to document complication rates to justify continuing to use this device, modifying our techniques, or using a different port for the benefit of our patients.

REFERENCES:

(1) B Burbridge, G Stoneham, HJ Lim, C Lee, 2015 (Jun). Radiology-Implanted Arm Ports: A Review of the Literature. Journal of the Association for Vascular Access, 20: 80-90

Evaluation of Current Femoral Neck Version Measurement Techniques in MRI

Kavita Kanga, Michael Shepel, and Haron Obaid

Department of Medical Imaging, University of Saskatchewan

Research Project

BACKGROUND: Femoral neck retroversion is a risk factor for the development of hip impingement and MRI can be utilized to measure the FNA. Currently employed MRI techniques to measure the FNA require imaging both the hip joint and knee joint to measure the epicondylar or retrocondylar line angles. This enables correction for internal or external rotation due to patient positioning in the MR scanner. More recently, the posterior lesser trochanteric line (PLTL) has been demonstrated to be effective for measuring the FNA on CT without the need of additional imaging of the knee joint. However, PLTL has not yet been assessed in MRI.

OBJECTIVE: This study will assess interobserver and intra-observer agreement between the retrocondylar, epicondylar and PLTL measurements in adults.

METHODS: Montage was used to retrospectively identify consecutive patients who underwent bilateral hip and knee MRIs in Saskatoon Health Region at Royal University Hospital from September 2016- March 2018. The sample size of 98 hips and knees (49 patients) was chosen for a level of significance of 0.05, power of 0.80 and equivalence margin of 3. Patients were excluded if they had prior arthroplasty/surgery or an inadequate study.

Measurement techniques were standardized among three independent readers, including two fellowship trained musculoskeletal radiologists and a senior radiology resident after an hour training session and literature review. Measurements were performed on PACS utilizing diagnostic monitors.

RESULTS: Of 58 consecutive patients, 49 patients met criteria and were enrolled. Patient demographics include 24 females, 25 males; median age 33, age range 20-41. Final results are pending statistical analysis.

CONCLUSION: To be presented on research day.

Coracoclavicular Bursitis: A Forgotten Diagnosis?

Mia du Rand[1], Prosanta Mondal[2], Haron Obaid[1] and Michael Shepel[1]

Department Medical Imaging[1] and Community Health and Epidemiology[2],
University of Saskatchewan

Research Project

PURPOSE: Edema was anecdotally identified in the coracoclavicular interval on several shoulder MRIs of subjects presenting with shoulder pain. Coracoclavicular bursitis has never been described on MRI. The prevalence and clinical relevance of this finding has also not yet been studied. Does fluid in the coracoclavicular bursa correlate with biomechanical factors? What is the correlation between coracoclavicular edema and AC joint, Rotator cuff and Glenohumeral joint pathology? The purpose of this study is to assess the prevalence of fluid in the coracoclavicular bursa (bursitis) and its association with common shoulder pathologies.

METHODS: A retrospective analysis of 200 shoulder MRI scans (3 Tesla) was obtained for patients presenting to RUH MRI with shoulder pain. The following criteria were used for inclusion: (a): age 18 to 80 years, (b): no history of inflammatory arthritis, (c): no recent surgery, (d): no tumor or infection. Sagittal PD FS images were used to assess for the presence of edema or fluid in the coracoclavicular interval. Measurements of the coracoclavicular interval and coracoid takeoff angle were obtained. Clinical information regarding patients' location of pain was gathered from the pre-imaging questionnaire to assess for relevance.

RESULTS: First reader data analysis pending. Pending interobserver analysis.

Dual Energy CTA in the Setting of Acute Ischemic Stroke

Gage Watson, Graeme Bell, and Kyle Moulton

University of Saskatchewan Department of Medical Imaging

Research Study (Work in Progress)

OBJECTIVES: To assess the utility of Dual Energy CTA in predicting final infarct compared to unenhanced CT.

METHODS: This is a retrospective study which is compliant with the HIPA as per the Research Ethics Board. All patients presenting to RUH with symptoms consistent with acute ischemic stroke were imaged using unenhanced CT and dual energy triple phase CTA from September 2018- February 2019. A total of 70 patients were scanned during this time period. Each patient's imaging was anonymized and will be individually interpreted by a neuroradiologist, a general radiologist, and a radiology resident. An ASPECTs score will be given to the unenhanced CT in isolation, the dual energy CTA in isolation, and finally to the unenhanced and dual energy CTA interpreted together. The final infarct core is determined by either a follow up CT or MRI > 24 hours after the patient's presentation.

RESULTS: In total, 70 patients have been scanned and are currently in the process of analysis of by the interpreting radiologists. Once this data has been compiled, it will be sent to statistics for further analysis. Representative examples and discussion will be presented at research day.

