

Canadian Society for Vascular Surgery 2011 Annual Meeting

Sept. 23–24, 2011, St. John's, NL

FRIDAY, SEPT. 23, 2011

PAPER SESSION I: AORTIC ANEURYSM I

Trends in the utilization of endovascular therapy for elective and ruptured abdominal aortic aneurysm procedures across Canada: a cohort study. *P. Jetty,* D. Husereau.†* From the *Division of Vascular Surgery, The Ottawa Hospital, and the †Canadian Agency for Drugs and Technologies in Health, Ottawa, Ont.

Background: Whereas randomized trials have shown improved operative mortality with endovascular aneurysm repair (EVAR) but similar long-term mortality rates, enthusiasm for EVAR persists, and rates of EVAR use continue to increase. Currently, knowledge of utilization rates of EVAR in Canada is limited. **Methods:** Patients who underwent nonruptured abdominal aortic aneurysm (AAA) and ruptured AAA (RAAA) repair, by either open surgical repair (OSR) or EVAR, in Canada were identified from hospital discharge abstract data. Trends in rates for OSR and EVAR were calculated by province and by year, and standardized per 100 000 persons over 65 years of age (per capita). **Results:** Between April 2004 and March 2009, 15 960 AAA procedures were performed in Canada, either by OSR ($n = 12\ 204$) or EVAR ($n = 3756$). The proportion of all elective AAA procedures by EVAR increased from 11.5% in 2005 to 35.5% in 2009, the highest current proportion of EVAR utilization being in British Columbia (45.0%) and the lowest in Manitoba (15.8%). After standardization, the national rate of total procedures was steady, but the rate of RAAAs declined over the entire study period. Alberta consistently had the highest per capita rates of EVAR use (38.9), whereas Prince Edward Island had the lowest (8.4). Provincial variations in EVAR use did not correlate with differences in comorbidities. Compared with Canadian averages, Atlantic provinces performed the most AAA procedures per capita (137.5 v. 93.4), had the highest rate of RAAAs per capita (29.7 v. 2.2) and the lowest proportional rates of EVAR use. **Conclusion:** Use of EVAR in Canada for AAAs has increased in the past 5 years, without affecting overall AAA procedure volumes. Large discrepancies in EVAR use exist across Canada. The Atlantic provinces had the highest rates of RAAAs despite having the highest rates for total AAA procedures, suggesting a population with higher susceptibility for AAAs. This region may also have the largest potential for future increased use of EVAR.

Total percutaneous endovascular aneurysm repair is safe and cost effective: a single centre experience. *G. Azoubel,**

C. Werneck,† M. Pope.† From the *University of Toronto, Toronto, and the †Trillium Health Centre, Mississauga, Ont.

Background: Recent developments in aortic stent-graft technology have led to an increase in the use of total percutaneous endovascular aneurysm repair (P-EVAR). **Methods:** A retrospective review of all EVAR cases performed from Apr. 1, 2010, to Mar. 31, 2011, in a single centre was done. The electronic records as well as the EVAR database were reviewed, and demographic and clinical data were collected. Primary outcomes reviewed were success rate, loco-regional complications and cost. Secondary outcomes included operative time, hospital stay and systemic complications. **Results:** In the study period, 69 EVARs were performed, 59 of them through a total percutaneous access. The majority of patients were male in both the P-EVAR (80%) and the operative (O-EVAR) group (70%). The mean age was 74.1 years in the P-EVAR group and 77.3 in the O-EVAR group. The overall success rate of percutaneous arterial closure was 89.8%. The mean number of percutaneous closure devices used was 2.9. The access-related complication rate was 3% in the P-EVAR group, and no local complications were seen in the O-EVAR group. In our study, P-EVAR was associated with reduced operative time (102.9 min v. 175.9 min, $p = 0.02$). The mean total cost of the procedure was Can\$12 455.06 in the P-EVAR group and Can\$12 156.55 ($p = 0.63$). The length of stay was 2.19 days for the P-EVAR group compared with 3.6 days in the O-EVAR group ($p = 0.07$). **Conclusion:** Percutaneous EVAR appears safe and effective with low local access-related complications and similar costs. The length of stay was similar in the 2 groups, but with a trend toward shorter time in the P-EVAR group.

Graft limb occlusion in elective endovascular aneurysm repair. *B. Howe, G. DeRose, T. Forbes, J. Harris.* From the London Health Sciences Centre, London, Ont.

Background: Graft limb occlusion (GLO) is a known complication of endovascular aneurysm repair (EVAR) and has been reported to occur in 3.7%–7.2% of cases. Little research exists examining the factors that may predispose individuals to GLO. This study evaluates our clinical experience with GLO and attempts to better define risk factors associated with it. **Methods:** Retrospective single-centre review of all elective EVAR for infrarenal abdominal aortic aneurysms (AAAs) during the 5-year period from January 2005 to December 2009. Details regarding placement of a bifurcated or aorto uni-iliac (AUI) graft and landing zone of distal limbs were collected retrospectively. Aortic bifurcation diameter and iliac vessel diameters were measured

from preoperative CT scans. The investigator was blinded to which patients developed GLO until data collection was complete. Patients without an accessible preoperative CT scan were excluded from analysis. **Results:** Endovascular aneurysm repair was performed in 529 patients over this 5-year period. In total, 202 (38.19%) patients had placement of an AUI graft and 327 (61.81%) had placement of a bifurcated graft. We excluded 41 patients with bifurcated grafts (2 with GLO) and 14 with AUI grafts (1 with GLO) owing to their preoperative CT scans being unavailable. There were 11 (3.85%) cases of GLO in bifurcated grafts and 2 (1.06%) cases in AUI grafts. Graft limb occlusion occurred in 14.29% of bifurcated grafts with at least 1 limb extending into the external iliac artery and 3.02% of bifurcated grafts terminating in the common iliac artery ($p = 0.010$). There was no demonstrable difference between the mean aortic bifurcation diameters in patients with bifurcated grafts that occluded and did not occlude (23.63 mm v. 26.31 mm, $p = 0.177$). The iliac arterial diameter where the graft limb terminated did appear to be smaller in bifurcated grafts that developed GLO (11.44 mm v. 13.62 mm, $p = 0.030$). **Conclusion:** Our results suggest that smaller distal vasculature and extension of the graft limbs to the external iliac artery are associated with GLO in bifurcated grafts. This has ongoing implications for patient selection for this still evolving surgical technique.

Detailed analysis of a series of explanted Talent abdominal aortic aneurysm stent-grafts: I. Biofunctionality assessment. M. Nutley,* R. Guidoin,[†] T. Yin,[†] Y. Douville,[‡] Z. Zhang,[†] G. Marinov,[§] D. Wei,[¶] J. Lin,^{**} B. Weber,^{††} L. Wang,^{‡‡} B. Li,^{§§} G. Samis,* Y. Merhi,^{¶¶} R. McGregor,^{***} P. Petrusek,* G. Dionne,^{†††} N. Gilbert.[‡] From the *University of Calgary, Calgary, Alberta; [†]Québec Biomaterials Institute CHUQ, Québec, Que.; [‡]Department of Surgery, Laval University, Québec, Que.; [§]Key Laboratory of Biorheological Science and Technology of Ministry of Education and Chongqing Municipal Engineering Laboratory in Vascular Implant, Chongqing, China; ^{¶¶}The Institute of Cardiovascular Disease, Heng Yang, China; ^{**}Key Laboratory of Textile Science and Technology of Ministry of Education and College of Textile Donghua University, Shanghai, China; ^{††}Clinic for Cardiovascular Surgery, Zurich, Switzerland; ^{‡‡}Key Laboratory of Textile Science and Technology of Ministry of Education and College of Textile Donghua University, Shanghai, China; ^{§§}Laval University and Québec Biomaterials Institute CHUQ, Québec, Que.; ^{¶¶¶}Laboratory of Experimental Pathology, Montréal, Que.; ^{***}Imaging Department, Boundary Trails Health Centre, Winkler, Man.; ^{†††}Department of Radiology Laval University, Québec, Que.

Background: A total of 6 explanted Talent stent-graft devices obtained from reoperations and postmortem autopsies were analyzed as part of an ongoing clinical validation of aortic endograft prostheses in order to highlight their strengths and weaknesses. **Methods:** Six devices were harvested at reoperations (R1–R5, $n = 5$) and autopsy (A1, $n = 1$). The explants were observed non-destructively by way of gross morphology, radiographs, CT scans and by closed pressure system analysis. The medical records of each case were also evaluated in a retrospective manner. **Results:** The Nitinol frames in 3 devices harvested at reoperations and

1 harvested at autopsy were intact. Of the 2 devices that demonstrated structural failures, the metallic frame of 1 had a stent fracture of the proximal bare stent causing distal migration of the device at 2 years postimplantation. The second device failure also had a wire fracture of a thin proximal external supporting stent as well as a hole in the fabric just above the bifurcation. This ultimately led to reoperation owing to a type III endoleak and abdominal aortic aneurysm sac rupture. For 3 devices that remained structurally intact, reoperations were performed for a type 1A endoleak in 1 patient and aorto-enteric fistulas in 2 patients in whom a fabric tear was observed in the main body of one of these grafts. The healing characteristics observed macroscopically of the devices from reoperations were poor or absent. Minimal encapsulation was observed inside or outside of the endografts. The fabric in the main body of the grafts harvested after aorto-enteric fistula at 2 and 4.5 years postimplantation were devoid of deposits, and their impermeability remained in question. Two of the grafts harvested at reoperation demonstrated fabric holes of more than 4 mm². The device obtained at autopsy showed an almost continuous internal capsule with a variable thickness. The luminal surface was smooth, but the capsule was not encroaching into the fabric and detached easily. The external capsule also separated from the device at harvesting. **Conclusion:** These devices explanted at reoperations showed various levels of impaired biofunctionality associated with adverse outcomes resulting from neck dilatations, endoleaks, device failures and absence of encapsulation. The stent graft retrieved from autopsy of the patient whose death was not related to the endovascular procedure was, however, intact with appropriate biofunctionality and encapsulation. This study identified issues concerning the Talent graft design; however, the clinical context of each of these adverse outcomes must also be considered.

Differences in aneurysm surgery between urban and rural patients. D. Harrington, J. Faulds, T. Novick, J. Harris, G. DeRose, T. Forbes. From the London Health Sciences Centre and the University of Western Ontario, London, Ont.

