Canadian Society for Vascular Surgery Meeting

September 12–13, 2008, Saskatoon, Sask.

GLOBAL DATABASE REVIEW OF 1045 AAA PATIENTS. *M.A. Burnett, A.G. Lossing.* **University of Toronto, St. Michael's Hospital, Toronto, Ont.**

Purpose: This study examined the aortic aneurysm patient population in a Canadian tertiary care centre. **Methods:** All patients who came to our office for assessment of their aneurysm between 1994 through to March 2008 were evaluated. **Results:** A total of 1045 patients were evaluated (828 male, 198 female). Of these, 399 underwent open repair (38.18%), 120 underwent endoluminal repair (EVAR; 11.48%) and 510 are currently being followed (48.80%). Preoperative risk factors were as follows: diabetes 10.05%, cardiac 41.24%, hypertension 38.76%, smoking or history of smoking 36.27%, carotid disease 7.08%, renal issues 15.98%, pulmonary disease 15.02%, cystic renal disease 16.94% and dyslipidemia 15.98%. Patients who had 2 or more of these risk factors comprised 47.94% of the group; 7.94% of patients' reported none of these risk factors. The rate of endoluminal versus open repair over the last 3 years with dedicated government funding is 44.69% (101 EVAR/226 total). In order to offer EVAR on a regular basis to an aneurysmal population, dedicated government funding is required. Our historical data reflect the growing popularity of the EVAR technique.

MENTAL BURDEN TO PATIENTS LIVING WITH ABDOMINAL AORTIC ANEURYSMS. *M.A. Burnett, A.G. Lossing.* **St Michael's Hospital, University of Toronto, Toronto, Ont.**

Background: The mental burden on patients with post–abdominal aortic aneurysm (AAA) repair has been described. New onset psychiatric morbidity after repair has necessitated investigation of vulnerability factors preoperatively. High rates of depressive disorders have been documented postoperatively in cardiac patients. There are no data in patients undergoing AAA repair in the preoperative phase. **Aim:** We aim to assess the preoperative mental burden of aortic aneurysm patients undergoing either open or endovascular (EVAR) repair. **Method:** We are conducting a pilot study using the validated Hospital Anxiety and Depression Scale (HADS), which is a series of 14 questions with 4 possible answers that was given to patients before their surgery date. **Results:** To date, preliminary results of 28 patients indicate an increase in anxiety scores in the preoperative period. Of the 16 patients, 25 patients were male and 3 were female. Twenty patients underwent endovascular repair and 8 underwent open repair. Interventions include counselling, education, email availability and patient-to-patient dialogues. **Conclusion:** Initial data confirm the mental burden of patients requiring AAA repair. The intervention and management of this previously undocumented burden in AAA patients will be discussed.

WITHIN A FOLLOW-UP PATIENT POPULATION, RUPTURED ANEURYSMS STILL REMAIN A PROBLEM. *M.A. Burnett, A.G. Lossing.* **University of Toronto, St. Michael's Hospital, Toronto, Ont.**

Abdominal aortic aneurysms (AAA) remain the 13th leading cause of death in North America. Following patients with AAA by serial ultrasound is standard practice to monitor growth.

Within our patient population of 1045 patients, death from ruptured aortic aneurysms still is evident. We have 510 patients currently being followed in our office practice, of whom 232 have aortic aneurysms over 5 cm in diameter. Thirteen patients have ruptured during the course of their follow-up.

Overall rupture within the entire followed group is 2.55% (13/510); overall rupture in patients with an aneurysm over 5 cm is 5.6% (13/232). Among the patients who have a ruptured aneurysm, 23.21% were being actively followed by a vascular surgeon (13/57).

Within this group of 13 patients, 10 were male, 3 were female. Types of aneurysms were 7 thoracic, 4 abdominal, 1 perirenal and 1 right common iliac. One patient reported a known family history. Two patients received surgery for their ruptured aneurysm. Sizes of aneurysm ranged from 5.8 cm to 8 cm; 2 aneurysms were below 5 cm; average size was 6.4 cm.

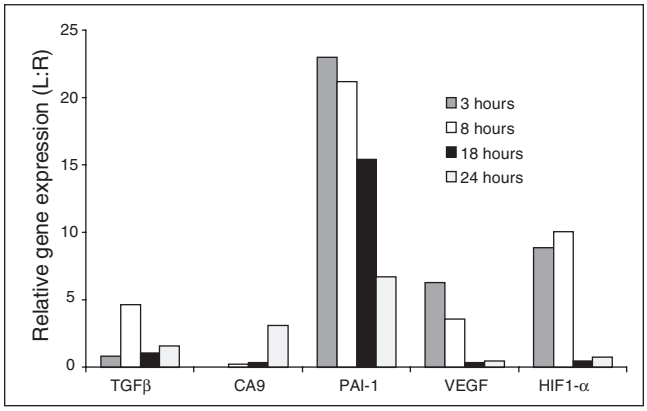
Length of follow-up varied: 4 patients were being followed for less than 6 months, 2 for 1 year, 1 for 2 years, 2 for 3 years and 5 had completed greater than 3 years of follow-up with a vascular surgeon. Two patients were booked for surgical repair but ruptured before their surgical date. Reasons for following the patients were: not fit for repair, patient wanted nothing done at the time or waiting for further workup (i.e., computed tomography, angiogram) for surgical repair.

Despite regular follow-up protocol, aneurysmal rupture is still evident.

