VASCULAR SURGERY RESEARCH DAY

Friday May 26th, 2017

University Club of Toronto
380 University Avenue
Toronto, Ontario
It is with great pleasure that I welcome you to the Annual University of Toronto Vascular Surgery Research Day. It’s been another productive year and as we come to the end of the academic year we gather to celebrate the successes and research productivity of our faculty, students, residents, fellows and research trainees. This year’s Research Day has several new features, including the announcement of the Blair Foundation Innovation Fund Grant recipients, the Blair Early Career Professors, Researcher’s Forum sessions and a Rapid Fire session.

The highlight of the day will be the 6th Annual K. Wayne Johnston Visiting Lecture in Vascular Surgery. We are privileged to have Dr. Marc Schermerhorn from Boston as our guest. I’m sure his talks will be fascinating, informative and will inspire us to greater academic heights.

I’d like to extend specific thanks to the U of T Vascular Surgery Executive who made this day possible through their commitment to our academic mission. These surgeons include: Drs. Thomas Lindsay (Division Head, UHN), Mohammed Al-Omran (Division Head, St. Michael’s), Andrew Dueck (Division Head, Sunnybrook), Marc Pope (Division Head, Trillium), Kerry Graybiel (Division Head, Humber River), George Oreopoulos (Residency Program Director), Mark Wheatcroft (Fellowship Program Director), Elisa Greco (Director of Undergraduate Medical Education) and Giuseppe Papia (Quality & Best Practices).

Special thanks to Michelle Paiva, our Division’s Administrative Assistant, without who this day would not have been possible.

Also, we appreciate the generosity and commitment of W.L. Gore & Associates who are the premier sponsor of this event through an unrestricted education grant.

Welcome and I hope you enjoy the University of Toronto Vascular Surgery Research Day.

Sincerely,

Thomas L. Forbes, MD, FRCSC, FACS
Professor & Chair, Division of Vascular Surgery
University of Toronto
K. Wayne Johnston Visiting Lecturer in Vascular Surgery

In recognition of Dr. Johnston’s unprecedented contributions to our specialty of Vascular Surgery and the University of Toronto an annual lecture began in his name. Dr. Johnston was a founding member and President of the Canadian Society for Vascular Surgery and later became President of the Society for Vascular Surgery. He is a pre-eminent academic surgeon who served as Editor-in-Chief of the Journal of Vascular Surgery and Co-Editor of two editions of Rutherford’s Textbook of Vascular Surgery. No other Canadian, and few internationally, have contributed more to academic vascular surgery than Dr. Johnston. In 2009 he was honored with the Lifetime Achievement Award by the Society for Vascular Surgery.

This lectureship was made possible through the generous donations of faculty, students and alumni.

Previous Johnston Lecturers

<table>
<thead>
<tr>
<th>Year</th>
<th>Lecturer</th>
<th>Institution</th>
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<tbody>
<tr>
<td>2012</td>
<td>Joseph L. Mills</td>
<td>University of Arizona</td>
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<td>2013</td>
<td>Lewis B. Schwartz</td>
<td>University of Chicago</td>
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<td>Philip P. Goodney</td>
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2017 K. Wayne Johnston Visiting Lecturer in Vascular Surgery

Marc Schermerhorn, MD
Chief of Vascular & Endovascular Surgery
Beth Israel Deaconess Medical Center
Associate Professor of Surgery
Harvard University

Dr. Schermerhorn is Associate Professor of Surgery at Harvard Medical School and Chief of Vascular and Endovascular Surgery at BIDMC. He received his medical degree from Georgetown University School of Medicine in Washington, DC, and completed a residency in surgery at BIDMC. He went on to complete his fellowship in vascular surgery at Dartmouth-Hitchcock Medical Center in Hanover, NH. Board certified in vascular surgery, Dr. Schermerhorn's clinical interests include abdominal and thoracic aortic aneurysm and aortic dissection surgery (open surgery and endovascular stent grafting), carotid artery stenting and surgery, and lower extremity angioplasty and surgery.

Dr. Schermerhorn's research group has an active interest in outcomes research in vascular surgery on a local and national level. As the surgical armamentarium evolves to include emerging technologies in a variety of clinical settings, comparative effectiveness research has been instrumental in the identification of best practices from among an increasingly complex set of therapeutic options. His group's main interest is to compare outcomes after open surgery and endovascular surgery for a variety of vascular diseases, including aortic aneurysm, carotid disease, and lower extremity arterial disease, to help guide patient selection for each type of procedure. In order to understand the comparative effectiveness of various interventions, they have extended our inquiries beyond small, randomized controlled trials of ideal populations to study interventions in real-world settings using observational data.
Objectives:

1. To obtain new knowledge regarding advances in basic science and clinical research in the field of vascular surgery.
2. For vascular surgery trainees, to have an opportunity to present their research work and to obtain feedback and questions from their peers.
3. To obtain new knowledge regarding the pathophysiology of abdominal aortic aneurysms.
4. To understand the value of continuing quality assurance in surgical practice.
5. To have an opportunity to learn and collaborate with colleagues within and without the University of Toronto.

Accreditation:

The 2017 University of Toronto Division of Vascular Surgery Annual Research Day is a self-approved group learning activity (Section 1) as defined by the Maintenance of Certification Program of the Royal College of Physicians and Surgeons of Canada.

Certificates of Attendance and Evaluation Forms will be sent to attendees following the meeting.
Sponsorship:

W.L. Gore and Associates has agreed to a five year commitment as sole sponsor to support the U of T Vascular Surgery Research Day through an education grant. Special thanks to David Grieco, Senior Development Officer in the Office of Advancement at the U of T Faculty of Medicine for stewarding this donation.

Marty Sylvain, Global Sales Leader for Gore says, “W.L. Gore & Associates has provided creative therapeutic solutions to complex medical problems for more than forty years. During that time, more than 35 million innovative Gore Medical Devices have been implanted, saving and improving the quality of lives worldwide. W.L. Gore & Associates is committed to advancing vascular surgical and endovascular therapy and as a result is pleased to be able to provide educational grant support to the University of Toronto, Division of Vascular Surgery. It is our hope that through this educational grant we will be able to support the University of Toronto in some of our shared values including commitment to ongoing learning, dedication to sharing knowledge with peers and patients, creating consensus within the medical community and the analysis of clinical outcomes”.

United in a Tradition of Leadership, Discovery & Excellence
0730 – 0745: Continental Breakfast

0750 – 0800: Welcoming Remarks

Dr. Thomas Forbes
Professor & Chair, Division of Vascular Surgery, University of Toronto

0800 – 0930: Morning Session (10 minute presentations, 5 minutes questions)
Moderator: Dr. Thomas Lindsay (Division Head, University Health Network)

0800 – 0815: Improving radiation shield utilization during cardiovascular endovascular procedures
Bader AlSuwailem, Monica Abdulamasih, Patrick McVeigh, Rashmi Neddur, Giuseppe Papia

0815 – 0830: Endovascular imaging of a porcine model of carotid atherosclerosis
Patrick Z McVeigh, Brian C Wilson, Mark Wheatcroft*

*Recipient of 2016 Blair Innovation Fund Grant Award

0830 – 0845: Endovascular Repair of Abdominal Aortic Aneurysm (EVAR) in Octogenarians: A Report on Clinical Outcomes
Sneha Raju, Naomi Eisenberg, J Montbriand, Graham Roche-Nagle

0845 – 0900: c-myb is pathogenic in atherosclerosis through an effect on B2 cell responses

United in a Tradition of Leadership, Discovery & Excellence
0900 – 0915: Performance Assessment of a Radiofrequency Powered Guidewire for Crossing Peripheral Arterial Occlusions Based on Lesion Morphology
James J. Zhou, Mohammad A. Tavallaei, Trisha Roy, Andrew D. Dueck, Graham A. Wright

0915 – 0930: The effect of renin-angiotensin system blockade on abdominal aortic aneurysm growth, rupture and perioperative outcomes: a systematic review and meta-analysis
Muzammil Syed, Konrad Salata, Mohamad Hussain, Norah Alsaif, Subodh Verma, Mohammed Al-Omran