Background: In our region of the country, abdominal aortic aneurysm (AAA) surgery has become increasingly centralized at our centre, requiring patients to travel further for treatment. The effect of rural or urban residence has not been explored. This study compares the clinical outcomes and rates of repair of patients from urban and rural residential locales. **Methods:** All patients who received open or endovascular repair of an infrarenal AAA at our centre between 2005 and 2010 were identified. Patients were grouped according to their residential postal codes as rural or urban dwellers, and rates of repair and outcomes following repair were compared between these groups. **Results:** During this 5-year period, 1258 AAA repairs were performed with more patients residing in urban centres (911 patients, 72.4%) than rural areas (347 patients, 27.6%). The majority of repairs were elective (1119 cases, 89%) as opposed to emergent (139 cases, 11%). The overall in-hospital mortality rate following elective repair was 2.8% and did not differ between urban and rural patients (3.1% v. 1.9%, $p = 0.4$). The overall in-hospital mortality rate following emergent repair was 43.9% and did not differ between urban and rural patients (43.6% v. 44.7%, $p = \text{NS}$). Annual rates of repair (per 100 000 population) were compared between urban and rural areas.

Emergent repair rates did not differ (1.0 v. 1.1, $p = \text{NS}$); however, overall (10.4 v. 8.9, $p = 0.02$) and elective (9.2 v. 7.9, $p = 0.02$) repair rates were higher in rural areas. **Conclusion:** Rural and urban patients had similar outcomes following AAA repair, although a higher rate of elective repair was observed in rural patients. Possible explanations include patient specific factors (rural patients are more prone to be smokers, male and older) and differences in access to care and health care delivery.

Open repair of juxtarenal aortic disease: 20 years' experience. B. Cartier. From Valleyfield, Que.

The growing use of endovascular aneurysm repair (EVAR) in the treatment of infrarenal abdominal aortic aneurysm (AAA) has resulted in an increase in open juxtarenal aortic aneurysm (JAA). Fenestrated endograft technology for JAA is developing rapidly, but only limited outcomes are known. The aim of this study was to review the experience of the author with open JAA repair and also in juxtarenal aortic occlusive disease (JAOD) requiring clamping above one or both renal arteries. Clinical data of patients undergoing elective or urgent open repair of JAA and JAOD were retrospectively collected and analyzed. Between July 1, 1990, and Dec. 31, 2010, 563 aortic surgeries were performed, 422 for AAAs (75%) and 141 (25%) for aortic occlusive disease. Juxtarenal aortic aneurysm (mean 6.2, range 4.5–9 cm) accounted for 8.5% (36 of 422) of all AAAs repaired and JAOD for 7.8% (11 of 141) of all aortic occlusive diseases repaired in 33 men (70%) with a mean age of 67.8 (range 49–81) years and 14 women (30%) with a mean age of 70 (range 52–86) years. Straight grafts were used in 17 (36%) and bifurcated in 30 (64%) patients. Left renal vein division was required in 8 patients. Clamp location included 3 supraceliac and 45 suprarenal (35 bilateral, 10 inter-renal). Renal ischemia time averaged 18 (range 4–32) minutes. There were no 30-day or in-hospital mortalities. Cardiac complication included myocardial infarction in 4 (8.5%) and arrhythmia in 4 (8.5%). Pulmonary complications occurred in 4 (8.5%). Postoperative renal insufficiency occurred in 16 of 47 (34%). Temporary in-hospital hemodialysis was required in 2 (4.2%). Fifteen of 16 (94%) had return of serum creat. to $< 120 \mu\text{mol/L}$ or within 30% of the preoperative baseline serum creatinine value at the time of hospital discharge. Renal artery reconstruction (10) and left renal vein division (8) were not associated with a greater risk of postoperative renal insufficiency. The renal ischemia time and the location of the aortic clamp placement were not associated with a greater risk of postoperative renal insufficiency. One-, 3- and 5-year cumulative survival rates were 100%, 90% and 80%, respectively. No patient progressed to hemodialysis. Contemporary open repair of JAA in the era of evolving fenestrated endograft technology is safe, effective and durable, even in patients with multiple cardiovascular risk factors.

FRIDAY, SEPT. 23, 2011

PAPER SESSION II: VASCULAR EDUCATION AND SAFETY

Current status of continuing medical education activities undertaken by vascular specialists — the results of an online survey. E. Wooster,* E. Greco,† A. Dueck,† D. Wooster.†

From the *OISE/University of Toronto, and the University of Toronto, Toronto, Ont.

Background: Advanced technology is expanding into continuing medical education (CME) and allows for multiple opportunities and alternative methods of undertaking CME. Multimedia methods, including e-learning and interactive websites, are now prevalent in the educational field. This study addresses physicians' attitudes and practice of CME in this new environment. **Methods:** We conducted a survey of CME practice among vascular surgeons. Questions explored included demographics, resource support (monetary and protected time), perceived barriers, preferred methods of undertaking CME, attitudes to e-learning and traditional programs and present CME practice. The results were compared with data in the Royal College of Physicians and Surgeons of Canada (RCPSC) Maintenance of Certification (MOC) program database and with the current trends in CME program development. **Results:** Our preliminary results indicate that the majority of vascular surgeons prefer traditional CME activities, and this is how they complete a majority of their required CME hours. When compared with the overall MOC program results, the results are similar to the overall reported numbers. These results are in contrast to trends being supported by CME providers, researchers and accreditation agencies; these actors are advocating for increased interaction and technological involvement in CME activities. **Conclusion:** This study has identified a disconnect between the types of programs practitioners prefer and continue to use to achieve their CME requirements and the programs that are currently being developed and advocated for by CME providers, researchers and accrediting agencies. This disconnect needs to be addressed in order for effective CME to continue in the future.

Evaluating intraoperative teaching from both the surgeon and resident perspective: a qualitative study using focus groups. R. Gowing, J. Harlock, D. Szalay. From McMaster University, Hamilton, Ont.

Background: An integral part of surgical residents training occurs in the operating room. This is a complex environment that the surgeon must negotiate to achieve successful teaching and learning. There is no research that has evaluated the operative teaching experience from both the surgeon and resident perspective. The purpose of this study is to describe the relationship and dynamic between the intraoperative learner and teacher. **Methods:** Using a qualitative description approach, a purposive sample of 53 staff surgeons from a variety of subspecialties and 45 junior and senior surgical residents from varied subspecialties at a single tertiary care centre participated in focus groups. Focus groups were audiotaped for transcription, and notes were taken by 2 research assistants. Qualitative content analysis included generating a thematic coding scheme which identified emerging concepts and linkages in the data. Study rigor (integrity and validity) was achieved through maintaining an audit trail, investigator and data triangulation, member-checking and reaching conceptual saturation of the data. **Results:** Surgeons' intraoperative teaching responsibilities include factors affecting the self and interactions with learners, the patient and others in the operating room (OR). The key, underlying theme in teaching responsibility is first having the

intention to teach, managing the internal distractions and other barriers so that surgeons can behave as responsible, professional, ethical teachers. From the resident focus groups, 2 overlapping domains emerged from the data; these were grouped under teaching techniques (what we do) and teaching environment (how we do it). Among the findings that the residents deemed positive were “providing constructive criticism,” “assigns increasing responsibility” and “awareness of resident learning needs.” Included in those findings that were deemed negative were “consistent lack of feedback,” “lack of instruction” and “develops negative learning atmosphere.” **Conclusion:** Surgeons manage a multitude of responsibilities when teaching in the complex environment of the OR. They directly teach learners, set up a supportive environment, interact with others in the OR and protect their patients. For residents, effective teachers are those who employ techniques and provide an environment that engages the learner. How things were taught, in general, we viewed as more important than what was taught.

Strategies for increasing medical student awareness and exposure to vascular surgery in Canada: new ventures for 2012. *K. Hunt,* E. Wooster,† A. Dueck,‡ D. Wooster.‡* From *McMaster University, Hamilton, †OISE/University of Toronto, and the ‡University of Toronto, Toronto, Ont.

Background: As of 2012, there will be a 5-year, direct-entry residency program (0+5) in vascular surgery in Canada. This presents an opportunity to investigate the most effective strategies for raising medical student awareness, knowledge and interest in a career in vascular surgery. In the current medical school curriculum, only a fraction of students will have exposure to vascular surgery. The use of electronic communication tools and multimedia may have a role in generating interest in vascular surgery among potential applicants. **Methods:** A survey to be hosted on an encrypted online survey website (SurveyMonkey.com) and sent to all medical students in Ontario was developed to assay demographic data, 12 career choice determinants, the availability and usage of computers, laptops and portable devices and preferred social networking and communication methods. A small-scale β test survey was conducted on a sample of 20 medical students. Comments and feedback received during the test survey period were used to guide the creation of the finalized complete survey. **Results:** The type of clinical problems encountered, lifestyle factors and difficulty in obtaining a residency ranked highly in specialty selection. Future income, research potential and malpractice issues had a low ranking. Information was best delivered preclerkship. Websites with individual or aggregate residency information were most useful; journal articles and mass emails were not. All students owned a computer and MP3 player; 70% had a “smartphone” capable of data transmission. The complete survey was elaborated to address more detailed study of best approaches to electronic communication regarding vascular specialty training and practice based on the findings of this β survey. **Conclusion:** We identified the preferences of medical students for receiving information regarding residency selection. We demonstrated the feasibility of further assessing this through a detailed Internet-based survey. The information obtained will be useful to develop focused, effective and efficient communication strategies for vascular surgical training programs in addressing the 0+5 program development.

Safety in vascular surgery — when 2 worlds unite. *M. Wheatcroft, N. Eisenberg, D. Wooster, G. Roche-Nagle.* From the Toronto General Hospital, Toronto, Ont.

Background: Safety in medicine is of paramount importance. To this end, the surgical safety checklist was identified as an effective tool in the operating room, and its impact expands way beyond safe surgical processes to improvement in teamwork, communication and culture. In the department of interventional radiology (IR), proper radiation training and implementation of safety procedures is of critical importance in lowering physician and patient health risks associated with radiation exposure. Modern vascular surgery is becoming increasingly characterized by minimally invasive intervention, where radiographs (fluoroscopy) are used, and IR involves invasive procedures to which a safety checklist could be applied. The safety lessons learned separately by specialties should be readily transferable. We sought to study surgical safety in general, especially evaluating current radiation safety education among IR staff, vascular surgeons and trainees. In addition, we sought to focus on attitudes toward preprocedure safety checklists among these groups. **Methods:** A questionnaire-based survey was performed of vascular surgery, IR staff and trainees. Questions included whether radiation safety training had been received, habits of dosimeter and lead goggles use, and utilization of preprocedure checklists. **Results:** Overall, 100% of IR staff and trainees had undergone formal radiation safety training compared with only 40% of those in the vascular surgery department. In addition, only 20% of vascular surgery physicians routinely wore a dosimeter compared with 50% of IR staff. A preprocedure checklist was performed 100% of the time by vascular surgical staff before a surgical intervention but only instituted in 62% before a percutaneous peripheral vascular intervention. **Conclusion:** In conclusion, vascular surgical staff have not been adequately educated about radiation safety. Based on the above facts, the authors recommend that all vascular surgical staff and trainees should have more information and knowledge about ionizing radiation to ensure physician safety. Furthermore, the culture of the preprocedural checklist needs to be implemented in all areas of the hospital where invasive procedures are performed to ensure maximum patient safety.