DOES HYPOXIA COINCIDE WITH A FIBROTIC RESPONSE IN RENAL ISCHEMIA-REPERFUSION AND DOES N-ACETYL CYSTEINE MITIGATE THIS RESPONSE? CONSTRUCTING THE MODEL. *D.P. Cina,*[*] *P.J. Margetts, C.S. Cina.*[†] **From the Divisions of *Nephrology and Vascular Surgery, McMaster University, Hamilton, Ont.**

Background: Ischemia-reperfusion of the kidney, a common outcome of vascular surgery, frequently leads to acute renal

failure. This outcome is secondary to a hypoxic response, which may also play a role in the progression of renal fibrosis. The hypoxic response induces transcription of factors such as carbon anhydraze (CA) 9, hypoxia inducible factor (HIF)-1α and vascular endothelial growth factor (VEGF), whereas fibrosis is characterized by the upregulation of transforming growth factor (TGF) β and plasminogen activator inhibitor (PAI)-1. *N*-acetyl cysteine (NAC) is a sulphydryl-containing compound that mitigates hypoxic damage by neutralizing reactive oxygen species and may therefore protect the kidney from fibrotic damage brought on by ischemia-reperfusion. **Aim:** The aim of this study was to define where hypoxia occurs in an ischemic-reperfused kidney, whether it coincides with fibrosis and whether NAC plays a protective role. **Methods:** *Animal work:* The left renal artery of 12 C57BL/6 mice was clamped for 45 minutes following anesthesia with isofluorane. Upon unclamping, reperfusion was observed, and 2 mL of saline solution was administered. Three animals were sacrificed at 3, 8, 18 and 24 hours. All animals were given 15 mg of pimonidazole intraperitoneally for the detection of hypoxic tissue. At sacrifice, samples were taken of the left (ischemic) and right (nonischemic) kidneys: 1/4 for frozen section and subsequent laser capture microdissection, 1/4 formalin fixed for histological assessment and 1/2 flash frozen for protein and RNA extraction. *Histology:* Dual immunofluorescence was performed on formalin fixed ischemic and nonischemic kidney sections from all time points. Costaining was done with a polyclonal antibody to pimonidazole and either *Phaseolus lectin* (p-lectin) or *Arachis hypogaea lectin* (a-lectin), which designate proximal and distil tubules, respectively. *Laser capture:* Laser capture was used to excise hypoxic tissue from experimental kidneys and proximal tubules from control kidneys for RNA extraction. Real-time polymerase chain reaction (PCR) was used to assess the expression of TGFβ-1, CA9, HIF1-α, PAI-1 and VEGF in the captured tissue. *Protein:* Protein was extracted from whole tissue and assessed for relative abundance of HIF1-α using Western blotting and a β-actin control. **Results:** *Histology:* Dual immunofluorescent histology showed colabelling of pimonidazole and p-lectin in the left kidney at 3 hours and 8 hours post-ischemic insult, but none between pimonidazole and a-lectin at either of these time points. Furthermore, the hypoxic damage was completely resolved by 24 hours. *Laser capture:* Laser capture miscroscopy showed a trend toward upregulation of both fibrotic and hypoxic genes within the first 8 hours, which was resolved by 18 hours, as illustrated in the figure. *Protein:* HIF1-α protein was not present at 3 or 8 hours in the experimental kidneys and at all time points in the control kidney, yet showed a significant increase at 18 and 24 hours in the experimental kidney. These results were normalized to a β-actin control. **Conclusion:** Ischemia-reperfusion causes acute hypoxic damage to the proximal tubules that coincides with fibrosis. This is confirmed by the colocalized regulation of fibrotic genes, TGFβ-1 and PAI-1, and hypoxia-induced genes, CA9, HIF1-α and VEGF. NAC may therefore be promising in mitigating hypoxia induced fibrosis and will be investigated within the framework of this model.



Are the components of modular hybrid endografts for aneurysm repair compatible? A systematic study of pull-out forces.

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Background: Endovascular aneurysm repair (EVAR) using modular components is an accepted treatment for abdominal aortic aneurysms. Applicability, however, is limited by anatomic variables and design of different types of endografts. Long-term studies show that a significant number of reinterventions are caused by component separation (type III endoleaks). Each company has tested modular components to meet governmental standards, but no gold standards of ideal pull-out forces have been defined in an environment simulating the intravascular medium. In addition, to meet the demands of patients' anatomy, physicians may use modular hybrid endografts (MHEG) derived from different manufacturers. The safety of MHEG is uncertain because of limited information regarding their mechanical properties. **Aim:** The aim of this study was to define the pull-out forces of modular endografts built with components derived from the same or different manufacturers. **Methods:** For our experiment, in order to improve accuracy and to limit mechanical or frictional losses, we used a custom-built steel test bed with an electronic actuator that applied standard forces to the modular endografts. Pull-out forces were measured with an electronic load cell that was calibrated using a regression equation generated using the forces exerted by 2 known masses and a null weight. This calibration was validated by its correlation coefficient, which was > 0.99. A closed circuit containing a 5% human albumin bath was used to simulate the intravascular medium. We study pull-out forces between legs from Gore (diameters, 15 and 18 mm) and Anaconda (diameters 12.5, 15 and 17 mm) with the contralateral limb of bifurcated aortic components from Zenith (Cook), Anaconda (Vascutek) and Excluder (Gore) (diameter 12, 12.5 and 13 mm, respectively). Because of space limitations, only results obtained using a 4-cm overlap are reported. In addition, legs-to-legs pull-out forces were studied. Measurements were automatically transmitted from the load cell to an attached computer via USB connection for data analysis. Each pull-out force was repeated 3 times, reported in Newtons (N) and comparisons made using Student's 2-tail *t* test at the 95% confidence level. **Results:** Results and statistical significance are in Table 1. When the 12-mm Anaconda limb was tested with a 15-mm component, the pull-out force