0930 - 1015: 6th Annual K. Wayne Johnston Lecturer
Lessons from Medicare on Abdominal Aortic Aneurysm Repair
Dr. Marc Schermerhorn
Chief of Vascular & Endovascular Surgery, Beth Israel Deaconess Medical Center
Associate Professor of Surgery, Harvard Medical School

1015 - 1045: Refreshment Break

1045 - 1100: Researcher’s Forum
John Byrne*, Surgeon-Scientist, Division of Vascular Surgery, Peter Munk Cardiac Centre, University Health Network, Assistant Professor, Department of Surgery, University of Toronto
Deciphering macrophage responses in abdominal aortic aneurysms
*Recipient of 2017 Blair Innovation Fund Grant Award

1100 - 1200: Surgeon-Scientist Training Program Forum
(10 minute presentations, 5 minutes questions)
Moderator: Dr Mohammed Al-Omran (Division Head, St. Michael’s Hospital)

1100 - 1115: Iliac Artery Torsion and Calcification Predict Endovascular Device Rotation and Severe Perioperative Complications in Advanced EVAR
Sean A. Crawford, Ryan M. Sanford, Matthew G. Doyle, Naomi Eisenberg, Mark Wheatcroft, Cristina H Amon, Thomas L Forbes
1115 - 1130: Does Operator Specialty Effect Outcomes After Carotid Endarterectomy and Stenting?  
Mohamad A. Hussain, Muhammad Mamdani, Jack V. Tu, Gustavo Saposnik, Konrad Salata, Deepak L. Bhatt, Subodh Verma, Mohammed Al-Omran

1130 - 1145: From bench to bedside: Validation of MRI techniques to characterize peripheral chronic total occlusions from critical limb ischemia patients  
Trisha L. Roy, Andrew D. Dueck, Graham A. Wright

1145 – 1200: The impact of statins on abdominal aortic aneurysm growth, rupture, and perioperative outcomes: a systematic review and meta-analysis  
Konrad Salata, Muzammil Syed, Mohamad Hussain, Norah Alsaif, Subodh Verma, Mohammed Al-Omran

1200 - 1245: Lunch

1245 - 1415: Afternoon Session (10 minute presentations, 5 minutes questions)  
Moderator: Dr. Andrew Dueck (Division Head, Sunnybrook)

1245 - 1300: Percutaneous TEVAR under local anesthesia without cerebral spinal fluid drainage  
Dennis Jiang, Sean Crawford, Marc Pope, Christiane Werneck, Ivica Vucemilo

1300 - 1315: Physicians’ Peripheral Arterial Disease Knowledge Gap Starts in Medical School  
Musaad AlHamzah, Rachel Eikelboom, Muzammil Syed, Konrad Salata, Mohamad A. Hussain, Mohammed Al-Omran

1315 - 1330: Arteriovenous Access Failure: Long-Outcomes of Endovascular Salvage  
Monica Abdelmasih, Naomi Eisenberg, Graham Roche-Nagle

1330 – 1345: Evaluating quality metrics and cost after discharge: a population based study of value in health care following major vascular surgery in Ontario  
Charles de Mestral*, Konrad Salata, Mohamad A. Hussain, Ahmed Kayssi, Mohammed Al-Omran, Nitharsana Manoharan, Graham Roche-Nagle

*Recipient of 2017 Blair Innovation Fund Grant Award
1345 – 1400: Development of a Semi-Automated FEVAR Planning Method
Helen Genis, Sean A Crawford, Matthew G Doyle, Thomas F Lindsay, Cristina H Amon, and Thomas L Forbes

1400 – 1415: The Impact of Morbid Obesity in Carotid Intima-Media Thickness
Stefany Gonzalez De Leo, JA Súarez Cuenca, N Rodríguez

1415 - 1430: Researcher’s Forum
Mohammad Qadura, Assistant Professor, Division of Vascular Surgery, St. Michael’s Hospital, University of Toronto; Scientist, Keenan Research Centre for Biomedical Science

Multiple-lineage progenitor cell therapy for critical limb ischemia: we can do better

1430 - 1515: 6th Annual K. Wayne Johnston Lecturer
Advanced Image Guidance for Complex Endovascular Interventions
Dr. Marc Schermerhorn
Chief of Vascular & Endovascular Surgery, Beth Israel Deaconess Medical Center
Associate Professor of Surgery, Harvard Medical School

1515 - 1545: Refreshment Break

1545 - 1625: Rapid Fire Presentations (5 minute presentations, 3 minutes questions)
Moderator: Dr. Mark Wheatcroft (Fellowship Director)

1545 – 1553: Understanding the Clinical Impact of Fenestrated Stent Graft Misalignment using Computational Fluid Dynamics
Tianyi Xia, Matthew G. Doyle, Thomas L. Forbes, Cristina H. Amon

1553 – 1601: Ruptured Abdominal Aortic Aneurysm (AAA): just another case report. Should this Ontario resident have had an AAA screening?
Lukasz M. Boba, Ivica Vucemilo, Barry Pakes

United in a Tradition of Leadership, Discovery & Excellence
1601 – 1609: Predicting stent graft rotation in patient specific abdominal aortic aneurysm repair using computational methods
Ryan M. Sanford, Sean A. Crawford, Matthew G. Doyle, Cristina H. Amon, Thomas L. Forbes

1609 – 1617: Demographic predictors of disease progression in subacute and chronic type B dissections in Ontarians, a retrospective review
Miranda W. Witheford, Daryl Kucey

1617 - 1625: Burkholderia pseudomallei mycotic aortic aneurysm in a returning traveller
Zamzam Al Obaidan, Ali Alshehri, Kaisor Iqbal, Musaed Alsalman,1 Jaffar A. Al-Tawfiq

1630: Awards Presentation

Best Presentation by a Junior Resident (PGY1 & 2)
Best Presentation by a Senior Resident or Fellow
Alumni Award for Best Presentation by a SSTP Resident

Adjournment
Improving Radiation Shield Utilization during Cardiovascular Endovascular Procedures
Bader AlSuwailem, Monica Abdulamasih, Patrick McVeigh, Rashmi Nedadur, Giuseppe Papia

Objectives: Advances in technology and equipment has increased the complexity of cardiovascular endovascular procedures and thus patients and staff are exposed to higher doses of radiation than ever. Minimizing occupational radiation exposure has become a constant goal in modern cardiovascular interventions. We designed a quality improvement project to improve utilization of radiation shields present in most endovascular suites and cath labs.

Methods: A total of 18 cases were sampled in two major teaching hospitals in Toronto between Oct 2016 and Feb 2017. Shield availability, positioning and repositioning were observed.

Results: 83.3 % of sampled procedures were vascular procedures and 16.7 % were cardiac interventions. Cases included TAVI, peripheral angiography, TEVAR, standard EVAR, and advanced EVAR. Trainees level ranged from medical students to fellows. 8 and 10 cases occurred at site 1 and 2 respectively. Based on our convenience sample, there is 100% shield availability and 100% shield use for cardiovascular procedures at site 2. Re-positioning varied with the majority requiring 1-2 events. In contrast, at site 1 although there is 100% shield availability for vascular procedures, there is 0% shield use and 0% shield positioning for intended use.

Conclusion: A gap is identified in radiation shield utilization despite 100% availability across sampled sites. Location and presence of other operating staff members did not seem to be a strong contributing factor. Phase II of the study is ongoing to identify key barriers and to propose appropriate interventions.
Endovascular imaging of a porcine model of carotid atherosclerosis

Patrick Z McVeigh¹, Brian C Wilson¹, Mark Wheatcroft²

¹Department of Medical Biophysics, University of Toronto, ²Division of Vascular Surgery, St Michael’s Hospital

Objectives: To develop a porcine model of carotid atherosclerosis and visualize the endovascular angioplasty and stenting of carotid plaque using a novel high-resolution endovascular optical imaging system.