Fleischner Criteria Web App

Jimmy Tanche Wang, Tasha Ellchuk, Geoff Karjala, and Derek Fladeland

University of Saskatchewan Department of Medical Imaging

Research Project

PURPOSE:

1. Introduce a web based application for the latest 2017 Fleischner Society Guideline for the management of pulmonary nodules
2. Raise awareness of the revision of the Fleischner Society Guideline for the management of pulmonary nodules

DESCRIPTION: The Fleischner Society Guidelines for management of pulmonary nodules has been revised in 2017 based on new data and accumulated experience. The guidelines represent the consensus of the Fleischner Society which incorporates the opinions on the multidisciplinary international group of thoracic radiologists, pulmonologists, surgeons, pathologists, and other specialists. The guidelines apply to incidental pulmonary nodules with specific management recommendations based on a multiple of factors including the nodule type, multiplicity, size thresholds and clinical risk. A web based application (www.fleischnerapp.com)was developed to facilitate the dissemination and application of the latest Fleischner Society Guidelines for the management of pulmonary nodules.

SUMMARY: A web based application was developed to facilitate the dissemination and application of the latest 2017 Fleischner Society Guideline for the management of pulmonary nodules.

Research on Research: How Many Resident Presentations at Canadian Medical Imaging Research Days Go on to Publication?

Sarah Melendez and David Leswick

Department of Medical Imaging, University of Saskatchewan

Research Project

OBJECTIVE: Determine the percentage of resident presentations at Canadian medical imaging resident research days that go on to publication.

METHODS: Each of the thirteen English speaking diagnostic imaging residency programs across Canada was contacted via email to request data and participation in the study. Programs were then asked to provide details about presentations at resident research days between 2013 and 2017, including presenter name, presentation title and abstract (if available). Internet searching was then preformed to confirm if presenters were medical imaging residents at the time. Repeat presentations on the same topic in subsequent years were excluded.

In summer 2018, publications were identified via internet searching using resident name and keywords for each presentation via PubMed, web of science, and google. Identified publications were linked with the presentation to determine total number of publications and how many presentations resulted in publications by year at each school. Additional factors assessed were resident author order on publications, publishing journals, and time between research day presentation and publication.

RESULTS: Data was obtained from 7 residency programs, with information from a total of 32 research days available to review. From this, 287 unique resident presentations were evaluated. 99/287 (34%) presentations generated a total of 118 publications. Publication rates were lower for 2017 than other years, and overall school publication rates ranged between 19% and 73% by school. 82/99 (82%) presentations generated a single publication with 15/99 (15%) generating multiple publications. Mean time from presentation to publication was 12.3 ± 13.6 months, with 48% of publications within 1 year following research day, and 14% published before research. 76/118 (64%) of publications listed the presenting resident as first author. The most common journal to publish in was the Canadian Association of Radiologists Journal with 16/118 (15%) publications.

CONCLUSION: 34% of medical imaging research day presentations went on to publication, with variation in number of presentations and publications between schools.

Past Prize Winners

We would like to again recognize prize winners from previous years as follows:

Stuart Houston Award for Medical Imaging Research at the University of Saskatchewan

- 2018: Scott Adams (with B Burbridge, A Badea, N Kanigan, L Bustamante, I Mendez and P Babyn for his project "A Crossover Comparison of Standard and Telerobotic Approaches to Prenatal Sonography"
- 2017: Neil Kalra (with JN Pena-Sanchez, A Badea, S Vanderby, and P Babyn) for the project "A Day in MR: Exam Variation and Appropriateness of MRI Exams in Canada"
- 2016: Meredith Lynch (with D Leswick, S Kisch, R Bryce & H Lim) for the project "Image Quality in Day Optimizing Throughput (Dot) Knee MRI vs Routine Knee MRI"
- 2015: Navdeep Sahota and Nasir Khan (with M Shepel and H Obaid) for the project "Posterior Ankle Labral Changes at MRI: A Preliminary Study"
- 2014: Christopher Plewes (with B Burbridge) for the project "Comparison of a Power Injectable Versus a Non Power Injectable Totally Implanted Venous Access Device in the Upper Arm"
- 2013: Nasir Khan (with H Obaid, M Shepel & D Leswick) for the project "An MRI Study to Correlate between Increased Lateral Tibial Slope and Articular Cartilage Changes in the Knee"
- 2012: Christopher Plewes for the project "Towards Efficient MR Utilization"
- 2011: Darin White (with D Fladeland) for the project "Dual-Energy CT Pulmonary Angiography – Part I: Image Quality"
- 2010: Adelaine Wong (with D Leswick, H Nikota & S Webster) for the project "Dose Reduction in Scoliosis Surveys"

Past Prize Winners

Best Quality Assurance Project

- 2018: Raza Naqvi (with S Bharadwaj, R Kennedy, R Bigsby, P Babyn and C Tyan for the project "The Effect of Coordinated Investigations for Rural Lung Cancer Patients on Traveling and Time to Staging Completion"
- 2017: Jimmy Wang (with T Ellchuk, R Otani, G Groot and P Babyn) for the project "On-line TI-RADS Calculator"
- 2016: Navdeep Sahota (with H Obaid) for the project "Pre-MRI Patient Questionnaire: Clinical Audit"
- 2015: James Huynh (with D Leswick and F Rashidi) for the project "Retrospectively Conducted First Cycle of Practice Quality Improvement Evaluating the Technique of Liver Span Measurement Used by Sonographers at a Single Institution"
- 2014: Meredith Lynch (with B Burbridge) for the project "Use of Power Injectable Ports for Contrast Enhanced CT and MR"
- 2013: Brandy Sessford (with V Chow) for the project "Management of Asymptomatic Adnexal Cysts identified on Ultrasound: A Clinical Audit Project at the Saskatoon Health Region"