Table 1. Compatibility of components of modular hybrid endografts for aneurysm repair

	Limb, manufacturer, diameter; pull-out force, N				
	Anaconda			Gore	
Bodies	12 mm	15 mm	17 mm	15 mm	18 mm
Anaconda	1.08	7.25†	> 10‡	3.15§	3.67¶
Excluder	< 0.1*	3.54††	4.59‡‡	1.87§§	2.28¶¶
Zenith	0.91**	3.31	7.76	2.39	2.67

Compared with … *the other 2, $p < 0.01$; **Anaconda, $p = 0.14$; ††the other 2, $p = 0.001$; ††Zenith, $p = 0.07$; ‡the other 2, $p = 0.001$; ‡‡Zenith, $p = 0.003$; §the other 2, $p < 0.06$; §Zenith, $p = 0.03$; ¶the other 2, $p < 0.004$; ¶¶Zenith, $p = 0.021$.

was 6.59 N, and when a 15-mm limb was tested with a 17 mm component it was 7.65. **Discussion:** Modular combinations using only Anaconda components, and MHEG using Zenith in selecting hybrid components.

Canadian experience with percutaneous endovascular aneurysm repair (PEVAR): short-term outcomes. ***S. Marlene Grenon, Joel Gagnon, York Hsiang, Jerry Chen.*** **Division of Vascular Surgery, Vancouver General Hospital, University of British Columbia, Vancouver, BC.**

Objective: The goal of this report is to evaluate and describe our centre's initial experience with the total percutaneous endovascular aneurysm repair (PEVAR) for aortic abdominal aneurysm (AAA). **Methods:** PEVAR was performed using Perclose Proglide suture-mediated closure systems, which were deployed before the EVAR procedure. A retrospective analysis was made of consecutive patients with AAA between July 2007 and March 2008 who underwent elective EVAR procedures. Comparison was made between patients who under went PEVAR and those who underwent EVAR with femoral artery cut-down. **Results:** A total of 52 patients underwent EVAR repair of AAA during the study period. Twelve of these patients underwent PEVAR. All PEVAR patients received bifurcated grafts made by various companies. The median length of stay was 2 (average 2.5) days for the PEVAR group compared with 3 (average 8.6) days for the cut-down group. Two patients in the PEVAR group had persistent bleeding from the puncture sites. One of these patients needed femoral cut-down during the initial procedure to repair 1 femoral artery. The other patient had persistent minor oozing that resolved with compression on postoperative day 3. Follow-up computed tomography was done in all PEVAR patients, and there was no false aneurysm at any of the puncture sites. **Conclusions:** We find the PEVAR to be technically straightforward, safe and reliable. There was a trend to discharge of patients at an early time after surgery.

Successful transapical thoracic endovascular graft deployment in a pig model. ***S.M. Grenon,* R.S. Sidhu,* J.D.S. Reid,* A. Cheung,† Y. Hsiang,* J. Clement,‡ P.S. MacDonald.**** **From the Divisions of *Vascular Surgery and †Cardiac Surgery and the ‡Department of Radiology, University of British Columbia, Vancouver, BC.**

Purpose: Aortoiliac occlusive disease may preclude retrograde thoracic endovascular aortic repair (TEVAR). This study evaluated the physiologic and anatomic feasibility of introducing an aortic endograft in an antegrade manner into the descending thoracic aorta (DTA) of a pig via the left ventricle (LV) apex. **Methods:** Twelve adult pigs were to undergo antegrade endograft deployment. Under fluoroscopic guidance, a stiff guidewire was introduced past the aortic valve (AV) and into the distal abdominal aorta through the LV apex on a beating heart. An 18-French introducer sheath containing a 24 × 36 mm aortic endograft was introduced and deployed in the DTA. The accuracy of graft delivery was determined at necropsy by measuring the distance from the trailing edge of the graft to the downstream ostium of the left subclavian artery. AV competency was assessed angiographically and on necropsy. LV function was assessed angiographically. Five hemodynamic and respiratory parameters were recorded at 12 stages and assessed for significant changes from baseline. **Results:** One animal died upon sternotomy. All remaining subjects survived the experiment with minimal hemodynamic support. A significant drop in systolic blood pressure was noted upon crossing the AV with an 18-French sheath (mean 75, standard deviation [SD] 2 to mean 60 [SD 4] mm Hg, $p < 0.05$). The blood pressure returned to baseline upon endograft deployment and at the end of the procedure. Bradycardia was noted at several stages of the procedure, requiring treatment in 2 pigs. Eleven endografts were deployed; 7 grafts were delivered within 5 mm and 3 grafts within 10–20 mm of the intended landing point. One graft was deployed 10 mm too proximally, covering the left subclavian artery. No AV insufficiency or LV dysfunction was noted. **Conclusion:** An aortic endograft can be delivered in an antegrade manner transapically into the DTA in a pig model with a reasonable degree of accuracy and minimal hemodynamic compromise.