Methods: Mechanical properties of the scanning fiber angioscopy system were tested alongside clinical angioplasty devices in a human carotid bifurcation silicon flow model. Carotid atherosclerosis with vulnerable plaque features were induced in a trial cohort (n=2) of Yorkshire swine using a surgical injury and high-cholesterol diet model for 3 months duration. Conventional angiography and angioscopy were used to assess the carotid lesions in-situ. Technical elements such as depth of field, achievable flush rates, and image resolution were recorded. Plaque features such as adherent thrombus, apparent cap thickness and endothelial coverage, apparent lipid content, and degree of vessel stenosis were assessed to compare with ex-vivo appearance.

Results: In all animals the 3-month angiograms demonstrated a persistent induced stenosis and post-stenotic dilatation. Clear angioscopic images were obtained using a revised optical flushing system that utilizes a much smaller volume of saline by increasing the tubing diameter connected to the imaging catheter.

In all cases the non-absorbable suture material used to induce the stenosis was visible from within the lumen of the vessel, and the pre-stenotic region of the vessel wall was studded with numerous amber deposits that protruded into the lumen that were clearly distinguishable from the smooth white endothelium elsewhere in the carotid artery. The pathological sections from this region demonstrate scattered hypercellular sub-endothelial deposits that are being examined with other histological stains to fully characterize the lesions.

Conclusions: The surgically-induced carotid injury model produces atherosclerotic changes in swine at 3 months follow-up that is primarily concentrated in the pre-stenotic region of the artery. Clear optical imaging is possible in such high-flow arteries without occlusion by making use of a higher pressure flush delivery system. Subtle changes in endothelial appearance corresponding to areas of pathologic change are detectable using the angioscope that cannot be appreciated on conventional angiography.
Endovascular Repair of Abdominal Aortic Aneurysm (EVAR) in Octogenarians: A Report on Clinical Outcomes

Raju S1, Eisenberg N2, Montbriand J2, Roche-Nagle G2

1Faculty of Medicine, University of Toronto
2Division of Vascular Surgery, Toronto General Hospital, University Health Network, University of Toronto, Toronto, Ontario, Canada.

Objectives: To investigate outcomes and predictors of EVAR complications in octogenarians.

Methods: A retrospective chart review of consecutive patients ≥80 years of age who received an EVAR between August 2010 to January 2017. After appropriate univariate comparisons, logistic regression was completed to determine predictors of complications, and Kaplan Meir was used to explore survival times.

Results: One hundred and fifty-four octogenarians underwent an EVAR during this period for an infrarenal aneurysm with an average size of 63.77 mm (SD= 12.73). The average age was 84.1 and the majority were males (81%). Eighteen patients presented as ruptured AAA. Intraoperative endoleak was documented in 64 (42%) cases with Type II lumbar being the most common (n=38). On follow-up, there were 12 retreatments for these. Forty-three patients sustained a postoperative complications with myocardial ischemia (n=24) and dysrhythmias (n=10) being the highest contributors. Diabetes (B = 1.45, OR = 4.27, 95% C.I. = 1.09–16.74, p = 0.037) was found to be multivariate predictor of all complications. Most patients (88%) continued follow-up to an average of 20 months (range 0-72.5 months). An average patient attended three follow-up visits with CT or ultrasound imaging. Overall mortality was 13% (n=21), with 43% (n=9) occurring during index admission. Of those that died during index admission, all 9 were ruptured AAA ($\chi^2$=37.3, p = 0.0005). Patients who sustained a postoperative complications were found have significantly lower survival times (Figure 1; KM Log rank $\chi^2$= 6.55, p = 0.011). The average survival time post-EVAR was 58 months.

Conclusion: EVAR in octogenarians is a suitable form of therapy with acceptable short and long-term results in the elective setting. Diabetes was a predictor of complications in this population.
There were 106 cases with no complications (9 events) and 43 with complications (10 events). The average survival time for those without events was 61.5 months (SE=3.31, 95% CI = 55.02 to 67.99 months) and for those with complications was 49.89 months (SE=4.65, 95% CI = 40.77 to 59.02 months). There was a significant difference found between these survival times (Log rank $\chi^2= 6.55$, $p = 0.011$).
c-myb is pathogenic in atherosclerosis through an effect on B2 cell responses


**Introduction:** Atherosclerosis, in the form of cerebrovascular, cardiovascular, and peripheral vascular diseases remains a prevalent cause of morbidity and mortality. Rather than discrete entities, these syndromes should be seen as manifestations of an underlying systemic disorder. Attention has therefore turned towards understanding the fundamental mechanisms shared by all atherosclerotic syndromes, with the goal of developing therapies to interfere with all of them through a common pathway. c-myb is a transcription factor which has been implicated in atherosclerosis through the use of transgenic murine models, and is one such potential common pathway of atherosclerosis.

**Objective:** We set out to determine the role played by c-myb in experimental atherosclerosis.

**Methods:** c-myb hypomorph (c-myb\(^{h}\)) mice with an M303V mutation were crossed with ldlr\(^{-/-}\) mice genetically predisposed to atherosclerotic disease. Additional experiments were performed using adoptive transfer of ldlr\(^{-/-}\) bone marrow cells into c-myb\(^{h}\) hosts. Mice were given a diet high in fat and cholesterol or standard feed. Atherosclerosis was determined by histology of aortic root explants, while cell populations were determined by flow cytometry. We determined the contribution of antibody responses with anti-CuOxLDL ELISAs.

**Results:** c-myb deficient mice are protected against the development of atherosclerosis. This effect is derived from bone-marrow expression of c-myb as opposed to expression in stromal cells. We trace this to a defect in the B-cell lineage in this mouse model. Specifically, c-myb mice exhibit a severe defect in the development of pro-atherosclerotic B2 cells, while still maintaining natural IgM expression which may be protective against atherosclerosis.

**Conclusions:** c-myb is a novel regulator of atherosclerosis. Interference with this pathway, or with its downstream targets in B-cell development may be a therapeutic target in atherosclerotic diseases.
Performance Assessment of a Radiofrequency Powered Guidewire for Crossing Peripheral Arterial Occlusions Based on Lesion Morphology

James J. Zhou, Mohammad A. Tavallaei, Trisha Roy, Andrew D. Dueck, Graham A. Wright

Sunnybrook Research Institute, University of Toronto, Toronto, Canada

Objective: The goal of this study was to assess and compare the performance of a conventional guidewire to a radiofrequency (RF) powered guidewire for crossing various types of peripheral chronic total occlusions as characterized by Magnetic Resonance Imaging (MRI).

Methods: In this study, 31 samples of peripheral arterial plaques were excised from 2 amputation patients. To characterize the lesion morphology, each sample was imaged with 7 Tesla MRI using ultrashort echo time (UTE), and T2-weighted (T2W) sequences (97×97×97 μm³ voxels), and imaged with micro-CT (50×50×50 μm³ voxels). The lesions were categorized as “soft” (fat, thrombus, microchannels or loose fibrous tissue – bright on T2W images) or “hard” (dense fibrous tissue/collagen and segmented calcium – grey on UTE and dark on T2W images). Using a custom catheter test station, the load cell advanced the guidewires at a constant velocity of 0.05 mm/s while recording the exerted forces. The performance of a 0.035” conventional hydrophilic guidewire was compared to a 0.035” RF guidewire with RF power (ON) (50W maximum at 468 kHz) and without RF (OFF).

Results: For “hard” lesions, the conventional guidewire failed to penetrate (n=6) while the RF guidewire successfully punctured (n=5) with forces of 1.58 N ± 0.18 when OFF and significantly lower forces of 0.48 N ± 0.05 when ON (n=5) (one-tailed t-test, p<0.002) (Fig. 1). For “soft” lesions, the conventional guidewire experienced forces of 0.62 N ± 0.28 when OFF (n=5) and 0.04 N ± 0.03 when ON (n=5) (one-way ANOVA, F(2,12), p<0.002).