Developing a Canadian primary certification in vascular surgery curriculum: a guide for rotation schedules and training time allocation. *T. Roy,* A. Dueck,† D. Kucey.‡* From the *Faculty of Medicine, University of Toronto, Mississauga, the †Sunnybrook Hospital and the ‡Division of Vascular Surgery, Sunnybrook Health Sciences Centre, Toronto, Ont.

Background: The Royal College of Physicians and Surgeons of Canada (RCPSC) recently approved the implementation of a primary certification program in vascular surgery starting July 2012. There is considerable flexibility in the rotation schedule, and therefore the design of the curriculum presents a challenge to vascular surgery program directors. In light of the shortened length of training, residency duty hour restrictions and the expanded scope of vascular surgery, rotations must be selected carefully for trainees to get the optimal mix of experience and education. The purpose of this study is to compare the current Canadian (5+2) vascular surgery training paradigm with US

primary certification (0+5) vascular surgery programs to help guide the rotation schedule for a Canadian primary certification vascular surgery program. **Methods:** A survey was performed of the 17 RCPSC-approved general surgery residency programs, 10 RCPSC-approved vascular surgery residency programs and 28 Accreditation Council of Graduate Medical Education (ACGME) primary certification in vascular surgery programs. The primary certification residency program survey included the year of accreditation, anticipated quota for 2012, number of primary certification vascular surgery residents in the program, full-time physician faculty:trainee ratio, percent female full-time physician faculty, number of training sites and estimated average case volumes. A curriculum review of the 17 RCPSC-approved general surgery and the 28 ACGME-approved programs was performed to determine the allocation of time spent in various training disciplines. **Results:** Fourteen of 17 RCPSC general surgery programs and 15 of 28 ACGME primary certification (0+5) vascular surgery programs had published rotation schedules. The average training time in core endovascular/vascular surgery rotations was 32.6 months in ACGME 0+5 vascular programs compared with 16.5 months in RCPSC 5+2 vascular programs. In addition, ACGME 0+5 programs had more training time in transplant surgery, plastic surgery, trauma, vascular medicine, hematology, stroke neurology and interventional radiology compared with RCPSC 5+2 programs. The RCPSC 5+2 programs spent an average of 5.1 months in nonsurgical rotations that are not applicable to other surgical specialties including gastrointestinal/endoscopy and outpatient clinics/protected time in PGY5 for RCPSC exam preparation. **Conclusion:** Our results suggest that rotations in core surgical specialties (general surgery, cardiac, thoracic, transplant and trauma), medical specialties (critical care, cardiology, vascular medicine and stroke neurology) and radiology (diagnostic, interventional and vascular laboratory) can be integrated with vascular surgery into the first 4 years of training in a primary certification program. The final year should be spent as a chief resident in vascular and endovascular training to meet current international training standards.

Identifying an endovascular research agenda for Canada: results of the Toronto Endovascular Conference (TEC) 2011. E. Wooster,* A. Dueck,† D. Wooster.† From the *OISE/University of Toronto and the †University of Toronto, Toronto, Ont.

Background: The rapid evolution of endovascular (EV) management has led to a variety of important clinical management questions. The concept of a cogent Canadian EV research agenda may allow for collaborative national research approaches through the CSVS. **Methods:** At the Toronto Endovascular Conference (TEC), March 2011, we developed a strategy to identify an endovascular research agenda for Canada. Through expert presentations and group discussion we identified a series of clear questions that could be addressed by future research regarding endovascular situations. **Results:** The issues addressed in 13 clinical areas included the following: options in managing primary and recurrent iliac and lower extremity artery stenotic and occlusive disease, advanced strategies in managing the internal iliac artery at the time of an endovascular aneurysm repair, interventions for endoleaks, mesenteric vascular interventions, endovascular treatment of arch aneurysms, catheter management of iliac

venous thrombotic disease and options in treating varicose veins. From the presentations, 37 specific issues were identified. **Conclusion:** The presentations and discussions held at TEC identified a series of important research questions. Further study is warranted to identify a Canadian EV research agenda, best approaches, feasibility and priorities, consider collaborative opportunities and address resource requirements of each potential study. It is proposed to involve the CSVS membership in the further elaboration of this agenda.

**SATURDAY, SEPT. 24, 2011
PAPER SESSION III: GENERAL VASCULAR TOPICS**

Does female sex influence 30-day stroke and mortality rates following carotid endarterectomy? R. Guzman,* W. Weighell,† S. Piper,† C. Guzman,* D. Rodriguez.‡ From the *University of Manitoba, the †St. Boniface Hospital and the ‡St. Boniface Research Centre, Winnipeg, Man.

Background: Our objective was to determine if sex influences stroke and mortality rates following carotid endarterectomy (CEA). **Methods:** A retrospective chart review of 1086 CEAs performed by a single surgeon from Jan. 1, 1993, to Dec. 31, 2010, was completed for analysis. There were 39 combined CEA and coronary artery bypass grafting procedures excluded from the analysis, leaving a total of 1047 procedures. The risk factors of age, sex, race, dyslipidemia, hypertension, diabetes, peripheral arterial disease, coronary artery disease, smoking, medication profile and intraoperative variables were reviewed. The 30-day stroke and mortality rates were analyzed. **Results:** The tables below show the distribution of patients according to age and symptomatic status; the distribution of patients according to risk factors;

Table 1. Distribution of patients according to age and symptom status

Characteristic	Patients, no. (%)*			p value
	All	Female	Male	
Group	1047 (100)	364 (34.8)	683 (65.2)	< 0.001
Age, mean (SD)	70 (9.1)	70.6 (9.1)	69.7 (9)	0.1
Asymptomatic	367 (35)	120 (33)	247 (36.2)	0.6
Symptomatic	680 (65)	244 (67)	436 (63.8)	0.5

SD = standard deviation.
*Unless otherwise indicated.

Table 2. Distribution of patients according to risk factors

Risk factor history	Patients, no. (%)			p value
	All, n = 943	Female, n = 327	Male, n = 616	
Dyslipidemia	487 (51.6)	165 (50.5)	322 (52.3)	0.7
Hypertension	695 (73.7)	249 (76.1)	446 (72.4)	0.3
Diabetes	229 (24.3)	75 (22.9)	154 (25.0)	0.7
Peripheral arterial disease	277 (29.4)	83 (25.4)	194 (31.5)	0.4
Coronary artery disease	417 (44.2)	125 (38.2)	292 (47.4)	0.1
Smoker, current or ex	617 (65.4)	201 (61.5)	416 (67.5)	0.2
Current smoker	203 (21.5)	83 (25.4)	120 (19.5)	0.5

Table 3. 30-day stroke and mortality rate

Patients	No. (%)			p value
	Total	Asymptomatic	Symptomatic	
All	22 (2.1)	6 (1.6)	16 (2.3)	0.5
Female	7 (1.9)	2 (1.7)	5 (2.0)	0.7
Male	15 (2.2)	4 (1.6)	11 (2.5)	0.6

and the 30-day stroke and mortality rates. **Conclusion:** The 30-day stroke and mortality rates were similar in males and females undergoing CEA regardless of symptom status.

Improvement in postoperative outcomes following carotid endarterectomy in the Regina Qu'Appelle Health Region. J. Misskey,* D. Kopriva,† D. McCarville.† From the *University of Saskatchewan and the †Regina Qu'Appelle Health Region, Regina, Sask.

Background: Numerous studies have shown that postoperative outcomes for carotid endarterectomy are related to surgeon caseload (Archie, *South Med J* 1988;81:707-10 and Holt et al., *Eur J Vasc Endovasc Surg* 2007;33:645-51), though relatively few assess the role of cumulative surgical experience and its effect on surgical outcomes other than stroke or death. The purpose of this study is to determine whether surgeons achieve significant improvements in multiple postoperative outcomes over time. **Methods:** Data were collected through a retrospective chart review of all cases of carotid endarterectomy by 2 vascular surgeons in the Regina Qu'Appelle Health Region from 2002 to 2010. Pertinent information was entered into a dedicated database of 138 fields including demographic, clinical, diagnostic and technical variables. Patients were stratified into 2 groups: group 1 for the first half of all endarterectomies and group 2 for the remainder. Five clinical outcomes were statistically assessed: postoperative neurologic events (stroke, transient ischemic attack, amaurosis fugax), mortality, cranial nerve injury, hematoma and length of postoperative stay. Outcomes were analyzed using χ^2 for nominal level data, the Wilcoxon rank sum test for continuous data that violated parametric assumptions, and multivariate analysis with multiple logistic regression. **Results:** A total of 461 carotid endarterectomies were performed with a mean 28.8 endarterectomies per surgeon per year (range 17–38). The cumulative postoperative neurologic event rate was 20 (4.3%), including 9 (1.9%) strokes. The number of postoperative neurologic events in group 1 (6.5%) was higher than the number of postoperative neurologic events in group 2 (2.2%; $p = 0.024$). The mean (and standard deviation) postoperative length of stay was significantly higher in group 1 than group 2 (3.5 [2.8] v. 2.5 [1.6]; $p < 0.001$). There were similar though nonstatistically significant reductions in the number of cranial nerve injuries (7.4% v. 5.4%; NS), postoperative hematomas (4.8% v. 3.9%; NS) and mortality (1.7% v. 1.3%; NS) between groups 1 and 2, respectively. Multiple logistic regression demonstrated procedures in the first 230 cases (OR 3.04, CI 1.07–8.66; $p = 0.037$) and renal failure (OR 5.44, CI 1.348–21.91; $p = 0.017$) to be independently associated with an increased risk of postoperative neurologic events. **Conclusion:** Postoperative complication rates for carotid endarterectomy in the Regina Qu'Appelle Health Region have fallen over the study period. The study findings suggest that

postoperative outcomes for carotid endarterectomy decrease with increasing surgical experience and refinement in patient management.

Risk of recurrent stroke in a prospective series of patients with carotid artery disease identified using carotid ultrasound. E. Cheng,* D. Sahlas,* M. Ellins,† D. Szalay,* T. Rapanos.* From *McMaster University, Toronto, and the †Hamilton Health Sciences, Hamilton, Ont.