Clinical outcome following knee disarticulation. ***Ramez Hanna, Karen Fairley, John J. Murnaghan.*** **Sunnybrook Health Sciences Centre, Toronto, Ont.**

Purpose: To determine the wound healing rate, perioperative mortality and ambulatory status of patients following knee disarticulation. **Methods:** We conducted a retrospective review of all cases performed by one surgeon at a tertiary centre. Charts were reviewed for demographic, surgical and follow-up data. Ambulatory status was graded pre- and postoperatively after the scale by Volpicelli et al. (*J Bone Joint Surg Am* 1983;65:599-605.) Descriptive statistics applied. **Results:** There were 34 knee disarticulations in 28 patients and 3 perioperative deaths (11%). We report on 31 procedures in 25 patients with mean follow-up of 7 months There were 20 male and 5 female patients with a mean age of 73 (55–92) years and the following comorbidities: peripheral vascular disease (PVD) 21/25; diabetes mellitus 13/25 (52%), chronic infection 2, scleroderma 1 and squamous cell carcinoma 1. Primary wound healing occurred in 25 (81%), delayed healing in 6 (19%), reoperation in 1 and revision of amputation in 0. The mean ambulatory status preoperatively was 2.5/6. Mean ambulatory status postoperatively was 1.8/6. **Conclusion:** Knee disarticulation is a reliable surgical procedure with 81% primary healing in a high-risk population. Knee disarticulation

should be considered as an alternative to above-knee amputation for PVD and complications of diabetes.

Management of incidentally discovered abdominal aortic aneurysms. ***Jeremy Harris, Corey Adams, Marg Lovell, Stewart Kribs, Guy DeRose, Thomas Forbes, Kirk Lawlor, Ken Harris.* Division of Vascular Surgery, University of Western Ontario, London, Ont.**

Background: Many patients undergo abdominal imaging for various nonvascular reasons and have incidental discovery of an abdominal aortic aneurysm (AAA). It is assumed that these patients then undergo appropriate follow-up imaging and/or referral to a vascular surgery service. Recent experiences at our centre have raised concerns that this may not always occur. Several patients with previously documented AAAs have presented with rupture of their AAA, and review of their records confirmed that no follow-up imaging or referral had occurred since the time of the initial incidental diagnosis. The purpose of this study was to investigate this problem within our regional health care system and make recommendations that could potentially result in decreased AAA-related morbidity and mortality. **Methods:** A retrospective chart review of over 10 000 patients over the age of 60 who underwent computed tomographic or ultrasonographic imaging of the abdomen at our institution from January 1 to December 31, 2006, was conducted. Transcribed radiology reports for each patient were assessed for the presence of an AAA (defined for this study as aortic diameter of 3 cm or greater). The records of patients with newly diagnosed AAAs were then further examined to determine if follow-up imaging or referral to a vascular surgeon occurred by December 31, 2007. A pilot study period from January 1 to February 15, 2006, was used to assess project feasibility. **Results:** Of the imaging studies done for non-AAA related reasons, 3.2% (24/751) resulted in a newly diagnosed AAA during the pilot study period; 33% (8/24) of these patients do not appear to have had follow-up imaging or referral to a vascular surgeon within the ensuing 23 months. These patients had an average AAA diameter of 4.1 cm and an average age of 84 years. **Conclusions:** Preliminary data support the contention that a cohort of patients with newly diagnosed AAAs are not undergoing regular surveillance imaging or referral to a vascular surgeon. Each of these patients therefore remains at risk of aneurysm growth and rupture with its high attendant mortality despite the seemingly serendipitous discovery of their AAA. Further investigation is ongoing to determine the potential reasons for the apparent lack of post-diagnosis management.

Changing trends in vascular injuries in a Canadian urban trauma centre 1993–2006. ***P.D. Heneghan, M.M. Corriveau, C.Z. Abraham, K.S. MacKenzie, D.I. Obrand, O.K. Steinmetz.* Department of Vascular Surgery, McGill University, Montréal, Que.**

Purpose: To evaluate trends in vascular injuries treated at an urban trauma centre from 1993 to 2006. **Methods:** A retrospective review of the prospective trauma database at this site was performed with specific reference to patients with diagnosis of vascular injury. Out of a total of 18 633 trauma victims, 574 patients with vascular injury were recognized using the Abbreviated Injury Scale (AIS). A variety of data including the age, sex, date of injury, mechanism of injury, Injury Severity Score (ISS), site of anatomic vascular injury and grade of injury (minor v. major) were obtained. Using the Canadian Classification of Diagnostic, Therapeutic, and Surgical Procedures and The Canadian Classification of Health Interventions, treatment modalities for all patients were identified. Data were evaluated to determine potential trends over time in vascular trauma etiology, epidemiology and treatment with a view to identify predictors of mortality. **Results:** A total of 681 vascular injuries were discerned in 574 patients. There was an increase in incidence of vascular trauma from an average of 34.6/year over the first half of the review to 47.4/year during the ensuing half. Of all vascular injuries, 44% were graded as major and 56% as minor. Overall, 85% of vascular injuries occurred in men, 79% of whom were under the age of 50 years. Stab injury (26%) and motor vehicle collision (24%) comprised the bulk of vascular injury etiology, and the only significant change in trend of mechanism of injury was an increase in stab injuries: from 18.1% (1993–1997) to 26.9% (1998–2002) to 48.9% (2003–06). Injury sites were extremity (46%), trunk (41%) and neck (13%). Associated ISS was > 25 in 27.7% of patients. Treatment of vascular injuries ranged from no intervention (29%), to simple suture repair, vessel ligation, exploration or patch repair (61%) to more complex vascular reconstruction in 10%. Endovascular repair of blunt thoracic aortic injuries was introduced during the latter half of the study period. Mortality rates during the study period fell from 11.6% (1993–1997) to 11.9% (1998–2002) to 5.5% (2002–2006). On univariate analysis, mortality was associated with an ISS score > 25 (82% of deaths, $p < 0.0001$), blunt injury (68.5% of deaths, $p < 0.0001$), trunk and neck injury (89.3% of deaths, $p < 0.0001$) and age below 50 years (38.9% of deaths, $p < 0.0005$). **Conclusions:** The annual incidence of vascular injuries increased over the time period evaluated, and this is largely related to an increase in stab injuries. Lower mortality rates in vascular trauma patients have been seen in the last 4 years of this 14-year review.