Conclusion: These results indicate that using RF power significantly reduces the required amount of force to puncture “hard” lesions; and, where the conventional guidewire fails, the RF guidewire succeeds. Future work will analyze the safety aspect of using RF in-vivo.
Figure 1: a) Average puncture forces for the “soft” and “hard” lesions with each guidewire. b) Force-displacement plots for representative cases of each category; the dotted lines indicate the puncture forces. The conventional wire failed to penetrate all hard lesions.
The Effect of Renin-Angiotensin System Blockade on Abdominal Aortic Aneurysm Growth, Rupture and Perioperative Outcomes: A Systematic Review and Meta-Analysis

Muzammil Syed1; Konrad Salata2,3, MD; Mohamad Hussain2,3, MD; Norah Alsaif3, MD; Subodh Verma2,4, MD, PhD, FRCSC, FAHA; Mohammed Al-Omran2,3, MD, MSc, FRCSC

1Faculty of Science, McMaster University, Hamilton, Canada; 2Department of Surgery, University of Toronto, Toronto, Canada; 3Division of Vascular Surgery, St. Michael’s Hospital, Toronto, Canada; 4Division of Cardiac Surgery, St. Michael’s Hospital, Toronto, Canada.

Objective: To summarize the literature regarding the effects of ACEi and ARBs on human AAA growth, rupture, and peri-operative mortality.

Methods: We conducted a systematic review in accordance with PRISMA guidelines. Our review protocol was registered at the International Prospective Register of Systematic Reviews (PROSPERO 2016: CRD42016054082). We searched MEDLINE, EMBASE, and The Cochrane CENTRAL databases from inception to 2017 for studies examining the effects of ACEi or ARB treatment on AAA growth, rupture or peri-operative mortality. Review, abstraction, and quality assessment were conducted in duplicate, and a third author resolved discrepancies. We assessed study quality using the Cochrane, and Newcastle-Ottawa scales. We used random effects models to calculate pooled mean differences and odds ratios (OR) with 95% confidence intervals. Heterogeneity was quantified using the I² statistic.

Results: Our search yielded 525 articles. One randomized and 8 observational studies involving 35,565 patients were included. Inter-rater agreement was excellent (κ=0.78), and risk of bias was low to moderate. All studies investigated ACEi; three studies investigated ARBs; and two studies included a composite ACEi or ARB group. Four studies assessed rupture and 30-day mortality, and 5 studies assessed AAA growth. There was no difference in AAA growth rate between ACEi vs control (mean difference 0.11 mm/yr, 95% CI -0.21, 0.42, p=0.51, I²=42%) (Figure 1) or ARB vs control (mean difference -0.57, 95% CI -1.33, 0.18, p=0.14, I²=0%). No protective effect of ACEi was demonstrated for AAA rupture (OR 0.90, 95% CI 0.73, 1.12, p=0.36, I²=85%).

Conclusion: Angiotensin converting enzyme inhibitors do not affect AAA growth or rupture rates. The small number of retrospective studies, and limited long-term follow-up precludes the dismissal of ACEi or ARBs as pharmacotherapy for AAA. More prospective, long-term research is needed to determine the effect of renin-angiotensin system blockade on AAA growth, rupture and peri-operative mortality.
**Figure 1:** Effect of angiotensin converting enzyme inhibitors on abdominal aortic aneurysm growth rate

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<th>Study or Subgroup</th>
<th>ACEI Mean [mm/yr]</th>
<th>SD [mm/yr]</th>
<th>Total</th>
<th>Control Mean [mm/yr]</th>
<th>SD [mm/yr]</th>
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<th>Weight</th>
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<td>0.24</td>
<td>2.63</td>
<td>204</td>
<td>15.1%</td>
<td>-0.24 (-0.91, 0.43)</td>
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<td>Lederle 2015</td>
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<td>0.24</td>
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<td>0.10 (-0.25, 0.45)</td>
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<td>77</td>
<td>3.74</td>
<td>3.02</td>
<td>151</td>
<td>16.9%</td>
<td>0.03 (-0.59, 0.65)</td>
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<td><strong>Total (95% CI)</strong></td>
<td><strong>1583</strong></td>
<td><strong>3570</strong></td>
<td></td>
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<td></td>
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<td></td>
<td><strong>0.11 (-0.21, 0.42)</strong></td>
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**Footnotes:**
1) Only mean difference provided. Control group set as reference.

**Heterogeneity:** $I^2 = 42\%$; $Q = 4 (P = 0.14); I^2 = 42\%$

**Test for overall effect:** $Z = 0.66 (P = 0.51)$
1045 - 1100:  Researcher’s Forum

John Byrne MD*, Surgeon-Scientist, Division of Vascular Surgery, Peter Munk Cardiac Centre, University Health Network, Assistant Professor, Department of Surgery, University of Toronto

*Recipient of 2017 Blair Innovation Fund Grant Award

Deciphering macrophage responses in abdominal aortic aneurysm

Dr. John Byrne is a vascular surgeon-scientist at University of Toronto. Following completion of his higher surgical training in Ireland and University of Toronto fellowship in vascular surgery, he commenced on staff at University Health Network. His primary academic interest is understanding the biology of aneurysm progression and the reasons for regional variation in aneurysm susceptibility. Building on his doctorate of medicine by research, which focused on inflammation and ischemia-reperfusion, he is exploring the differential macrophage responses in abdominal aortic aneurysm using in-vivo models. The goal is to explore fundamental properties of macrophage biology and their relation to aortic homeostasis and disease.
Objective: The objectives of this study were A) to quantify the short-term clinical outcomes in patients with stent graft rotation and B) to identify anatomical markers that can predict stent graft rotation.

Methods: A prospective study evaluating all patients undergoing advanced EVAR was conducted at two university affiliated hospitals between November 2015 and December 2016. Stent graft rotation (defined as $\geq 10^\circ$) was measured on intraoperative fluoroscopic video of the deployment sequence. Standard pre-operative CTA imaging was used to calculate the geometric properties of the arterial anatomy. Any in-hospital/30-day complications were prospectively documented and a composite outcome of any end-organ ischemia and/or death was used as the primary endpoint.

Results: Thirty-seven patients undergoing advanced EVAR were enrolled in the study with a mean age of 75 [64-89] and a mean aneurysm diameter of 63 mm [42-90 mm]. The incidence of stent graft rotation was 39% (n=14) with a mean rotation of 25.4$^\circ$ [10.2-51$^\circ$]. The total net torsion and the total volume of calcific plaque was higher in patients with stent graft rotation, 8.9±0.84 mm$^1$ vs 4.1±0.53 mm$^1$ (P<0.0001; Figure 1A) and 1054±143 mm$^3$ vs 537±89 mm$^3$ (P<0.01; Figure 1D) respectively. The composite outcome of any end-organ ischemia and/or death was also substantially higher in patients with stent graft rotation, 43% vs 4.5% (P<0.01; Table 1). Additionally, patients with stent graft rotation had significantly higher combined rates of type 1 and type 3 endoleaks, 36% vs 9% (p<0.05).

Conclusions: Patients with intraoperative stent graft rotation have a significantly higher rate of severe postoperative complications and this is strongly associated with higher levels of iliac artery torsion and calcification. These findings suggest that pre-operative quantitative analysis of iliac artery torsion and calcification is essential for patient risk stratification prior to advanced EVAR.
Figure 1.  (A) Total iliac torsion (B) Mean Iliac Curvature (C) Mean minimum iliac radius (D) Iliac calcium volume in patients with stent graft rotation or without (control). Mean ± SEM. (E) Scatter plot of total iliac calcium volume relative to total iliac torsion in patients with stent graft rotation (white) or without (black).
Does Operator Specialty Effect Outcomes After Carotid Endarterectomy and Stenting?

Mohamad A. Hussain, Muhammad Mamdani, Jack V. Tu, Gustavo Saposnik, Konrad Salata, Deepak L. Bhatt, Subodh Verma, Mohammed Al-Omran

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Objective: To examine the effect of operator specialty on 30-day outcomes among patients undergoing carotid endarterectomy and carotid-artery stenting.