Background: The benefit of carotid endarterectomy for symptomatic carotid artery stenosis is well established, although the true prevalence of carotid artery disease is hard to determine. Recent guidelines support surgical intervention for moderate (50%–99%) as well as severe (> 70%) stenosis, if surgery can be performed within 2 weeks of the index clinic event. In patients with symptomatic carotid artery disease who do not undergo surgery, there are few data regarding subsequent outcome with modern medical management. **Methods:** In all, 604 patients were identified by Doppler carotid ultrasound between Jan. 1, 2009, to Oct. 31, 2009, from the Hamilton Health Sciences Regional Sector of the Ontario Stroke System Database. Patients with 50%–99% carotid stenosis were grouped according to the presentation of appropriate clinical symptoms and the grade of the carotid stenosis (50%–69% or > 70%). Follow-up 12–16 months from the time of ultrasound was performed to determine whether the patient received surgery and whether a recurrent ipsilateral stroke had occurred. The Fisher exact test was used for analysis of the data. **Results:** Of carotid arteries evaluated, 206 of 1208 had 50%–99% stenosis (106 of 206, > 70%; 100 of 206, 50%–69%). Patients with severe stenosis were twice as likely to be presenting with symptoms referable to the appropriate carotid territory (30 of 106, ~27% v. 14 of 100, ~13%; $p = 0.02$). Twenty-three of 30 patients with symptomatic severe stenosis underwent surgery, compared with only 3 of 14 patients with symptomatic 50%–69% stenosis ($p = 0.0009$). Of the patients followed, 1 of 7 patients with symptomatic severe stenosis who did not undergo surgery suffered ipsilateral strokes, compared with 0 of 11 patients with symptomatic 50%–69% stenosis who did not undergo surgery ($p = 0.39$, NS). Four of 145 patients with asymptomatic stenosis underwent surgery (14 lost to follow-up; 3 with prior carotid stenting), none of whom went on to suffer a stroke. One of 68 (1.5%) asymptomatic high-grade carotid stenosis patients without carotid endarterectomy experienced ischemic stroke. **Conclusion:** Greater than 70% carotid stenosis was more likely to represent symptomatic disease when encountered in our ultrasound department, suggesting that the higher grade of stenosis increases the risk of stroke. Despite prior evidence of benefits of CEA in moderate-grade carotid stenosis, patients with symptomatic carotid stenosis greater than 70% were more likely to receive surgery than patients with symptomatic 50%–69% stenosis. Asymptomatic patients on intensive medical therapy have a low 1-year risk of stroke.

A population-based analysis of pediatric and adult vascular trauma in Canada. C. de Mestral,* A. Dueck,† D. Gomez,‡ B. Haas,‡ A. Nathens.‡ From *St. Michael's Hospital/University of Toronto, the †Sunnybrook Hospital and the ‡Keenan Research Centre in the Li Ka Shing

Knowledge Institute of St Michael's Hospital, University of Toronto, Toronto, Ont.

Background: Arterial injuries are an important source of morbidity and mortality in patients sustaining traumatic injury. Our objective was to evaluate the epidemiology and management of arterial trauma across Canada. **Methods:** From the population-based National Trauma Registry (NTR-MDS) of Canada, we identified all patients admitted to acute care hospitals from 2002 to 2008 with a diagnosis of traumatic injury to the carotid, aorta, brachiocephalic, subclavian, axillary, brachial, femoral and popliteal arteries. We evaluated injury frequency by age group (pediatric, adult, elderly) as well as temporal trends in the incidence of arterial trauma and the use of endovascular repair. **Results:** In all, 2307 arterial injuries were identified in 2232 patients; 12% occurred in children (< 18 yr) and 9% in the elderly (≥ 65 yr). Motor vehicle collisions (47%) and stab wounds (24%) were the 2 most common mechanisms of injury overall. From 2002 to 2008, the incidence of arterial injury in adults 18–64 years increased ($p < 0.01$), while remaining stable in children and the elderly. The mean annual incidence of arterial injury and the 3 most common arterial injuries following blunt and penetrating injury are presented by age group in the Table.

Age category	Mean annual incidence of hospitalization for arterial injury per 1 000 000 Canadians	3 most common arterial injuries following penetrating trauma (%)	3 most common arterial injuries following blunt trauma (%)
Pediatric (< 18 yr, n = 256)	6.9	Brachial (45) Femoral (16) Carotid (14)	Brachial (32) Femoral (18) Popliteal (18)
Adults (18–64 yr, n = 1752)	15.9	Brachial (42) Femoral (19) Carotid (15)	Thoracic aorta (33) Popliteal (17) Brachial (16)
Elderly (≥ 65 yr, n = 224)	10.2	Brachial (42) Femoral (27) Carotid (13)	Thoracic aorta (46) Brachial (9) Popliteal (9)

The overall rate of intervention was similar in children (56%) and adults younger than 65 (58%) but significantly lower in the elderly (38%; $p < 0.01$). In all patients undergoing repair, the proportion of endovascular repairs increased significantly from 2002 to 2008 (1.5% in 2002 to 12.6% in 2008, $p < 0.01$). Endovascular intervention was most common in repairs of the thoracic aorta (36% of repairs), brachiocephalic/subclavian (20% of repairs) and carotid arteries (12% of repairs). **Conclusion:** While rare, the incidence of major arterial trauma is increasing in adults aged 18–64 years and endovascular management is becoming increasingly prevalent.

Analysis of vascular trauma trends in Ontario. A. Altoijry,* M. Al-Omran,† K.W. Johnston,* M.M. Mamdani,* T. Lindsay.* From the *University of Toronto, Toronto, Ont., and †King Fazel University, Rhyiad, Saudi Arabia

Background: Trauma is the most frequent cause of death during the first 4 decades of life. Vascular injuries are a major component of trauma and together with brain injuries represent the leading

causes of traumatic death. There is considerable information on vascular trauma in a military context; however, there are few comprehensive studies examining the epidemiology of vascular trauma in the civilian setting. No recent studies have examined temporal trends in the rates of civilian vascular trauma internationally or in Canada. We sought to examine temporal trends in vascular trauma related hospital admissions in Ontario between 1991 through 2010. Further analysis was performed to examine these temporal trends stratified by mechanism of injury, age, sex, economic status and geographical setting. **Methods:** A retrospective population-based cross-sectional time series study using Ontario's administrative claims database, conducted for fiscal years 1991–2010. Male and female patients of any age admitted to hospital for vascular trauma (neck, thorax, abdomen, upper and lower limbs vascular injuries) in the province of Ontario were the study population. The study was conducted at the Institute for Clinical Evaluative Science in Ontario. The Canadian Institute for Health Information Discharge Abstract Database was used to identify vascular trauma admissions and demographic characteristics of hospitalized patients. The Registered Persons Database was used for geographic, economic data and mortality of vascular trauma patients. Time series methodology was conducted to identify the nature of the phenomenon represented by the sequence of the observational data. To forecast the projections based on past trends, exponential smoothing models and autoregressive integrated moving average models were used. **Results:** In all, 8252 vascular injuries were identified in Ontario for the study period, with the upper limb being the most common site of injury (52%). The incidence of vascular injuries was relatively stable in Ontario over the study period. Hospital mortality was 5.5% for all vascular injury admissions, and peak rate was among seniors (> 65 yr) with injuries localized to the thoracic and abdominal areas. Transport associated vascular injuries (blunt) accounted for only 22% of cases, leaving the majority due to penetrating injury. Men were disproportionately affected (79%), with the peak incidence in the 25–64 age group (59%). The rate of vascular trauma was significantly higher among youth group population (15–24 yr), those with low economic status and those living in rural areas. **Conclusion:** The incidence of vascular injuries in Ontario has been stable over the 2 decades. Penetrating injuries are the most frequent, with the upper limb being the most common site of injury. These results have important public health implications for injury prevention strategies.

Rates of elastic compression stockings prescription following diagnosis of deep venous thrombosis. A. Kayssi, N. Eisenberg, G. Roche-Nagle. From the Toronto General Hospital, Toronto, Ont.

Background: Postthrombotic syndrome (PTS) is a complication of deep vein thrombosis (DVT) characterized by chronic pain, swelling and heaviness, and may result in ulceration. Elastic compression stockings (ECS) worn daily after DVT appear to reduce the incidence and severity of PTS. The aims of our study were to investigate practices and perceptions of physicians regarding adjunct therapies to anticoagulation in patients diagnosed with lower extremity DVT. **Methods:** A survey was conducted of staff and trainee clinicians ($n = 225$) to investigate their attitudes toward prescription of ECS postdiagnosis of DVT. In addition, patients diagnosed with DVT were questioned on whether ECS

were prescribed and on their attitudes toward them. **Results:** The results demonstrated that the majority of senior staff (75%) believed that ECS were effective in preventing PTS and in managing venous symptoms. However, this was in contrast with junior trainees (21%; $p < 0.05$). This resulted in only 63% of patients being prescribed ECS post-DVT. There was a lack of consensus as regards the optimal timing of initiation of ECS, duration of therapy and compression strength. Nearly all DVT patients who were prescribed ECS purchased them, 74% wore them daily, and most (61%) reported that ECS relieved swelling and symptoms. Physicians correctly predicted the main reasons for noncompliance, but misjudged the scale of patient compliance with ECS. **Conclusion:** Our findings suggest that there is a lack of consensus among doctors regarding ECS use after DVT and widespread education regarding the latest evidence of the benefit of ECS after DVT.

SATURDAY, SEPT. 24, 2011

PAPER SESSION IV: AORTIC ANEURYSM II

Impact of serial contrast-enhanced CT scans on renal function post-endovascular aneurysm repair. X. Xiong, C. Abraham, M. Corriveau, K. MacKenzie, D. Obrand, O. Steinmetz. From McGill University, Montréal, Que.

Background: Computed tomography (CT) with intravenous contrast is the gold standard for the evaluation and follow-up of patients post-endovascular aneurysm repair (EVAR). However, the additive effect of contrast load over years may lead to decline in renal function. The objective of this study was to determine the relation between the number of CT scans post-EVAR and the long-term renal function. **Methods:** Sixty-six patients were selected based on inclusion criteria from our division database. These patients underwent elective endovascular repair for infrarenal aortic aneurysms between 2002 and 2007 with follow-up of ≥ 30 months. The following data were collected: patient demographics, relevant medical history and medications, baseline creatinine and creatinine at last follow-up with their respective glomerular filtration rate (eGFR), preoperative renal artery and aneurysm anatomy, intraoperative contrast use and blood loss, proximal stent fixation position, total months of follow-up, number of CT scans with contrast postoperatively, number of ultrasounds and other imaging modalities, number of secondary interventions and presence of renal infarct on last imaging. Single-variable analyses using odds ratio, Student t test, χ^2 test, Fisher exact test and linear regression test were performed for statistical analysis. **Results:** Mean total follow-up was 55.13 (± 16.96) months. Out of 66 patients, 19 patients (28%) had a decline in renal function of $\geq 20\%$. In this subgroup, the mean rate of change in eGFR was -1.47 (± 0.66 ; $p < 0.01$). Baseline characteristics analysis demonstrated statistical significance for the following variables: smoking ($p = 0.05$), lower number of CT scans with contrast postoperatively ($p = 0.04$) and greater number of ultrasounds postoperatively ($p = 0.01$). No correlation was demonstrated between number of CT scans with contrast and renal outcome ($R^2 = 0.01$). Univariate analysis of potential risk factors associated with poorer renal outcome showed statistical significance with the presence of tobacco usage and preoperative renal artery disease, with odds ratios of 3.54 (1.16–10.83) and

3.80 (1.19–12.09), respectively. Seven patients (11%) had a renal infarct demonstrated on postoperative imaging. For those patients, suprarenal stent fixation was not a statistically significant risk factor (odds ratio 0.33, 95% confidence interval 0.03–3.73). **Conclusion:** No correlation was noted between the number of contrast enhanced CT scans and renal outcome. Risk factors that were statistically significant in the patients with poorer renal outcomes were smoking and diseased renal artery on preoperative CT scans. Patients with poorer renal function had fewer CT scans with contrast and an increased number of ultrasounds during their follow-up. Further studies with greater sample size may be necessary to determine other significant risk factors among patients with poorer renal outcome.