Fenestrated endovascular aneurysm repair for pararenal aortic aneurysms. Short- to midterm results. ***R. Jamjoom, M.M. Corriveau, K.S. Mackenzie, D.I. Obrand, O.K. Steinmetz, C.Z. Abraham.* McGill University, Royal Victoria Hospital, Jewish General Hospital, Montréal, Que.**

Purpose: To present short- and midterm results for an academic centre's clinical experience with fenestrated endovascular stent grafts in the treatment of pararenal aortic aneurysms (AAA). **Methods:** A retrospective study was performed for fenestrated aortic stent grafts implanted between December 2004 and February 2008. **Indication:** Patients with short or nonexistent necks, deemed inappropriate for standard endovascular aneurysm repair (EVAR), were considered for fenestrated EVAR. Chart review was conducted to determine short- to midterm results. **Results:** The median diameter of AAA was 6.1 cm. Fourteen fenestrated grafts were implanted incorporating a total of 46 target vessels (celiac, superior mesenteric and/or renal arteries).Of these 46, 32 were fenestrations and 14 were scallops. Neck length ranged from 0 to 5 mm. There

were 12 bifurcated grafts, 1 aorto-uni-iliac and 1 tube graft implanted distal to the fenestrated component. A total of 32 stents (2 bare stents, 30 covered stents) were deployed in target vessels. One fenestrated graft was performed in conjunction with an iliac branch graft. Technical success was 97.8%. Mean follow-up was 13.7 months. One type III endoleak was treated successfully intraoperatively with a bare stent. There were otherwise no significant type III or I endoleaks. One type II endoleak noted at 3 months follow-up resolved spontaneously. One renal artery was occluded at 3-month follow-up on computed tomography angiographic (CTA) imaging postoperatively. One patient died of a massive myocardial infarction on postoperative day 4, resulting in an aneurysm-related mortality of 7.1% for our series. **Conclusion:** Fenestrated aortic stent grafts for patients with inappropriate anatomy for standard EVAR can be perfomed safely with high technical success and low target vessel loss. Further follow-up is warranted to assess mid- to long-term results.

Predicting operating room resource needs using discrete event simulation for a vascular surgery service. ***Jim Dooner*. Royal Jubilee Hospital, Victoria and Department of Surgery, UBC Faculty of Medicine, Vancouver, BC.**

Objectives: Operations research methods are becoming increasingly critical to health care organizations. We chose to look at the service needs of our community for vascular surgery. We attempted to create a model that would predict the amount of operating room (OR) time needed to minimize waitlist development. **Methods:** Based on the rate of arrival of new booking requests and the established pattern of practice for the 3 vascular surgeons in the community, the rate and distribution of new bookings was combined with the mean and standard deviation operating times in the available vascular OR booking model. Five categories of surgery were defined with the cases not being prioritized. The mathematical distribution of the case types was also included. The categories were: aortic reconstruction, lower limb revascularization, carotid surgery, A-V access, miscellaneous. The data were incorporated into a model developed using Extend software. **Results:** The model accurately reflected the existing situation. Two years of data were analyzed to form the baseline. Using an OR work week of 42.5 hours per week and a range of 10–30 new bookings per week, the queue would increase by 1.34 cases per week (95% confidence interval [CI] 0.99–1.69), and 15.25 cases would be completed. By improving average OR time and reducing volatility (standard deviation) by 20%, the throughput would improve to 18 cases per week, and the number added to the queue would reduce to 0.44 per week (95% CI 0.2–0.6). Finally, increasing the total allotment of OR time to 50 hours per week at the improved rate of efficiency would increase the throughput to 20.6 cases per week, and queue growth would remain static at 0.44 per week (95% CI 0.31–0.61). This model can be run iteratively over any defined length of time. One-year cycles were used for comparison. The queue stabilizes due to the inefficiency of the OR having to await the arrival of the next patient based on a "just in time" concept. We then added a resource program block to represent the 300 patients on the waitlist. With the optimized model, a mean of 5 patients a week would come off the waitlist while working at full capacity. The ability to reduce and control waitlist growth can be accurately predicted using this methodology. **Conclusions:** Discrete event simulation is a potentially powerful tool for predicting resource needs and optimizing use of scarce resources in a constrained system. Focus on the rate of arrivals is needed to avoid the development of long waitlists and wait times. Improved efficiency can significantly increase throughput. There is a finite efficiency attainable for queue development. With a rate of growth of less than 0.5 patients per week, optimized performance has occurred. Waitlist decay can then be factored in to the program, and targeted end points can be created for resource reallocation.