Methods: We conducted a population-based, observational cohort study of all individuals who underwent carotid endarterectomy or stenting in Ontario, Canada (2002-2015) using administrative claims databases. We stratified endarterectomy and stenting patients according to operator specialty, and followed them for 30 days after the procedure. We built multilevel multivariable logistic regression models adjusted for patient demographics, comorbidities, carotid-artery symptom status, and annual institutional and operator volume to examine rates of 30-day stroke or death.

Results: A total of 16,544 patients were studied (n=14,301 endarterectomy and n=2,243 stenting). Vascular surgeons performed the majority (55.7%) of endarterectomy procedures, followed by neurosurgeons (21.0%), general surgeons (15.3%), and cardiac surgeons (7.9%). Radiologists (82.5%) and neurosurgeons (17.5%) performed carotid-artery stenting. In the endarterectomy group, the risk of stroke or death was higher among patients treated by non-vascular surgeons (4.0%) compared with vascular surgeons (2.9%) (adjusted odds ratio [OR], 1.32; 95% confidence interval [CI], 1.08-1.62; P=.008) (Fig.). With respect to specific non-vascular surgery specialties, the rate of 30-day stroke or death was higher in endarterectomy patients treated by neurosurgeons (4.1%; adjusted OR, 1.27; 95% CI, 1.00-1.61) and cardiac surgeons (4.4%; adjusted OR, 1.54; 95% CI, 1.04-2.30) compared with vascular surgeons (2.9%). Patients who underwent carotid-artery stenting by radiologists versus neurosurgeons experienced 30-day stroke or death at similar rates (8.0% vs. 7.9%, respectively; adjusted OR, 1.07; 95% CI, 0.66-1.74; P=.79).

Conclusions: The risk for stroke or death was significantly higher among carotid endarterectomy patients treated by non-vascular surgeons (neurosurgeons and cardiac surgeons) compared with vascular surgeons. Operator specialty did not appear to have a significant effect on outcomes among patients who underwent carotid-artery stenting. These results can have implications for physician referral practices and local policies.
Fig. Risks of 30-day events after carotid endarterectomy based on operator specialty
From bench to bedside: Validation of MRI techniques to characterize peripheral chronic total occlusions from critical limb ischemia patients

Trisha L. Roy BASc MD1,2, Andrew D. Dueck MD MSc1,2 and Graham A. Wright PhD1,3

1Schulich Heart Program and the Sunnybrook Research Institute, Sunnybrook Health Sciences Centre, Toronto, Ontario, Canada
2Division of Vascular Surgery, Department of Surgery, University of Toronto, Toronto, Ontario, Canada
3Department of Medical Biophysics, University of Toronto, Toronto, Ontario, Canada

Objective: To test and validate a novel native-contrast magnetic resonance imaging (MRI) technique for popliteal and tibial lesion characterization in critical limb ischemia patients.

Methods: A clinical 3T MRI scanner was used to image 3 healthy volunteers and 7 amputated limbs from critical limb ischemia patients. A steady state free precession (SSFP) flow-independent MR angiogram was used to precisely locate lesions and a prototype ultrashort echo time (UTE) was used to further characterize hard chronic total occlusion (CTO) components including calcium and dense collagen. MR images (n=10) of popliteal and tibial CTOs with a broad range of heterogeneous morphologies were validated with high-resolution 7T MRI, micro–computed tomography and histology (Figure 1).

Results: SSFP MRI and UTE subtraction accurately differentiated hard CTO components from soft CTO components (e.g. loose matrix or thrombus). UTE subtraction images were 100% sensitive and specific to calcium and dense collagen. This MRI method was also able to detect non-calcified hard lesion components that were not seen on X-ray, CT or duplex ultrasound. In addition, MRI was able to detect intermittent patencies and “ghost lumens” with fresh blood in run-off tibial vessels that were not detected with X-ray angiography (the current gold standard).

Conclusion: Clinical 3T MRI scanners using SSFP and UTE subtraction imaging can be used to accurately characterize hard and soft popliteal and tibial CTOs. Future work will determine if this novel native-contrast MRI method can be used to predict success in peripheral endovascular interventions.
Figure 1: UTE subtraction images and validation of three ex-vivo lesion morphologies: 1) Calcium nodule within soft matrix 2) Speckled calcium intermixed with collagen 3) Concentric medial calcium around soft matrix and a microchannel. After harvesting, 5 mm long excised lesions were imaged with 3T MRI, 7T MRI, MicroCT and Histology. For analysis, 13 axial slices of 7T images were added in the longitudinal direction prior to image subtraction to create ~1mm slices for more accurate comparison with 3T images.
The Impact of Statins on Abdominal Aortic Aneurysm Growth, Rupture, and Perioperative Outcomes: A Systematic Review and Meta-Analysis

Konrad Salata¹,³, MD; Muzammil Syed²; Mohamad Hussain¹,³, MD; Norah Alsaif³, MD; Subodh Verma¹,⁴, MD, PhD, FRCSC, FAHA; Mohammed Al-Omran¹,³, MD, MSc, FRCSC

¹Department of Surgery, University of Toronto, Toronto, Canada; ²Faculty of Science, McMaster University, Hamilton, Canada; ³Division of Vascular Surgery, St. Michael’s Hospital, Toronto, Canada; ⁴Division of Cardiac Surgery, St. Michael’s Hospital, Toronto, Canada.

Objective: To summarize the literature regarding the effects of statins on human AAA growth, rupture, and peri-operative mortality.

Methods: We conducted a systematic review in accordance with PRISMA guidelines. Our review protocol was registered at the International Prospective Register of Systematic Reviews (PROSPERO 2017:CRD42017056480). We searched MEDLINE, EMBASE, and The Cochrane CENTRAL databases from inception to 2017 for studies examining the effects of statin treatment on AAA growth, rupture or peri-operative mortality. Review, abstraction, and study quality assessment steps were conducted in duplicate, and a third author resolved any discrepancies. We assessed study quality using the Cochrane, and Newcastle-Ottawa scales. Random effects models were used to calculate pooled mean differences and odds ratios (OR) with 95% confidence intervals. Heterogeneity was quantified using the I² statistic.

Results: Our search yielded 827 articles. Two case-control and 21 cohort studies involving 45834 patients were included. Inter-rater agreement was moderate (k=0.67), and risk of bias was low to moderate. Four studies assessed rupture, 8 assessed 30-day mortality, and 14 studies assessed AAA growth. Statins reduced AAA growth rate by a mean of 0.88 mm/yr (95% CI 0.39, 1.37, p=0.0005, I²=87%) (Figure 1), which translated into a reduced rupture risk (OR 0.54, 95% CI 0.36, 0.80, p=0.002, I²=79%). Pre-operative statin use also reduced 30-day mortality following elective AAA repair (OR 0.59, 95% CI 0.42, 0.84, p=0.003, I²=44%). Subgroup analysis revealed the former effect to be driven by the 30-day mortality following open AAA repair (OR 0.45, 95% CI 0.21, 0.96, p=0.04, I²=62%), whereas the effect of statins was lost in the EVAR subgroup (OR 0.25, 95% CI 0.02, 2.60, p=0.24, I²=65%).