Contrast ultrasound in the surveillance of endovascular abdominal aortic aneurysm repair. S. Nagpal, P. Jetty, T. Brandys, G. Hajjar, A. Hill. From the University of Ottawa, Ottawa, Ont.

Background: Our hypothesis was that ontrast ultrasound (CUS) is better than colour duplex (CD) and at least equal to enhanced computed tomography (CT) scan in the detection of endoleaks after endovascular aneurysm repair. **Methods:** This is a prospective, interventional, cohort trial. Health Canada approval was obtained for the off-label use of Definity, an ultrasound contrast agent. All patients who had undergone endovascular abdominal aortic aneurysm (AAA) repair were eligible for this trial. Patients with and without endoleak seen on CT scan were enrolled in the study. The ultrasound scanning technician was blinded to the CT scan results. Contrast injection techniques (infusion v. bolus) were evaluated previously by a lead-in phase. Scanning by CD was done before contrast injection. Patients were then rescanned after a bolus injection of Definity. Comparative CT scans were done within 6 weeks of the ultrasound studies. Presence of endoleak and graft stenosis were compared between the 3 modalities. **Results:** There were no complications associated with ultrasound contrast injection.

Table 1. Colour duplex ultrasound to detect endoleaks

Endoleak detected on ultrasound	Endoleak detected on CT	
	Yes	No
Yes	12	6
No	9	53

Table 2. Contrast ultrasound to detect endoleaks

Endoleak detected on ultrasound	Endoleak detected on CT	
	Yes	No
Yes	19	8
No	2	51

Contrast ultrasound observed more endoleaks than CD and CT scan (27 v. 18 v. 21). Using enhanced CT scan as the gold standard, the sensitivity and specificity of CD and CUS were 57%, 89% and 91%, 87%, respectively. Positive and negative predictive values for CD and CUS were 67%, 86% and 71%, 96%, respectively. Overall accuracy for CD and CUS were 81% versus 88%. The 2 patients with false-negative results in the CUS–CT scan comparison had rapidly decreasing size of AAA indicating a nonimportant endoleak. Of the 8 false-positive results in the CUS–CT scan group, 2 patients showed a leak on a subsequent scan, and 2 patients had enlarging AAA. One graft occlusion occurred and was noted on all modalities. No other stenoses or occlusions

were identified. **Conclusion:** Contrast ultrasound is a good alternative to enhanced CT scan for assessment of endoleaks. It did not miss any important leaks and detected leaks that were missed by CT scan on enlarging aneurysms. Contrast ultrasound is more accurate than colour duplex examinations.

Do changes in abdominal aortic aneurysm dimensions correlate with changes in atmospheric pressure?
S. Jamshidi, D. Valenti, K. MacKenzie. From McGill University, Montréal, Que.

Background: The relation between atmospheric pressure patterns and the incidence of abdominal aortic aneurysm (AAA) rupture is not well defined. Studies in aerospace medicine have established that peripheral vessels exhibit dilatation and contraction when extremities are exposed to low- and high-pressure environments, respectively. The identification of an analogous phenomenon in AAAs in response to normal atmospheric pressure variations may provide a potential mechanism for the suggested relation between atmospheric pressure patterns and the incidence of AAA rupture. The present study seeks to evaluate the relation between atmospheric pressure and AAA dimensions. **Methods:** The medical imaging databases at a tertiary care institution were queried to obtain all CT scans ordered for aneurysm by 2 vascular surgeons between 2007 and 2010. Scans identifying AAAs which were ruptured, post-open surgical repair, or post-endovascular stent grafting, as well as scans for aneurysms isolated to the thoracic aorta or iliac arteries, were excluded from our study. This query identified 100 CT scans for either follow-up or diagnosis of an untreated AAA. The diameter of the AAAs was measured at the transverse slice of maximal aortic diameter. The transverse slice with the maximal diameter of aortic lumen was also identified, and the diameter of both the entire aneurysm and the patent lumen alone were measured at this slice. Atmospheric data from the closest weather station were obtained from Environment Canada. The digitally recorded timestamp indicating when the CT scan was performed was used to match atmospheric pressure data to the exact time corresponding to each CT scan. Atmospheric variables used include instantaneous atmospheric pressure (IAP), 1-, 2-, 5-, 10- and 30-day pressure averages and 1-, 2-, 5-, 10- and 30-day pressure variability. Univariate linear regressions were performed to evaluate the effect of age, sex and atmospheric pressure variables on maximum AAA diameter (MAD), patent lumen diameter (LD) and the percentage of an AAA's cross sectional area (%CSA) composed of patent vessel lumen. The same predictors were then entered into a stepwise, forward, multivariate regression with inclusion in the model limited to $p < 0.05$. All analyses were performed using STATA. **Results:** Of the 100 scans reviewed, 82 were in male patients, and the average age was 76.0 (55.4–89.6, SD 8.4). The average AAA in our database had an MAD of 54.9 mm (34.7–83.3, SD 9.5), an LD of 38.8 mm (22.2–71.3, SD 0.96) and a %CSA of 59.6% (16.0%–99.0%, SD 20.5%). Univariate analysis identified significant correlation between MAD and age, sex and 30-day pressure variability, whereas significant correlation was seen between LD and age, 5- and 30-day pressure variability. The %CSA was significantly correlated with 5-day pressure variability. In multivariate analysis, only 30-day pressure variability exhibited a statistically significant correlation with both MAD (2.17 mm/%variability, 95% CI 0.17–4.17) and LD (2.95 mm/%variability, 95% CI 0.91–4.99). The %CSA was significantly correlated with

1-day pressure variability (7.9%area/%variability, 95% CI 3.0–12.8), 5-day pressure variability (–12.2%area/%variability, 95% CI –20.8 to –3.5) and sex (13.7% less lumen in men, 95% CI –24.9 to –2.5). **Conclusion:** Short- and medium-term atmospheric pressure variability appears to be correlated with CT-derived aortic dimensions in patients with untreated AAA. Whereas the implications of these findings with respect to aneurysm rupture risk are not known, our results suggest that a relation does exist between atmospheric pressure patterns and AAA anatomy. Further investigation of this relation with larger study sample sizes and experimental models may further increase our understanding of AAA pathophysiology.

Abdominal aortic aneurysm repair with balloon-expandable SETA stent graft: a single centre experience. *N. Ginting,* J. Chen,† Y. Hsiang,† K. Baxter,‡ J. Gagnon.†* From the *Division of Vascular Surgery, Vancouver General Hospital and University of British Columbia, the †Division of Vascular Surgery, Vancouver General Hospital, and ‡Vancouver, BC

Background: Inappropriate perirenal neck anatomy is the most common reason for exclusion from conventional endovascular repair of abdominal aortic aneurysm (AAA). The SETA graft, a balloon-expandable stent graft, was developed for use in endovascular repair of AAA with short, conical infrarenal necks. We report the experience with SETA AAA repair in our centre. **Methods:** A retrospective chart review of patients who underwent endovascular aortic aneurysm repair (EVAR) with the SETA graft was undertaken. Baseline demographics, comorbidities, aneurysm size and aneurysm neck configuration were recorded. Morbidity, mortality, success of implantation, as well as short- and midterm durability were measured. Other outcomes including endoleak, graft migration and graft thrombosis are reported. **Results:** Eight patients (7 men and 1 woman) with a mean age of 74 years whose AAAs had short or conical infrarenal neck anatomy underwent insertion of SETA graft between August 2009 and January 2011. These patients were not candidates for conventional open repair because of their comorbidities or for standard bifurcated endograft repair owing to the configuration of the aneurysmal neck. The mean aneurysm diameter was 6.3 cm. SETA repair was successful in all patients. However, deployment failure was seen in one iliac limb, which required graft removal through the femoral access. Two patients required use of a prosthetic conduit, while 1 patient required an endoconduit for SETA graft insertion. One patient had lower limb ischemia in the postoperative period and required an infringuinal bypass. During the mean follow-up of 10.5 months there were no mortalities or endoleaks. One SETA limb was kinked, which was successfully repaired with angioplasty and stenting. **Conclusion:** SETA graft enables the endovascular repair of AAA with short or conical neck anatomy. The majority of the morbidity was related to the delivery system.

SATURDAY, SEPT. 24, 2011
DIALYSIS ACCESS SYMPOSIUM

Predictors of failed hemodialysis AVF maturation at Vancouver General Hospital. *J. Hanco,* N. Zalunardo,† G. Li,† J. Chen,‡ N. Jastrzebski.†* From the *Nephrology, Belfast

City Hospital, Belfast, Ireland, and †Nephrology and ‡Vascular Surgery, University of British Columbia, Vancouver, BC

Background: The native arteriovenous fistula (AVF) is the preferred vascular access for hemodialysis; however, the high primary failure rate (or failure to mature [FTM]) is a major barrier to increasing AVF prevalence. The objectives of this study were to determine the predictors of AVF FTM in our population and to determine the utility of an existing predictive model based on age, race and history of ischemic heart disease (IHD) and/or peripheral vascular disease (PVD; Lok et al., *J Am Soc Nephrol* 2006;17:3204-12). **Methods:** All AVFs created from Jan. 1, 2005, to Dec. 31, 2009, at Vancouver General Hospital were considered and followed until Aug. 31, 2010. Only the first fistula created during the study period was included in patients with multiple procedures. Primary AVF failures within 14 days of surgery ($n = 5$) were excluded. Logistic regression was used to determine predictors of FTM. For comparison with the Lok FTM prediction model, AVFs first used more than 6 months after creation were excluded. **Results:** There were 401 AVFs created during the study period, of which 264 (77.6%) were eligible for analysis. The mean patient age was 63.3 years, 64.7% were male, 48.9% were white, 49.6% had diabetes, 20.8% had IHD, 9.1% had PVD, 12.9% had cerebrovascular disease, 32.5% were current/previous smokers and 22.7% had a BMI ≥ 30 . Arteriovenous fistulas were placed on the left in 81.4%; 3.8% were brachio-basilic (BB), 35.2% brachiocephalic (BC) and 61.0% radiocephalic (RC). Failure to mature occurred in 36.0%, with no change over time. Significant predictors of FTM in multivariable analysis included diabetes (odds ratio [OR] 1.92, 95% CI 1.07–3.46), current/previous smoking (OR 2.32, 95% CI 1.24–4.34), male sex (OR 0.52, 95% CI 0.28–0.98) and fistula type (BB compared with RC: OR 2.7, 95% CI 1.01–7.47; BC compared with RC: OR 0.43, 95% CI 0.23–0.80). Right-sided AVFs, nonwhite race, IHD and PVD had a nonsignificantly increased risk of FTM. In this population ($n = 186$), Lok score was predictive of FTM in the “very high” risk (Lok score ≥ 8) patient group but did not discriminate those at “low,” “moderate” and “high” risk ($p = 0.27$). **Conclusion:** Arteriovenous fistula failure to mature is common, occurring in about one third of first AVF creations. The predictors of FTM were diabetes, smoking history and female sex. Brachiocephalic AVFs were less likely to fail than other types. Application of an existing predictive model was not helpful in identifying those at low versus moderate/high risk of failure in our population.