Duplex ultrasound scanning in the assessment of native arteriovenous fistulas. ***Jean-François Jutras, France Laplace, Michel Dubé, Bernard Montreuil*. Department of Surgery and Radiology, Maisonneuve-Rosemont Hospital, Faculty of Medicine, University of Montreal, Montréal, Que.**

Thrombotic events are the leading cause of arteriovenous (AV) access loss. For most part, they result from venous outflow stenosis that can be detected before thrombosis occurs. The National Kidney Foundation Kidney Dialysis Outcomes Quality Initiative (NFK-DOQI) committee recommends routine AV access monitoring using several techniques. Our aim was to assess the value of duplex ultrasound in the detection of stenosis of native arteriovenous fistulas.

Fifty-five consecutive hemodialysed patients with dysfunctional but nonoccluded native arteriovenous fistulas were recruited prospectively between September 2005 and March 2007. Patients were allowed to be included once during the study period. Twenty-two women and 33 men with a mean age of 65 (range 36–85) years were evaluated. Twenty-three brachiocephalic, 17 brachiobasilic and 15 radiocephalic arteriovenous fistulas (AVFs) were studied with duplex ultrasonography (initial examination) and with digital subtraction angiography (final examination). Patients underwent both examinations within 24 hours. The reasons for referral were access blood flow less than 400 mL/min (41.8%), difficult cannulation (29.1%), a fall of more than 25% of the access blood flow (21.8%), venous hypertension (1.8%), prolonged venous bleeding postcannulation (1.8%), absence of thrill (1.8%) and distal ischemia (1.8%).

Quantitative Doppler spectrum analysis was correlated with the outcome of digital substraction angiography (detection of ≥ 50% stenosis). The vascular tree of the access was divided into 5 segments and the peak systolic velocities (PSV), end diastolic velocities (EDV), peak systolic velocity ratios (PSVR) and luminal diameter (Diam) measured in each segment. Digital substraction angiography was used as the gold standard, and receiver-operating characteristic (ROC) curves were plotted for the PSV, EDV, PSVR and Diam.

The area under the ROC curve were 0.92 for PSV, 0.88 for EDV, 0.89 for PSVR and 0.92 for Diam. Sensitivity and specificity were calculated using the optimal threshold value for each parameter. The sensitivity and specificity were 85.4% and 86.2% for PSV, 87.5% and 80.2% for EDV, 89.6% and 81% for PSVR, 90.2% and 83.6% for Diam, respectively.

We conclude that duplex scanning is an accurate noninvasive

method for the diagnosis of stenoses in native arteriovenous fistulas.

Anatomic variables that determine endovascular stent size when treating abdominal aortic aneurysms. *Michael Kilian,[*] Wilfred Dang,[*] Claudio Cinà.[†]* **From the Departments of *Surgery (Division of Vascular Surgery) and †Clinical Epidemiology and Biostatistics, McMaster University, Hamilton, Ont.**

Objectives: The study identifies trends in aortoiliac anatomic measurements in patients undergoing endovascular aortic aneurysm repair (EVAR). **Background:** Until recently, repair of abdominal aortic aneurysms required open surgery, resulting in a perioperative mortality of 5%–8% and a risk of complications of 15%–20%. Comparatively, EVAR reduces perioperative mortality to 1%–2% and risk of complications to 5%–10%. However, due to cost and the large number of possible stent combinations, hospitals cannot stock devices to perform emergency EVAR in a timely manner. **Methods:** We performed a retrospective review of patients undergoing elective (n = 127) and emergency (n = 17) EVAR. We evaluated the following diameters, lengths and angles: aneurysm (D3), aorta at the superior mesenteric (D1) and renal (D2a,b,c; 3 levels) levels, iliac arteries (D5a,b; right and left) and aortic bifurcation (D4); length from the lowest renal artery to the aortic bifurcation (H3), to the right and left iliac bifurcations (H4a,b); and angle of the aortic bifurcation on the transverse plane (A1). Frequency distributions identified the most common measurements for each variable and independent sample t tests compared elective with emergency cases to identify significant differences. **Results:** Elective variables D2max, D3, D5a,b and H3 have mean measurements of 26 mm, 60 mm, 15 mm, 15 mm and 118 mm, respectively. The means of emergency D2max (30 mm) and D5a,b (19 mm, 18 mm) were significantly different (p values 0.00, 0.006, 0.007, respectively), while H3 (121 mm) was not significant (p value 0.442). **Conclusion:** Frequency measurements and comparisons between elective and emergency EVAR patients can be used to optimize the design of stents and allow hospitals to efficiently stock appropriate devices.