Conclusion: Statins reduce AAA growth rates and consequently rupture rates. Furthermore, they improve peri-operative outcomes in elective open AAA repair patients. Statin pharmacotherapy should be considered in all patients with small AAAs.
**Figure 1:** The effect of statin use on growth of abdominal aortic aneurysms

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Statins Mean [mm/yr]</th>
<th>SD [mm/yr]</th>
<th>Total</th>
<th>Control Mean [mm/yr]</th>
<th>SD [mm/yr]</th>
<th>Total</th>
<th>Weight</th>
<th>Mean Difference IV, Random, 95% CI [mm/yr]</th>
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<td>Schouten, van Laar 2006</td>
<td>2</td>
<td>2.3024</td>
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<td>3.6</td>
<td>3.0731</td>
<td>51</td>
<td>8.3</td>
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<td>2006</td>
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<tr>
<td>Sukhija 2006</td>
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<td>8.49</td>
<td>75</td>
<td>1.1</td>
<td>1.0</td>
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<td>4.1</td>
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<td>Mosconi 2008</td>
<td>1.9</td>
<td>1.8</td>
<td>34</td>
<td>2.6</td>
<td>1.8</td>
<td>36</td>
<td>1.7</td>
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<td>64</td>
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<td>76</td>
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<td>Karlsen 2009 (2)</td>
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<td>10.2</td>
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<tr>
<td>Sweeney 2010 (4)</td>
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<td>-3.00 [-2.52, -1.48]</td>
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<td>39</td>
<td>9.2</td>
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<td>6.7</td>
<td>12.4</td>
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<td>4.7</td>
<td>-0.90 [-2.65, 0.45]</td>
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<td>Ledele 2015 (8)</td>
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<td>2.1</td>
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<td>1013</td>
<td>10.6</td>
<td>0.10 [-0.23, 0.45]</td>
<td>2015</td>
</tr>
</tbody>
</table>

Total (95% CI) $= 2149$

$\text{Heterogeneity: } \chi^2 = 81.76, \text{df} = 11 (P < 0.00001); I^2 = 87%$

Test for overall effect: $Z = 3.49 (P < 0.0005)$

Footnotes:
1. Control group was set as reference with 0 mm/yr growth due to provision of growth rate differences only. Statins grouped with other lipid lowering therapy.
2. Data are median growth rate, with standard deviation calculated from bootstrapped confidence intervals for medians. No indication of data skewness.
3. Only multivariate adjusted results presented. Data are adjusted for baseline diameter, curvature, sex, gender, smoking, MAP, anti-hyperglycemic meds.
4. Only univariate data provided. Data are adjusted for baseline diameter, age, and sex.
5. Data are median growth rate with standard deviation=$QR/\sqrt{13.5}$. Authors rated skewness of data.
6. No univariate data provided. Data are from analysis corrected for baseline diameter, age, and gender. Control growth rate set at 0 as only difference in growth rate provided.
7. Data for this outcome provided from correspondence with authors.
8. No univariate data provided. All data are from propensity scored analysis adjusted for demographics, diagnoses, smoking status, drug use and dose, and healthcare utilization among many covariates.
1245 - 1415: Afternoon Session

Percutaneous TEVAR under local anesthesia without cerebral spinal fluid drainage

Dennis Jiang, Sean Crawford, Marc Pope, Christiane Werneck, Ivica Vucemilo

Objective: The objective of this study was to assess the safety of performing thoracic endovascular aneurysm repair (TEVAR) under local anesthetic without cerebral spinal fluid drainage (CSF) drainage.

Methods: A retrospective review of consecutive TEVAR cases performed at Trillium Health Centre. Exclusion criteria included spinal anesthesia and aortic ruptures. The cases were analyzed with respect to the type of anesthesia (general vs local) and the use of CSF drainage.

Results: This retrospective case-series identified 45 patients (8 were excluded). 18 patients were performed under GA and 19 patients under LA. Patients performed under LA had significantly more co-morbidities than the GA group. There were no significant differences in aneurysm size or extent of aortic coverage between the two groups. Spinal drains were placed preoperatively in 78% (n=14) of patients performed under GA and in 32% (n=6) of patients performed under LA. There were no cases of permanent paralysis or stroke following TEVAR in either group. Other 30 day complications included 1 NSTEMI and 1 pneumonia in the GA group and 1 NSTEMI and 1 wound infection in the LA group. There was a trend towards shorter length of stay in the LA group at 5.5 days vs 8.5 days with a GA.

Conclusions: The routine insertion of a prophylactic spinal drain prior to TEVAR cases is controversial and likely provides minimal if any benefit in patients at low risk of spinal cord ischemia. In this study, there was no increased risk of paralysis or stroke in patients performed under local without CSF drainage. The use of local anaesthesia in this setting enables continuous intraoperative assessment of neurologic function and allows for timely intervention if required.
Physicians’ Peripheral Arterial Disease Knowledge Gap Starts in Medical School

Musaad AlHamzah¹, Rachel Eikelboom², Muzammil Syed³, Konrad Salata¹, Mohamad A. Hussain¹, Mohammed Al-Omran¹,⁴

¹Department of Surgery, University of Toronto, Toronto, Canada; ²University of Toronto Faculty of Medicine, Toronto, Canada; ³Faculty of Science, McMaster University, Hamilton, Canada; ⁴Division of Vascular Surgery, St. Michael’s Hospital, Toronto, Canada

Objective: Previous data indicate physicians have suboptimal knowledge about peripheral arterial disease (PAD). The aim of our study was to evaluate PAD knowledge among Canadian medical school graduates to understand if this knowledge gap exists early in medical training.

Methods: We conducted a descriptive, cross-sectional, interview-based study of graduating medical students at the University of Toronto. We administered a validated questionnaire to evaluate students’ knowledge of PAD and coronary artery disease (CAD) in the following domains: clinical presentation, risk factors, preventative measures, treatment, and complications. The maximum total score for each disease was 28 based on the number of correct responses. We calculated mean (SD) scores for each PAD and CAD knowledge domain, and the differences in PAD versus CAD scores using paired t-tests.

Results: Of the 72 participants, 58% were female; and most of them had been exposed to vascular surgery (89%) and cardiology (92%) in medical school. Overall, medical students scored better in identifying CAD characteristics (mean [SD], 16.0 [2.9]) compared to PAD (mean [SD], 14.2 [2.8]) (P=0.027).

Conclusions: Although PAD and CAD share common atherosclerotic risk factors and cardiovascular complications, medical students were less likely to associate these with PAD versus CAD. We recommend a comprehensive module that incorporates all presentations of atherosclerotic disorders to enhance students’ understanding of these pathologies in medical schools.
Arteriovenous Access Failure: Long-Outcomes of Endovascular Salvage

Monica Abdelmasih, Naomi Eisenberg, Graham Roche-Nagle

Objective: Annually, 14% of arteriovenous fistulas and 50-80% of grafts acutely fail, the majority due to thrombosis. The goal of this study is to examine the modalities, targets, and long-term outcomes, including patency, of endovascular access salvage.

Methods: This is a retrospective cohort study of all patients who underwent an endovascular salvage procedure at Toronto General Hospital between April 2005 to June 2015 for stenotic and/or thrombotic disease of an arteriovenous fistula or graft. The main outcomes of interest are primary and secondary patency.

Results: A total of 852 endovascular procedures for 311 patients were included in this study. Data analysis is currently in progress.

Conclusions: Conclusions will be determined based on the results formulated and relation to the current literature upon completion of the data analysis.
Evaluating Quality Metrics and Cost After Discharge: A Population-Based Study Of Value In Health Care Following Major Vascular Surgery In Ontario

Charles de Mestral\textsuperscript{a,*}, Konrad Salata\textsuperscript{a}, Mohamad A. Hussain\textsuperscript{a}, Ahmed Kayssi\textsuperscript{b}, Mohammed Al-Omran\textsuperscript{a}, Nitharsana Manoharan\textsuperscript{c}, Graham Roche-Nagle\textsuperscript{d}

\textsuperscript{*}Recipient of 2017 Blair Innovation Fund Grant Award

\textsuperscript{a}St. Michael's Hospital, Toronto, Ontario
\textsuperscript{b}Sunnybrook Health Sciences Centre, Toronto, Ontario
\textsuperscript{c}Institute for Evaluative Clinical Sciences, Toronto, Ontario.
\textsuperscript{d}University Health Network, Toronto, Ontario.

Objective: While a common target of quality improvement initiatives, early readmission to hospital after major surgery fails to capture the quality-of-life and economic burden associated with outpatient health-related resource use. Within a large, single-payer regional healthcare system, we characterized the 30-day costs and risk of an emergency department (ED) visit, readmission or death following major vascular surgery.