Past Prize Winners

Best Medical Student Project

- 2018: Bjorn Hunter (with N Kalra and D Leswick) for the project "Patient Symptom Questionnaires Result in Higher ACR and CAR Appropriateness Scores Compared with Physician Requisitions for Knee MRI"
- 2017: Jaques Van Heerden (with M Shepel and H Obaid) for the project "The Utility of Dual Energy CT in Visualizing the Menisci in Patients Unfit for MRI".
- 2016: Scott Adams (with B Burbridge, A Badea, L Langford, L Bustamante, I Mendez & P Babyn for the project "Initial experience using a telerobotic ultrasound system to perform adult abdominal examinations"
- 2015: Haven Roy (with B Burbridge) for the project "To CT, or not to CT? The influence of computed tomography on the diagnosis of appendicitis in obese pediatric patients"
- 2014: Danielle Dressler (with D Leswick) for the project "Canadian Association of Radiologists (CAR) Annual Scientific Meetings: How Many Abstracts Go On to Publication?"
- 2013 (split award): David Horne (with D Leswick & H Lim) for the project "The Case Breast Radioprotection During Abdominal CT"
- 2013 (split award): Neil Kalra (with B Burbridge, D Pinelle, G Malin & K Trinder) for the project "USRC: A Novel Method for Incorporating Diagnostic Radiology Images into the Medical School Curriculum"
- 2012: Anuj Dixit (with P Babyn) for the project "Contrast Media Safety and Education"
- 2011 (split award): Larissa Breanne Irving (with D Leswick, D Fladeland & H Lim) for the project "Knowing the Enemy: Health Care Provider Knowledge of CT Dose & Associated Risks"
- 2011 (split award): James Zheng (with D Leswick & D Fladeland) for the project "CT Dose to Patients Receiving Scans of Multiple Body Sites at a Single Visit in Saskatoon"
- 2010: Patricia Jo (with D Leswick, D Fladeland, R Otani & H Lim) for the project "Reduced Dose with Maintained Image Quality Utilizing 100 kVp Carotid CT Angiography"
- 2009: Chance Dumaine (with D Fladeland, D Leswick, and H Lim) for the project "Improving Radiation Dose from Diagnostic CT Examinations in Saskatchewan"
- 2008: Sumeer Mann (with Grant Stoneham) for his projects "Reproduction of a Phantom and Development of a 3D CT Reconstruction Protocol for the Assessment of Ventricular Volumes" and "Comparison of CT 3D Volumetric Analysis of Ventricular Size to Visual Radiological Assessment" and "Correlation of Frontal and Occipital (F/O) Horn Ratio to Ventricular Volume in Patients of Varying Ages, and Comparison with Evan's Ratio"

Past Prize Winners

Resident Research Award (awarded 2007 to 2009)

- 2009: Leslie Chatterson (with D Leswick*, D Fladeland, M Hunt & S Webster) for the project " Lead Versus RADPAD® Shielding for Fetal Dose Reduction during Maternal CT Pulmonary Angiography"
- 2008: Jennifer Tynan (with M Duncan and B Burbridge) for the project "Reduction of Adult Fingers Visualized on Pediatric Intensive Care Unit (PICU) Chest X-rays Following Radiation Technologist and PICU Staff Radiation Safety Education"
- 2007: Greg Kraushaar (with C King) for the project "Back to the Future: Shortening the Z Axis on Helical CT PE Studies without Compromising Diagnostic Power"

Resident Research Second Place Award (awarded 2008 to 2012)

- 2012: Nicolette Sinclair (with B Burbridge) for the project "Fluoroscopy of the Cook Vital Arm Port at the time of Removal"
- 2011: Andrew Scott (with D Leswick) for the project "Shaken or Swirled? Mixing Gadolinium for Arthrography"
- 2010: Aileen Rankin (with D Leswick) for the project "Patient Positioning in CT and the Induction of Sternoclavicular Joint Pneumatosis"
- 2009: Christina Theoret (with G Stoneham) for the project "Fibroid Size Reproducibility US vs MRI at Royal University Hospital"
- 2008: Sharon Goo for the project "Does Percutaneous Balloon Cryoplasty Improve Hemodialysis Access Longevity"

RSNA Roentgen Research Award:

- 2018: Neil Kalra
- 2016: Danielle Dressler
- 2015: Chris Plewes
- 2013: James McEachern
- 2012: Andrew Scott
- 2011: Leslie Chatterson
- 2010: Matylda Machnowska