The role of platelet rich plasma in vascular surgery groin wound healing. *D.K. Lawlor, T.L. Forbes, G. DeRose, K.A. Harris, M. Lovell, T. Novick.* **Divison of Vascular Surgery, University of Western Ontario, London, Ont.**

Background: Wound complications following lower extremity revascularization surgery remain a challenge for the vascular surgeon. These can range from a minor lymphatic leak or cellulitis, to a severe infection (often involving prosthetic grafts) that jeopardizes the limb and life of the patient. Despite recognized preventative measures, we experience a high groin wound complication rate for clean wounds that otherwise should have a minimal complication rate. There are reports of significantly improved wound healing and lower complication rates with topical application of platelet-rich plasma to the wound during closure. This is a product of the patient's own blood taken at the beginning of the procedure and easily processed in the operating room for application. This autologous concentration of human platelets in a small volume of plasma also contains a concentration of fundamental protein growth factors that are secreted by platelets to initiate all wound healing. Our objective was to determine if platelet-rich plasma applied to the wound bed during closure would decrease postoperative groin wound complications in vascular surgery patients. Wound complications were graded using a modification of the ASEPSIS tool for wound healing. This classifies wounds based on drainage, purulence, cellulitis and level of tissue involvement. **Study design:** This is a prospective, randomized controlled trial to determine if the application of platelet-rich plasma compared with a standard closure technique will decrease groin wound complications in vascular surgery patients. Eighty-one groins of patients who underwent elective infrainguinal and aortoiliac revascularizations, and abdominal aortic aneurysm repairs requiring femoral artery exposure at London Health Sciences Centre were randomized to receive platelet-rich plasma or standard wound closure. **Results:** We compared both group's demographics with respect to incidence of diabetes, hypertension, chronic renal failure, placement of prosthetic graft and steroid use and found no difference between them. Using the ASEPSIS wound classification system we compared both groups and found no difference in incidence of wound infection. Wound complications occurred in 29% of patients receiving platelet-rich plasma compared with 28% who did not receive the product. We did a subset analysis of the more severe wound complications and again demonstrated no difference with 14% of patients receiving platelet-rich plasma and 17% not developing complications. On multivariate analysis, the indication for surgery (critical limb ischemia v. EVAR), duration of procedure, timing of preoperative antibiotic administration, body mass index and presence of tissue loss were evaluated. None of these were found to be significant in incidence of wound complications. **Conclusion:** Groin wound complication rates are high in this patient group and correlate with those reported in the literature. No other risk factors for wound complications were identified in our series. Despite demonstrated benefit in other patient groups with respect to wound healing, platelet-rich plasma did not decrease the incidence of wound complications in our patients.

Comparison of radiofrequency puncture versus needle puncture for endovascular in vivo antegrade fenestration (IVAF) of perirenal aortic stent grafts in a canine model. *Leonard W. Tse,[*] Bao Bui,[†] Sophie Lerouge,[‡] Gilles Soulez.[‡]* **From the Universities of *Calgary, Calgary, Alta., †Sherbrooke, Sherbrooke, Que., and ‡Montreal, Montréal, Que.**

Objective: To qualitatively compare radiofrequency puncture with needle puncture for endovascular in vivo antegrade fenestration (IVAF) of perirenal aortic stent grafts in the canine model. **Methods:** Stent grafts were deployed in the perirenal aortas of four 25-kg canines. Prior to deployment, both renal arteries were landmarked with either bare stents, detachable coils (that were later removed) or hydrophilic catheters. The first 2 cases using long steerable endovascular needles to puncture the aortic stent grafts have previously been reported (Group A). The last 2 cases used a catheter-based endovascular

radiofrequency puncture device from within the aortic stent graft to perforate the graft (Group B). If puncture was successful with either technique, attempts were made to pass guidewires into the renal arteries to allow balloon dilatation of the graft perforation, followed by deployment of bare stents. Bloodwork and renal ultrasounds were obtained after 1 week. Repeat ultrasound and angiography were performed before autopsy at the end of the experiments (at 1 month for Group A and 3 months for Group B). **Results:** For Group A, successful IVAF was achieved in 1 case, which did well clinically with both renal stents patent at termination of the experiment. Although graft perforation and guidewire cannulation were achieved in the other case, dilatation of the perforation could not be achieved. This canine was sacrificed at the end of the case. For Group B, initial technical success was only achieved in 1 renal artery for each canine. In 1 case with accessory renal arteries, the stent graft was not long enough to cover all renal arteries. In the other case, IVAF was successful on one side, but despite graft puncture, the contralateral renal artery could not be cannulated. There was early thrombosis of 1 renal stent (the canine survived on a large accessory renal artery that was not covered). However, both cases did well clinically with at least 1 well-perfused kidney each until termination of the experiment. **Conclusions:** From this limited experience, we found that the radiofrequency device allowed easier puncture, whereas the long needle allowed better control and more accurate puncture of the graft.

Occlusion of the common and internal iliac arteries for aortoiliac aneurysm repair: experience with the Amplatzer vascular plug. ***S. Marlene Grenon,*†** ***Joel Gagnon,*†** ***York Hsiang,*†** ***Ravi Sidhu,**** ***David Taylor,*†** ***Jason Clement,*‡** ***Jerry Chen.*†** **From the Divisions of Vascular Surgery, *St. Paul's Hospital and †Vancouver General Hospital,and the ‡Department of Radiology, St. Paul's Hospital, University of British Columbia, Vancouver, BC.**