Methods: We designed a population-based retrospective cohort study of patients who underwent elective major vascular surgery (Carotid endarterectomy, EVAR, Open AAA repair, Lower extremity bypass) in Ontario, Canada, between 2004 and 2015. The outcomes of interest were ED visit, readmission, death and costs to the Ministry of Health (acute inpatient, ED, rehab, physician billing claims, homecare) within 30 days of discharge. Multivariable regression analyses identified pre-discharge variables associated with an increased 30-day risk of ED visit, readmission or death and with increased 30-day cost.

Results: A total of 28,014 patients were identified - 9,639 carotid endarterectomies, 5,403 EVARs, 7,348 open AAA repairs, 5,779 lower extremity bypasses. Within 30-days of discharge, 2,159 (7.7%) were readmitted to hospital and 11 patients died (0.4%). Nearly the same number, a total of 1,894 (6.8%) patients, had visited an ED without requiring admission. Median time to ED visit or readmission was 7 days (interquartile range 3-14 days). Cost within 30 days of discharge was positively skewed (median $519, interquartile range $174-$1,438, maximum $160,938). Approximately two thirds of the average 30-day cost is attributable to readmission. Older age, female sex, greater comorbidity level and a longer index admission length of stay were associated with increased 30-day cost.

Conclusions: A focus on hospital readmission significantly underestimates 30-day health-related resource use and costs after major vascular surgery.
Development of a Semi-Automated FEVAR Planning Method

Helen Genis¹, Sean A Crawford¹,², Matthew G Doyle¹,³, Thomas F Lindsay¹, Cristina H Amon²,³, and Thomas L Forbes¹

¹Division of Vascular Surgery, University Health Network, University of Toronto
²Institute of Biomaterials and Biomedical Engineering, University of Toronto
³Department of Mechanical and Industrial Engineering, University of Toronto
Toronto, ON, Canada

Objective: The objective of this study is to design a semi-automated technique for the generation of fenestrated stent graft plans to minimize the intra-operator variability seen in manual CTA measurements.

Methods: The validity of the current stent graft plans was assessed using a prospectively maintained advanced EVAR database. Aortoiliac geometries were segmented from preoperative CTA scans of FEVAR patients using a custom MATLAB interface. Vessel centerlines were calculated and used to determine the angles between the aorta and branching arteries. The vertical vessel position was calculated using two methods: the axial distance and the aortic centerline distance. Generated stent graft plans were then compared to the physician generated plans.

Results: Thirty-one patients were included in the study. The generated stent graft plans had excellent agreement with the physician based plans for horizontal fenestration alignment, with mean differences of 2±2°, 1±2°, 6±3°, and 2±2° for the celiac, SMA, left renal, and right renal arteries. In aortas with non-angulated visceral segments (n=17), both methods for calculating vertical alignment had good agreement with mean differences of 2.5±0.4mm and 2.8±0.4mm for the left and right renal arteries. In patients with angulated visceral segments (n=14), the difference between the axial distance and the aortic centerline methods was significant, with mean differences of 7.1±1.1mm and 5.0±0.9mm for the left and right renal arteries.

Conclusions: This semi-automated FEVAR planning technique demonstrated excellent agreement with the physician based plans for horizontal alignment of the fenestrations, but the vertical position was highly dependent on the planning physician’s measuring technique. This is potentially a significant source of fenestration misalignment and future studies will employ computational simulations to predict the degree of aortic straightening observed intraoperatively.
The Impact of Morbid Obesity in Carotid Intima-Media Thickness

Gonzalez De Leo S, Súarez Cuenca JA, Rodríguez N

Introduction: The carotid intima-media thickness (IMT) is a useful measure that determines cardiovascular risk. It has been noted that morbidly obese patients have a higher carotid IMT, which gives them a higher risk than patients without this risk factor for cardiovascular events and further complications.

Objective: The purpose of this study was to see if morbidly obese patients have a higher carotid IMT and therefore, higher risk of cardiovascular events in younger age than patients without this disease.

Methods: An observational, analytic, transversal and unicenter study was done at the National Medical Center “20 de Noviembre” (ISSSTE) in Mexico City. 90 patients between 18 and 40 years-old were included and divided into 3 groups. First group consisted of morbidly obese patients, second group consisted of overweight or obese patients and third group consisted of healthy patients (control group). The carotid IMT was measured and epidemiologic data was gathered from the clinical file. To measure carotid IMT an Aloka Prosound α7 ultrasound in B mode was used and measures were done according to Manheim Consensus. Statistical analysis was done with descriptive and inferential statistics.

Results: A statistical difference between the group of morbidly obese patients and groups 2 and 3 was found (p<0.0001) with the ANOVA test. A correlation between body mass index (BMI) and carotid IMT was demonstrated in this group only with a p= 0.025. Finally, we found an odds ratio of 10.54 with a p= 0.02 for elevated carotid IMT in morbidly obese patients.

Correlation between BMI and Carotid IMT

<table>
<thead>
<tr>
<th></th>
<th>Spearman's Rho</th>
<th>p</th>
</tr>
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<tr>
<td>Morbid obese</td>
<td>0.407</td>
<td>0.025</td>
</tr>
<tr>
<td>Overweight/obese</td>
<td>0.19</td>
<td>0.31</td>
</tr>
<tr>
<td>Control group</td>
<td>0.18</td>
<td>0.34</td>
</tr>
</tbody>
</table>

Conclusions: Morbidly obese patients have a higher risk of having elevated carotid IMT and this has a direct correlation with BMI, which is an important risk factor for cardiovascular events and marker of early atherogenic changes in this population.

Abbreviations: IMT (intima-medias thickness) BMI (body mass index)

Key words: Intima-media thickness, carotid, morbidly obese
Mohammad Qadura MD, PhD, Assistant Professor, Division of Vascular Surgery, St. Michael’s Hospital, University of Toronto; Scientist, Keenan Research Centre for Biomedical Science

Multiple-lineage progenitor cell therapy for critical limb ischemia: we can do better

Mohammad Qadura is a Scientist at the Keenan Research Centre for Biomedical Science and an Assistant Professor at the University of Toronto. He is a Staff Surgeon in the Division of Vascular Surgery at St. Michael’s Hospital. Dr. Qadura earned his PhD in Thrombosis and Hemostasis at Queen’s University. He then completed his medical school training and residency in Vascular Surgery at McMaster University. At the Keenan Research Centre for Biomedical Science, Dr. Qadura’s lab is poised to investigate the equilibrium between angiogenesis and vessel thrombosis. His research interests are broken down into the following 2 projects:

1) Investigating the exhaustion of stem cells and angiogenesis in patients with critical limb ischemia.

2) Studying the relationship between limb ischemia, inflammation, angiogenesis and coagulation factors in patients with peripheral arterial disease
1545 – 1625: Rapid Fire Presentations

Understanding the Clinical Impact of Fenestrated Stent Graft Misalignment using Computational Fluid Dynamics

Tianyi Xia, Matthew G. Doyle, Thomas L. Forbes and Cristina H. Amon

Objective: The objective of this study is to determine the impact of fenestration misalignment on renal hemodynamics (e.g. flow rate, wall shear stress) following FEVAR, with the ultimate goal of linking these changes in flow to clinical outcomes.

Methods: Computational fluid dynamic (CFD) simulations are performed in ANSYS Fluent (ANSYS, Inc., Canonsburg, PA, USA). Both idealized and patient-specific geometries are considered. Blood is assumed to be a Newtonian fluid and the vessel walls are rigid. Initial simulations were performed using an idealized symmetric model, using tetrahedral mesh elements, and consisting of half of the aorta, half of a stent graft, and a single renal artery. Flow in this geometry was assumed to be laminar. Initial validation simulations with no misalignment were found to be comparable to previous studies. Vertical fenestration misalignment (above and below) was then considered.