Arteriovenous fistula creation for hemodialysis can be successful despite failure of an arteriovenous graft in the same arm. N. Ginting,* J. Hanko,† N. Zalunardo,† J. Jastrzebski,† J. Chen.‡ From the *Division of Vascular Surgery, Vancouver General Hospital and University of British Columbia, the †Division of Nephrology, University of British Columbia, and the ‡Division of Vascular Surgery, Vancouver General Hospital, Vancouver, BC

Background: A well-functioning arteriovenous fistula (AVF) is preferred over an arteriovenous graft (AVG) for hemodialysis access for many reasons, including longer patency and lower complication rates. KDOQI guidelines recommend minimizing

the use of AVG in favour of AVF creation. In this study, we evaluate the patients who have undergone AVF creation following failure of AVG (G2F) in the ipsilateral arm. **Methods:** This was a retrospective study of all patients with G2F conversion from Jan. 1, 2005, to Dec. 31, 2010, at Vancouver General Hospital. Patients were identified from the dialysis access database. Patency rates and time to first use of AVF were evaluated. **Results:** From 2005 to 2010, 484 AVF and 84 AVG were created. Twenty of the AVFs were created in patients with a prior AVG procedure, 13 of the 20 in the ipsilateral arm to that of the failed AVG. The outflow vein used for AVF was the same as the AVG outflow in 6 of the 20 cases (3 basilic vein, 3 cephalic vein). One of the 6 AVFs has not been accessed, as the patient has not required hemodialysis. The remaining AVFs were used a median of 48 (range 1–101) days after creation; AVFs with 1 year follow-up are functionally patent ($n = 2$), as are 3 AVFs with less than 1 year follow-up. Seven AVFs were created using a different outflow vein on the ipsilateral arm. Functional patency was achieved a median of 101 (range 44–120) days after creation. Arteriovenous fistulas with 1 year follow-up are functionally patent ($n = 6$), and the remaining AVF is patent at less than a year follow-up. **Conclusion:** Patients with failing AVG should be re-evaluated for AVF creation on the ipsilateral arm as functional patency rates are acceptable. Arteriovenous fistulas mature earlier when created using the same outflow vein as the failing AVG; this may help minimize or eliminate time on dialysis with a central venous catheter.

SATURDAY, SEPT. 24, 2011

PAPER SESSION V: AORTIC ANEURYSM III AND STENTS

Mid-term results following endovascular repair of blunt thoracic aortic injuries. K. Abaiin, C. Lioupis, C. Abraham, M. Corriveau, K. MacKenzie, D. Obrand, O. Steinmetz. From McGill University, Montréal, Que.

Background: Previous studies have focused on early outcomes of thoracic endovascular repair (TEVAR) of blunt thoracic aortic injuries (BAI). Late results remain ill-defined. The purpose of this study is to review the midterm results of our experience with endovascular repair of BAI. **Methods:** A retrospective analysis was performed, reviewing all patients of confirmed BAI treated with TEVAR from 2000 to present. Clinical, anatomic and procedural variables of all cases were systematically reviewed. Clinical end points included aortic-related mortality, stroke, paraplegia, hospital length of stay and procedure-related complications. Access stent graft type and number, presence of endoleak and midterm clinical and radiological follow-up were evaluated. **Results:** Twenty-four cases of blunt thoracic aortic injury treated with TEVAR were identified. Among the 24 treated patients (mean age 39, range 16–89 yr), the mean injury severity score was 37.9 (± 12.6). Thoracic endovascular repair was successful in treating the aortic injury in all patients, and there were no instances of procedure-related death, stroke or paraplegia. Access to the aorta was obtained through a common iliac/aorta conduit ($n = 3$) or a femoral approach ($n = 21$). One access complication occurred, requiring an iliofemoral bypass. Intentional covering of the left subclavian artery was performed in 14 cases (58%). There was 1 device-related complication during follow-up (mean 46, range 6–107 mo; 10 patients

had more than 5 years follow-up). One patient required a secondary intervention 27 months following the initial repair to treat a “dissection-like” lesion at the distal half of the stented aorta causing symptoms of aortic coarctation. This was treated successfully with repeat endografting. **Conclusion:** Thoracic endovascular repair for BAI can be performed safely with low periprocedural mortality and morbidity. Midterm follow-up data presented in this report further support the therapeutic role of endoluminal approach for treating BAI in anatomically appropriate patients.

The use of superficial femoral artery nitinol stents in patients with nickel allergy – case presentation and literature review. *P. Jetty,* S. Jayaram,* A. Hill,* T. Brandys,* G. Hajjar,* S. Nagpal,* J. Veinot,† M. Pratt.‡* From the *Division of Vascular Surgery, the †Department of Pathology and the ‡Department of Dermatology, North American Contact Dermatitis Group, The Ottawa Hospital, Ottawa, Ont.

Background: Recent innovations in peripheral vascular interventions have led to wide-scale implementation of self-expandable Nitinol stents in the superficial femoral artery. Worldwide, the most common allergen in patients assessed for contact allergy is nickel, the predominant component of Nitinol. The use of Nitinol stents in patients with nickel allergy undergoing superficial femoral artery angioplasty has not been well studied in the literature. **Case presentation:** An active 55-year-old machinist with disabling right calf claudication underwent a subintimal angioplasty of a complete occlusion of the superficial femoral artery and placement of a long Nitinol stent. Two weeks later he presented to a dermatologist with generalized severe pruritus and an eczematous dermatitis but worse on the right leg. Patch testing (according to North American Contact Dermatitis group guidelines) revealed a severe reaction to nickel sulfate only. Despite corticosteroid therapy and job relocation to remove any occupational exposure to nickel, his symptoms persisted. He eventually underwent explantation of the stent, with vein graft reconstruction, as this was the only potential source for ongoing nickel exposure. On postoperative day 1, the patient had almost complete resolution of his severe itch, and by 1 month he had resolution of his dermatitis. Pathological analysis revealed severe fibrointimal fibroplasia within the neolumen, with a mild chronic inflammatory response, chiefly plasma cells, macrophages and lymphocytes. Giant cells and eosinophils were not prominent. Radiography of the specimen revealed a stent fracture. The patient remains asymptomatic with respect to his claudication symptoms and without any recurrence of his severe pruritic rash 2 years following stent explantation. **Literature review:** An extensive literature review of the PubMed, MEDLINE, EMBASE and Cochrane databases did not identify any previous studies or reports of the use of superficial femoral artery Nitinol stents in patients with known nickel allergy. However, several reports were identified looking at the hypothesis that the delayed type IV hypersensitivity reaction in nickel-allergic patients may be a triggering or exacerbating factor to the inflammatory process involved in coronary in-stent restenosis (ISR). A definitive association between ISR and nickel allergy has yet to be confirmed. **Conclusion:** Advancements in endovascular techniques have resulted in an increasing use of self-expandable Nitinol stents in

patients with claudication and critical limb ischemia. The predominant component of the Nitinol alloy is nickel. To our knowledge, despite an increasing incidence of nickel sensitivity in North America, this is the first report documenting a reaction to a peripheral Nitinol stent as a result of a systemic contact dermatitis from nickel allergy.

Changing patterns in vascular practice in the province of Ontario over the last 5 years. *M. Ameli, J. Cardella.* From St. Michael's Hospital, Toronto, Ont.

There has been a major change in the practice for abdominal aneurysms. Five years ago, open repair accounted for the majority of aneurysm repairs carried out, whereas in the last year (2010) endovascular repair outnumbered open by 2 to 1. The other major growth area was in angioplasties, which continue to increase in number and, again, an increasing number are now carried out by vascular surgeons. The fate of open surgeries such as carotid artery, femoral popliteal bypass and aortobifemoral bypass has been reduced significantly. These changing patterns have significant implications in the training of vascular residents and also future manpower requirements. In the province of Ontario there are approximately 65 surgeons servicing the province. This is a 10% increase in the last 5 years. However, 40% of these surgeons practice in Toronto and vicinity. Changes are in place for the vascular residents, which need to reflect the modern vascular surgical practice. There needs to be more emphasis on endovascular repair, angioplasty and stents as they become more and more the domain of the vascular surgeon. In conclusion, vascular surgical practice has changed quite dramatically in the last 5 years, and the training programs for future vascular surgeons must reflect the new reality, which will mean less open surgery and more endovascular surgery and angioplasty. The major concern for the future is how much open vascular surgery will residents get to do during their training, and will this experience be enough? As far as manpower is concerned, the total number of cases done in the province of Ontario has decreased by 20%, while the number of vascular surgeons has increased by 10% in the same period. This issue will clearly have to be addressed.

Open versus hybrid aortic arch repair: technical lessons learned and preliminary report. *J. Tittley, R. Whitlock, D. Szalay, K. Teoh, T. Rapanos.* From McMaster University, Hamilton, Ont.