Objective: The goal of this report is to evaluate and describe our centre's experience with the Amplatzer vascular plug (AVP) for the occlusion of the internal (IIA) and/or common (CIA) iliac arteries during endovascular aortic aneurysm repair (EVAR). **Methods:** A retrospective analysis was performed of 20 consecutive patients (mean age 70, standard error [SE] 3 y), who underwent embolization of IIA or CIA before or during EVAR to prevent endoleak between October 2006 and December 2007. **Results:** Twenty-one embolization procedures were performed in 20 patients. The procedure was successful in 20 cases. In the only unsuccessful case, the patient had EVAR but could not be embolized with the AVP because of severe narrowing at the origin of the vessel. Among the successfully treated patients, 2 presented with a ruptured aneurysm, while the others were elective procedures. Eleven patients received aorto-uni-iliac grafts and femoral-femoral bypass, and 8 patients received a bifurcated stent graft. Three grafts were fenestrated proximally. In 5 patients, the AVP occlusion and EVAR procedures were staged. If the procedure was staged, it was done on average 29 (SE 23) days later. Seven of the AVP were deployed in the CIA and 13 in the IIA. The average diameter of the vessels occluded was 10 (SE 1) mm, and the average size of the device used was 13 (SE 1) mm, representing a device diameter 28% (SE 2%) more than the vessel diameter. A single device was used in 18 cases, while 2 devices were deployed in 2 cases in the same artery to be occluded. Concomitant coil embolization was performed in 20% of cases. On follow-up computed tomography (CT), all embolization procedures were successful. Serum creatinine did not increase significantly in all patients after their procedures. At 5 (SE 1) month follow-up, 4 patients had a small type II endoleaks unrelated to the embolization procedure and one had a type I endoleak that required graft limb extension. Four patients had buttock claudication but none had changes in sexual function, ischemic complications or device dislodgement on CT. **Conclusions:** The AVP is a safe and effective method to occlude the IIA and CIA in patients undergoing EVAR.

National survey of potential Canadian vascular surgery fellow applicants. ***Sudhir Nagpal, Tim Brandys, David Szalay, Lygia Perron.*** **University of Ottawa, Ottawa and McMaster University, Hamilton, Ont.**

Purpose: The number of applications for vascular surgery (VS) fellowship training has decreased in the recent past. The causes are uncertain. This survey attempts to identify the concerns and impressions of potential trainees as they relate to the specialty of vascular surgery. **Methods:** Surveys were sent to all PGY 3–5 residents in general and cardiac surgery programs in Canada. Of 333 surveys mailed (273 general surgery residents [GSRs], 60 cardiac surgery residents [CSRs]), 197 surveys were returned and analyzed (GSR response rate 59.7%, CSR response rate 56.7%). A Likert scoring system was assigned, with 1 as strongly disagree and 5 as strongly agree to each proposed question. Questions were clustered into categories to assess trends but analyzed separately. The dependent variable used in the analysis was an interest (YVS) or no interest (NVS) in a career of vascular surgery. **Results:** Overall, 33% of residents are considering a career in vascular surgery. Fifty-six percent of CSRs expressed interest in VS compared with 28% of GSRs. Demographic factors including region, age, sex, marriage and children did not appear significant in choosing VS as a specialty. Endovascular therapy and mentorship are positive factors in residents choosing VS. Lifestyle is an important consideration in both groups but is more dominant in the NVS group (78.8% v. 64.6%, $p = 0.03$). Attitudes toward different training strategies did not differ in either group: 3 years GS + 3 years VS (31.3% NVS v. 34.0% YVS), 4 years GS + 2 years VS (34% NVS v. 37% YVS) and 5 years GS (with certificate) and 2 years VS (29% NVS v. 29% YVS). When asked specifically, both groups preferred primary certification before VS training (50.8% NVS v. 60.2% YVS, $p = 0.04$). Technical challenges attract all groups, but the medical complexity of vascular patients seems to be a strong deterrent for residents not considering VS (26% YVS v. 62.5% NVS, $p = 0.0001$). **Conclusions:** It is essential to appreciate the issues that determine resident interest in a career in vascular surgery. Mentorship and the increasing role of endovascular therapy appear to have a positive influence on future applicants, while a perception of the increased medical complexity of the patient population may discourage many others. Increasing interest from cardiac surgery residents may complement our traditional applicant pool from general surgery programs.

Vascular surgery programs should promote their strengths and where possible address perceived weaknesses to encourage interest and ensure success in securing quality applicants from both disciplines.

Role of above-knee amputation as initial treatment for ischemic lower extremity — gangrene — in diabetic and renal failure patients. ***R. O'Carroll, B. Ulmer, S. Shah, M. Hundseth.*** **Division of Vascular Surgery, University of Saskatchewan, Saskatoon, Sask.**

Background: Diabetes and renal failure are common comorbidities in patients undergoing amputation for lower extremity ischemia or gangrene. It is common for this patient group to undergo numerous procedures until successful healing occurs. This study assessed amputation conversion rates in all patients with chronic critical limb ischemia and tissue loss, with a particular focus on above-knee amputation (AKA) conversion rates. **Methods:** This was a retrospective chart review involving 285 patients with lower extremity ischemia/gangrene who underwent amputation in the Saskatoon Health Region from 2000 to 2005. Patients were subdivided according to comorbidities: Group 1 = no renal failure (RF) or diabetes (DM), 73 patients; Group 2 = DM no RF, 150 patients; Group 3 = RF no DM, 14 patients; Group 4 = both RF and DM, 48 patients. **Results:** Fifty of 285 (17.5%) patients underwent a second procedure: revision/nonhealing wound. Those subgroups needing a second procedure were divided as follows: Group 1, 17%; Group 2, 49.1%; Group 3, 5.7%; Group 4, 28.3%. Conversion from below-knee amputation (BKA) to AKA were as follows: Group 1, 33%; Group 2, 15.3%; Group 3, 33%; Group 4, 58% (on dialysis), 0% (no dialysis). **Conclusion:** The accepted conversion rate from BKA to AKA is about 15%. Our study suggests that AKA may be beneficial as the primary procedure for patients with renal failure requiring dialysis and with diabetes.