Results: The flow rate in the renal artery without misalignment was found to be $Q = 6.243 \times 10^{-6} \text{ m}^3/\text{s}$. Decrease of renal blood flow was found in both cases where the centre of the fenestration was misaligned above and below the renal artery (Table 1). The renal artery flow rate was found to be smaller when the fenestration was misaligned 4.5 mm below the renal artery ($Q = 1.337 \times 10^{-6} \text{ m}^3/\text{s}$) compared to when it was misaligned 4.5 mm above the renal artery ($Q = 2.149 \times 10^{-6} \text{ m}^3/\text{s}$), suggesting that, in this case studied, it is better for the fenestration to be placed above rather than below the renal artery.

Conclusions: Large misalignment of renal fenestrations substantially decreases blood flow to the renal artery. These simulations are presently being extended to more complex models, including pulsatile flow and patient-specific geometries, with the goal of improving our understanding of the fenestration misalignment impact on renal hemodynamics and, ultimately, on renal function.

Table 1: Renal flow rate change with respect to fenestration misalignment scales.

<table>
<thead>
<tr>
<th>Scale of Misalignment (mm)</th>
<th>-4.5</th>
<th>-3</th>
<th>-1.5</th>
<th>0</th>
<th>1.5</th>
<th>3</th>
<th>4.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renal Flow Rate ($\times 10^{-6} \text{ m}^3/\text{s}$)</td>
<td>1.337</td>
<td>3.512</td>
<td>5.514</td>
<td>6.243</td>
<td>6.45</td>
<td>5.189</td>
<td>2.149</td>
</tr>
</tbody>
</table>
Ruptured Abdominal Aortic Aneurysm (AAA): just another case report. Should this Ontario resident have had an AAA screening?

Lukasz M. Boba, Ivica Vucemilo, Barry Pakes

Objective: A patient whose demise was caused by a large, ruptured AAA was presented. There is a controversy about AAA screening as seen in literature and there is a history of incongruent guidelines. Screening in Ontario is minimal and lacks a population-based program. We will clarify this and find an explanation for why the presented patient was never screened.

Methods: We reviewed literature including four major RCT’s: MASS, VIBORG, Chichester, W. Australian, and The Cochrane Review. USPSTF, CTFPHC, OHTAC, SVS, CSVS and CFPC recommendations were reviewed.

Results: MASS (65-74 yo men), the largest trial with the narrowest CI and VIBORG (64-73 yo men), showed a large reduction in AAA-related mortality and a ruptured AAA rate. Screening was favored (HR, 0.58; 95% CI, 0.49-0.68 and 0.34; CI, 0.2-0.57, respectively). The Chichester (65-80 yo man and women) and W. Australian (65-83 yo men) trials showed no difference in screening. No trials showed a significant difference in all-cause mortality from AAA screening. The last Cochrane Review (2007) concluded that there is evidence of a significant reduction in AAA mortality in men 65-79 years of age who undergo ultrasound screening. The last USPSTF 2014 guidelines recommend AAA screening in men 65-75 yo who have smoked (level B), and in all men in that age group (level C). The last CTFPHC statement on screening for AAA was made in 1991, which neither included or excluded screening due to “poor evidence.” The last OHTAC in 2006 recommends screening for the 65-74 yo age group, particularly for those with a history of smoking. SVS and CSVS recommend screening for all men who are 65 and older and 65-75, respectively. Conversely, the CFPC Preventive Care Checklist, which was last updated in 2015, does not have AAA screening included, and there are no recommendations in place. The CFP journal has barely published anything about AAA screening.

Conclusion: The current literature, USPSTF, SVS, CSVS and OHTAC, support AAA screening in men 65-75 years old, especially in those with a smoking history. The confusion might be related to studies that are of poor quality and have unclear outcomes. CTFPHC and CFPC do not have recommendations in place yet. There might be a lack of knowledge translation.
Predicting Stent Graft Rotation in Patient Specific Abdominal Aortic Aneurysm Repair Using Computational Models

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Objective: The objective of this study was to use finite element analysis to predict the rotation of fenestrated stent grafts during deployment for use as a predictive tool as part of the pre-operative planning process.

Methods: Pre-operative CT scans of 3 FEVAR patients were obtained. Iliac artery and AAA geometries were then segmented and computational models of a Zenith fenestrated stent graft (Cook Medical, Bloomington, IN, USA) and its sheath were developed for use in the simulations. Realistic material properties for the graft, stents, guidewire, sheath, and vessel were specified. Friction between the sheath, graft, and the vessel walls was considered. Finite element simulations of FEVAR were performed as follows. First, a Lunderquist guidewire (Cook Medical) was inserted in order to straighten the iliac artery and to act as a guide for the sheath and stent graft. The stent graft model was then crimped, inserted within the sheath, and delivered through the distal end of the iliac artery, following the path of the guidewire. When the sheath reached the correct position within the aorta, it was then withdrawn, allowing the graft to expand. Rotation of the stent graft was then determined by calculating the rotation of two opposing points on the graft via a comparison between their initial and final position.

Results: Three patient specific cases have been simulated and show excellent agreement with clinical data. The model predicts rotations of 7°, 2°, and 12° in cases where 5°, 2°, and 16° respectively were observed clinically.

Conclusions: Simulations of FEVAR in three patient specific geometries were successfully completed and results were consistent with clinical observations. Further simulations in cases where even greater rotation has been observed are ongoing to determine the viability of this model across all probable rotation values.
Demographic Predictors of Disease Progression in Subacute and Chronic Type B Dissection in Ontarians, A Retrospective Review

Witheford MW, Kucey D

Objectives: The published literature categorizes approximately 25% of patients presenting with acute type B aortic dissection as “complicated”; per the current IRAD guidelines, this comprises individuals with malperfusion syndromes (renal, visceral organ, limb, spinal cord), frank or imminent rupture, as well as those with refractory hypertension, hemodynamic instability, or persistent pain. It is broadly accepted that these individuals should undergo emergent repair, with either a TEVAR or open strategy (Fattori et al. J American College of Cardiology, 2013). It is entirely less clear when patients present with uncomplicated dissection, (1) which patients are at greatest risk for the development of complications related to their dissection in the long-term, and (2) during which time frame intervention or repair are indicated.

Methods: There is currently a paucity of data examining the demographic features of patients presenting to hospital in Canada, and specifically Ontario, with acute type B dissection, as well as how and by which specialists these individuals are managed in hospital and once they are discharged. We are using ICD10 diagnostic codes at patient admission and at discharge, to identify patients with type B dissection between 2005 and 2016 in an Ontario-wide retrospective database. This process is ongoing with a validation of codes used to identify and subcategorize patients presenting with acute aortic dissection. Furthermore, we are exploring patient demographic features, as well as disease-specific risk factors at presentation and in follow-up in Ontario patients presenting with acute type B aortic dissection. The second phase of this project involves an ongoing examination of features characterizing hospital and post-hospitalization care of these patients, including examining the types of institutions, wards, physician services, and surgical services utilized by these patients. Of fundamental import is to address whether there is a relationship between the baseline demographic information, or medical comorbidities, and the time to operative intervention for aortic dissection in this cohort of patients.

Conclusions: Delineating the time between initial presentation and surgical intervention, with the indication for intervention, will allow for modeling of disease progression in aortic dissection. This will change our management paradigm, providing evidence-based indications regarding patients who should undergo early repair, and during what time interval this repair demonstrates the most favorable risk/benefit ratio.
Burkholderia Pseudomallei Mycotic Aortic Aneurysm in a Returning Traveller

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Mycotic aneurysm is a rare lethal vascular pathology. Antibiotic choice is crucial for successful surgical management and prevention of relapse. The choice of antibiotics might be challenging when the causative organism is presenting in a non-endemic area. Mycotic aneurysms due to *Burkholderia pseudomallei* in Tourists may have a misleading presentation.

We describe here the details of a patient, who recently visited Thailand, and presented with fever and abdominal pain related to mycotic aortic aneurysm. He was managed with endovascular stenting. His surgical course was complicated by a rupture of the aneurysm as the diagnosis of *B. pseudomallei* was not made because of negative cultures. He underwent a successful axillo-bi-femoral grafting. He received six weeks intravenous antibiotics followed by an eradication course of trimethoprim-sulfamethoxazole and doxycycline for another six months. He did well at eighteen months of follow up.