We have previously reported our limited series of open reconstructions of complex arch aortic pathologies. An “arch first” approach had been used, involving profound hypothermic circulatory arrest via a clamshell thoracic incision. With this technique, an in-hospital mortality of 16% (2 of 12) was achieved. One peri-/postoperative stroke resolved completely with no neurologic deficit at 3 months. We have since performed an additional 4 cases, with no death or stroke. Over the last 2 years, to reduce the morbidity associated with open repair, we have favoured a hybrid approach ($n = 7$), combining open aortic arch debranching through a midline sternotomy and endovascular exclusion of the aortic arch. A number of technical variations have been used, depending on the pathology, and the presence of symptomatic coronary artery disease. Seven cases were performed to repair aortic arch aneurysms, and 2 to deal aortic

arch dissection. All supra-aortic rerouting and arch advancement was performed within the chest cavity through a midline sternotomy. Most (6 of 7) were associated with concomitant aorto-coronary bypass. One early postoperative death (1 of 7, 15%) occurred owing to secondary aortic root dissection. Otherwise, we did not encounter any strokes or perioperative myocardial infarctions. A number of technical lessons have been learned as our learning curve has flattened, with both open and hybrid surgeries. We have integrated the use of extracorporeal circulation in the hybrid cases, allowing for simultaneously bypassing the coronary arteries (when required). Clamping the root "on pump" greatly facilitates debranching the arch and allows uninterrupted perfusion of the head vessels via axillary cannulation throughout the entire procedure. Hypothermic circulatory arrest can be avoided with this technique. The stent graft can then be introduced either antegrade or retrograde through a "run-away brake lane" inserted in the ascending aorta. In cases that were considered anatomically unsuitable for endovascular stenting, we have revised our protocol and preferentially approached these open cases via a midline sternotomy. In most cases, this affords access to the aorta all the way to the ligamentum arteriosum. We have found much less morbidity than our previously preferred clamshell incision. Newer approaches to the thoracic aortic arch involve endovascular branched grafts, combined with extrathoracic debranching procedures. These evolving techniques eliminate the need for open thoracic surgery, but are in the early stages of follow-up. As with all emerging technologies, early results should be compared with more established forms of therapy.

Neoadjuvant aortic endografting — durable and effective.
G. Oreopoulos, B. Rubin, G. Roche-Nagle. From the Toronto General Hospital, Toronto, Ont.

Background: The advent and success of endovascular repair of abdominal aneurysms led to the development of catheter-based techniques to treat thoracic aortic pathology. Such diseases, including thoracic aortic aneurysms, acute and chronic type B dissections, penetrating aortic ulcers and traumatic aortic transection, challenge surgeons to perform complex open operative repairs in high-risk patients. The minimally invasive nature of thoracic endografting provides an attractive alternative therapy. **Methods:** We present 2 cases of covered stent grafts deployed in the thoracic aorta to perform resection of the aortic wall infiltrated by malignancy in order to avoid a major vascular intervention and a traditional vascular graft interposition. The cases involved resection of a recurrent chondrosarcoma and a poorly differentiated pulmonary adenocarcinoma. **Results:** The presence of the endograft in these cases facilitated radical resection of these tumours including resection of aortic wall. Despite the graft being exposed intraoperatively, no complications arose. They remain disease free 30 months after the tumour resection. **Conclusion:** Our experience has demonstrated that an aortic endograft can be a valuable and reliable device to allow a combined resection of a tumour and the infiltrated aortic wall without the need for aortic cross-clamping possible cardiopulmonary bypass and graft replacement, potentially reducing morbidity and mortality associated with surgery. We suggest aortic endografts may become a valuable new adjunct in the armory of the vascular surgeon in oncological cases.

FRIDAY AND SATURDAY, SEPT. 23–24, 2011
CSVS POSTER SESSION

Activating peroxisome proliferator-activated receptor-gamma by its agonist in conditions of ischemia and hyperglycemia. *H. Al-Mubarak, T. Alamri, S. Aljabab, A. Aldahmash, B. Aljabri, M. Al-Omran.* From King Saud University, Riyadh, Saudi Arabia

Background: Myocardial infarction and stroke are the leading causes of death worldwide. Serious warning signs, namely angina and transient ischemic attacks, may precede them. The progressive ischemia associated with the latter is a shared characteristic with peripheral arterial disease. Abolishing the ischemia associated with these diseases by inducing angiogenesis would relieve the pain and suffering of millions. The aim of this study is to determine if administering a selective peroxisome proliferator-activated receptor-gamma (PPAR- γ) agonist will induce angiogenesis in vivo. **Methods:** The present study was conducted in 2 parts. The first part examined the effects of PPAR- γ activation in conditions of ischemia without hyperglycemia, and the second part examined the effects of PPAR- γ activation in conditions of ischemia with hyperglycemia. Male Balb/C mice were randomized to receive either a PPAR- γ agonist or vehicle. Mice in the hyperglycemic groups were injected with streptozocin 2 weeks before starting treatment. Then the mice were gavaged once daily for 5 days; on the sixth day unilateral hind limb ischemia was induced on the right limb. Animals continued to be gavaged daily postprocedure. Perfusion was assessed using laser Doppler perfusion imaging immediately postprocedure and weekly thereafter. The change in perfusion of the right limb compared with the left limb (control) was plotted against time. **Results:** Perfusion in all groups was greatly decreased postprocedure and improved steadily thereafter in the PPAR- γ treated normoglycemic groups. However, the PPAR- γ treated hyperglycemic groups did not respond positively to treatment. **Conclusion:** PPAR- γ activation in states of hyperglycemia negatively affects perfusion recovery in vivo.

The association of arterial stiffness with the high incidence of cardiac arrhythmias in patients with peripheral arterial disease. *D. Rodriguez Leyva,* R. Guzman,† G. Pierce.‡* From the *St. Boniface General Hospital Research Centre, †St. Boniface Hospital and University of Manitoba, and ‡St. Boniface Research Centre and University of Manitoba, Winnipeg, Man.

Background: A susceptibility to arrhythmias may explain the increased risk for cardiovascular events in patients with peripheral artery disease (PAD). The purpose of the study was to identify the incidence and type of arrhythmias in patients with PAD and their relation to the vascular abnormalities. **Methods:** This cross-sectional study examined 110 patients with PAD (73% male, mean age 67 yr) with an ankle/brachial index (ABI) of < 0.77. **Results:** Cardiac arrhythmias were found in 37% of the patients. Frequent premature ventricular and supraventricular contractions were the most common arrhythmias (78%). Most (65%) were observed at rest before exercise but were also detected during and after exercise. PR segment duration, QRS complex duration and

QTc interval were significantly longer in patients with arrhythmias. QTc differences were significant for male but not for female patients. Both initial and absolute claudication distances were greater in patients with arrhythmias, but ABI values were not. Age (> 60 yr), pre-existing coronary artery disease (CAD) and greater arterial stiffness (as determined by significantly higher augmentation index values during pulse wave analysis [PWA]) were identified as predictors of arrhythmias. **Conclusion:** Patients with PAD have a high incidence of cardiac arrhythmias that are concerning because they are most frequently observed at rest. Older age, concomitant CAD and greater arterial stiffness may predispose patients with PAD to arrhythmias. Better physician awareness of the potential presence of this condition in patients with PAD and screening these patients with the use of a simple, noninvasive technique like PWA may allow for risk stratification.

Factors associated with mortality in vascular surgery patients that undergo massive transfusion. R. Gowing, J. Harlock, D. Szalay, K. Kahn moui. From McMaster University, Hamilton, Ont.

Background: Whereas massive transfusion has been studied in trauma victims, emergent and elective surgeries also require similar interventions. The purpose of this study is to define the factors contributing to mortality associated with massive transfusion in a tertiary hospital setting. **Methods:** A retrospective chart review of 358 patients admitted to a tertiary academic centre who received a massive transfusion (≥ 10 units of red blood cells within 24 hours of admission). Mortality rates were calculated based on patient demographics, delay, comorbidities, physiologic parameters, type of surgery and transfusion requirements. In total, these patients used 7184 units of blood. **Results:** When traumatic injuries were included with elective and emergent surgeries, vascular surgery patients were the most frequent recipients of massive transfusion. On average, these patients received 16 units of packed red blood cells. The mortality and transfusion amounts differed between patients who had elective or emergent operations. The factors that were most predictive of mortality in both trauma and vascular surgery patients were coagulopathy, hypothermia and acidosis at admission to the intensive care unit. Factors that did not contribute significantly to mortality among the major recipient populations included anticoagulation, delay to the operating room, total transfusion volume or known cardiac, respiratory or gastrointestinal comorbidities. **Conclusion:** Despite strong univariate predictors, the multivariate model could only achieve a predictive R² value of 0.17. This suggests that successful resuscitation of the massively transfused patient is a key determinant of survival but that many other factors play a role in determining the eventual outcome.

Screening for atherosclerosis: correlating duplex-detected peripheral arterial disease with cerebrovascular disease. M. Clemente,* E. Wooster,† E. Greco,‡ D. Wooster,‡ A. Dueck,‡ From the *University of Waterloo, †OISE/University of Toronto and the ‡University of Toronto, Toronto, Ont.

Background: The purposes of our study are to determine, first, if a reduced ankle brachial index (ABI) can be correlated with presence of cerebrovascular disease (CVD) and, second, whether

or not increased severity of peripheral arterial disease (PAD) correlates with an increased severity in CVD. **Methods:** A single-centre, retrospective chart review was conducted of patients who had attended a community-based vascular clinic. Patients who had a carotid duplex study and a peripheral arterial study performed during the same visit were included in the study. Data from self-reported patient history charts were also gathered. Patients were excluded from analysis if the required patient history data were unavailable. Ankle brachial index values of > 1.4, indicating incompressible arteries, were also excluded from analysis. All data analysis was performed using the SPSS. Participant baseline characteristics were calculated using descriptive statistics. Characteristics were compared between groups using χ^2 and unpaired *t* tests. Two-tailed *t* tests were performed; $p < 0.05$ was considered significant. The relation between ABI and severity of CVD was also determined using Pearson and Spearman correlations. Ethics was obtained before beginning this study. **Results:** Of the 388 charts, 349 (90%) met the inclusion criteria. The mean age was 73, and 65% were male. The incidence of stroke risk factors was high, including hypertension (73%), hypercholesterolemia (72%), diabetes (30%) and a history of smoking (73.4%). The incidence of prior stroke was 11%. Average ABIs were 0.90 (± 0.28) and 0.89 (± 0.27) in the right and left legs, respectively. The incidence of PAD was 55%; 72% were symptomatic. When comparing the population with PAD to those without, those with PAD had higher rates of hypertension (38% v. 64%, $p < 0.001$), current smoking (38% v. 15%, $p < 0.001$) and ASA use (68% v. 57%, $p = 0.043$). In terms of carotid disease, those with CVD has higher rates of amaurosis fugax (5% v. 1%, $p = 0.008$), carotid bruit (28% v. 13%, $p < 0.001$), coronary artery bypass graft (15% v. 8%, $p = 0.031$) and ASA use (73% v. 57%, $p = 0.003$). Ankle brachial index was lower in patients with CVD, as opposed to patients without. In those without CVD, average ABIs were 0.93 and 0.94 for the right and left legs, respectively. In patients with CVD, average ABIs were 0.84 and 0.80 ($p < 0.01$). In individuals with PAD, 45% also presented with carotid stenosis, as compared with 30% of patients without PAD ($p = 0.005$). In individuals with CVD, 64% also have PAD, as compared with 49% for those without CVD ($p = 0.005$). **Conclusion:** Our study demonstrated that there is a correlation between decreased ABI and CVD as well as a small but significant correlation between the presence of CVD and PAD. Ankle brachial index values ranging from 0.6 to 0.4 tend to have the greatest predictive value for carotid artery disease. Further research is required to clarify the extent to which these correlations can be used as markers and predictors of further need for screening for stroke risk.

Registration relevant to vascular practice: a status report on the Registered Vascular Technologist and Registered Physicians' Vascular Interpretation from the American Registry for Diagnostic Medical Sonography credentials. D. Wooster. From the University of Toronto, Toronto, Ont.

The American Registry for Diagnostic Medical Sonography (ARDMS) provides registration services for health professionals involved in ultrasound practice with a goal of promoting quality care and patient safety through the certification process and evidence of continuing competence. Specific registrations relevant to vascular ultrasound practice are the Registered Vascular Technologist (RVT) and Registered Physicians' Vascular Interpretation

(RPVI). There are 125 active RVT and 15 RPVI at the present time. Various jurisdictions in Canada and the United States encourage or require them for practice. In order to satisfy registration, candidates undergo an assessment of eligibility, documentation of training and practice and pass an examination. The examination is a criterion-referenced high-stakes examination, developed by content experts, guided by a job task analysis and monitored by process experts; ARDMS is accredited by ANSI (ISO-ANSI standards). Continued registration requires ongoing documentation of continuing education. There is a disciplinary process which is applied as required. There have been some recent changes to the certification process for RVT and RPVI. In April 2009, a separate examination in physics and instrumentation (SPI) was instituted as a component of all ultrasound technology examinations including the RVT. New “advanced item types” are being introduced to allow interactivity and assess candidates’ analytic and synthesizing abilities. An updated task analysis is underway for the RPVI in 2011. Beginning in 2012, time-limited certification will be introduced with a recertification process required by 2019. The RPVI is being adopted as a component of vascular residency training completion. Details of the status of these programs will be discussed.

The impact of limited vascular ultrasound studies on clinical decision-making in patients with peripheral arterial disease. A. Dueck,* E. Wooster,† M. Angelson,‡ D. Wooster.* From the *University of Toronto, †OISE/University of Toronto and the ‡Toronto West Vascular Laboratory, Toronto, Ont.

Background: Combined vascular duplex ultrasound and physiologic testing provides detailed information regarding the nature, location and severity of peripheral arterial disease. Clinical decision-making (CDM) with respect to medical, catheter-directed and operative management can be dictated by these findings. Resource and facility management issues have resulted in proposed protocols for limited studies. The aim of this study is to address the impact of such studies on decision-making. **Methods:** Fifty limbs were selected to reflect differing severity (stenosis, occlusion), location (iliac, common femoral artery, superficial femoral artery, popliteal, tibial arteries) and clinical decisions. The findings were analyzed comparing full studies, comprised of ankle/brachial indices, waveforms, velocities and plaque at rest and after exercise, to the interpretation and clinical decisions if only subsets of data were available. **Results:** Interventions were recommended on 22 limbs (44%); full studies were considered adequate for CDM in 100%. Ankle/brachial indices alone was not helpful in CDM apart from a rough estimate of the presence of disease; exercise altered the interpretation in 40%. Selected waveforms at 3 levels (femoral, popliteal, ankle) guided CDM in 76%; exercise augmented this in 32%. Plaque assessment, with velocity measurements, identified location and severity accurately and improved CDM in 24%. **Conclusion:** Limited ultrasound studies for peripheral arterial disease can establish the presence of disease but is inadequate to guide clinical decision-making. Caution should be exercised in the use and interpretation of such protocols.

Venous practice guidelines: present status and implications for future vascular ultrasound utilization. E. Greco,*

E. Wooster,† M. Angelson,‡ A. Dueck,* D. Wooster.* From the *University of Toronto, †OISE/University of Toronto and the ‡Toronto West Vascular Laboratory, Toronto, Ont.

Background: Over the past 3 years, published consensus guidelines for the management of patients with deep venous thrombosis (DVT), superficial venous thrombosis (SVT) and varicose veins (VV) have recommended an increased role for venous duplex scanning in quality management of these patients. The aim of this study was to identify, first, the recommended ultrasound testing strategies for each disease process, second, the present application of these guidelines and, third, future implications for ultrasound utilization. **Methods:** Published guidelines were obtained from vascular-related journals and websites. Specific ultrasound-related recommendations were identified from the AVF, Pacific Venous and CHEST guideline publications. A mini-audit of interpretation reports and clinical advice to patients with the target disorders was done. An analysis of ultrasound practice implementing the guidelines was compared with an historical cohort of studies before the guideline use. **Results:** Venous guidelines identify a burden of ultrasound testing for patients with DVT, SVT and VV (previously 0–2; now 1–4 studies). Interpretation reports and clinical advice audits reflect implementation of guideline recommendations in 5% and 15% of patients. The analysis of a practice with implementation of the guidelines showed per patient averages of 4.4 (guideline) versus 1.7 studies (historical) for 30 patients with DVT, 4.2 versus 0.4 studies for 30 patients with SVT and 1.2 versus 0.3 studies for 50 patients with VV. **Conclusion:** The venous guidelines recommend an increased role for venous duplex ultrasound studies in patients with recognized venous disease. At the present time, there is little uptake of these guidelines. Guideline-driven quality management of venous disease will generate a significant burden for ultrasound diagnostic facilities.

Factors associated with walking performance in peripheral vascular patients with claudication. P. Brown, D. Zelt, J. Tramner, S. Sagar. From Queen’s University, Kingston, Ont.

Background: The relative effect of clinical, personal and lifestyle factors on walking performance in patients with peripheral vascular disease (PVD) with claudication is poorly understood. Thus, the purpose of this research study was to compare the influence of these factors in walking performance as measured with the standardized Gardner treadmill test. **Methods:** Patients seen in outpatient vascular clinics between March 2010 and February 2011 were screened for enrolment ($n = 390$). Patients were included if they reported claudication and had a resting ankle/brachial index (ABI) < 0.90 . Exclusion criteria were comorbid conditions that limited walking, noncompressible arteries and the absence of claudication. Consenting patients attended 1 study session in which they completed a detailed questionnaire, anthropomorphic measures and the Gardner’s treadmill test. Of the screened patients, 225 (61%) patients were excluded because of major comorbidities; of the eligible patients ($n = 154$), 44 (30%) refused participation and 110 participated in the study. **Results:** The mean absolute claudication distance (ACD) was 0.25 miles (range 0.03–1.0 mi). Participants with an ACD ≥ 0.28 miles (≥ 75 th percentile) were classified as high performers ($n = 25$).

There were no significant differences between performers and nonperformers with respect to age, sex, current smoking status, alcohol use, diabetes and BMI. High performers had a slightly higher ABI (0.6 v. 0.5, $p = 0.04$) and engaged in higher levels of recreational exercise ($p = 0.02$). Controlling for ABI, exercise had an independent effect on performance (OR 2.7, 95% CI 1.1–7.2).

Conclusion: Moderate levels of recreational exercise are associated with better walking performance, suggesting that there is opportunity to improve performance with exercise prescription. However, a significant portion of patients are not able to participate in effective exercise because of major comorbidities.

Quality improvement following participation in a vascular surgery registry. A. Moloney, N. Eisenberg, G. Roche-Nagle. From the Toronto General Hospital, Toronto, Ont.

Background: The Vascular Quality Initiative (VQI) of the Society for Vascular Surgery (SVS) is a new program designed to improve vascular health care. It provides an opportunity for individual providers, hospitals and regional quality improvement groups to collect and analyze clinical data in an effort to improve patient care. The VQI collects preoperative risk factors, intra-procedural variables, postprocedural outcomes and 1-year follow-up data to assess quality of care and determine best practices in vascular health care. We wished to study our experience following enrolment with the VQI in August 2010. **Methods:** The procedures currently tracked are carotid endarterectomy, carotid artery stenting, infrainguinal lower extremity bypass, and open and endovascular repair of infrarenal abdominal aortic aneurysm (AAAs), since these represent the most common vascular operations. Variables for data collection were chosen that represented key patient demographic parameters, surgical procedure details and in-hospital outcomes. The results are entered to the registry and reports generated demonstrate individual surgeon and institution results as well as comparison with the other centres enrolled in the registry. **Results:** For all patients in the database, preoperative β -blocker usage increased from 42% to 65% ($p < 0.001$). This increase was due to β -blocker specifically initiated preoperatively, which increased from 19% of patients in 2010 to 39% in 2011 ($p < 0.001$), versus the percentage of patients on chronic β -blockers, which did not change significantly over time. From 2003 to 2006, the usage of preoperative ASA or clopidogrel increased from 84% to 94%, and preoperative statin usage increased from 70% to 85% (both $p < 0.005$). In addition, our complication rates for the index procedures compare favourably with other large institutions. **Conclusion:** Based on our experience, we recommend this model of a regional cooperative quality

improvement group to others who are interested in analyzing and improving their results. The power of the registry increases with size, and momentum is maintained by feedback of key results to individual surgeons. Relevant quality measures can now be accurately monitored, which not only allows quality improvement, but also helps surgeons and hospitals prepare for performance initiatives that are being developed. We are confident that the methodology employed will meet the demands of public accountability and also improve the quality of care for our patients.

Electronic communication and implementation of eHealth solutions in a vascular surgery clinic: Still a long way to go to success or just a period of transition? T. Moloney,* S. Bandali,[†] G. Roche-Nagle,* A. Ajiboye,[†] N. Archer,[†] A. McKibbin.[†] From the *Department of Vascular Surgery, Toronto General Hospital, Toronto, and †eHealth, McMaster University, Hamilton, Ont.

Background: The patient–physician interaction still remains the pivotal event in the treatment algorithm of any disease process. A paradigm shift in communication technologies has provided each party with multiple options. Information communication technology (ICT) is set to revolutionize healthcare delivery, understanding that certain subgroups of patients warrant identification and further education. The aims of this paper is to analyze current trends of ICT methods in a vascular population, assess how the elderly have currently adopted ICT methods and propose ways to improve the adoption of ICT methods during this transition period. **Methods:** A literature review was conducted to identify meta-analyses and randomized control trials that assess ICT tools as a way to provide and support the delivery of patient care. To gather Canadian data, a patient satisfaction and quality survey was distributed within an outpatient vascular surgery population. **Results:** Of patients who completed the survey, 88.6% were over 60 years of age, with 70.6% of all patients preferring the home phone as their primary mode of communication; 57.6% of patients have a cell phone but only 22% overall use text messaging. Moreover, 95% of patients over 70 do not text message and only 39% have access to a computer; 58.2% overall use email, with decreasing use with age. **Conclusion:** Within our patient population, computer use, Internet access, email utilization and the use of cell phones are well below the Canadian average. This we believe highlights, on the ground, a large group of patients who are content with conventional communication means. Change within healthcare ICT is inevitable and, therefore, these patients need to be educated and informed so as to allow a smooth transition from the old to the new.