Preoperative Prediction of Spinal Cord Ischemia in Complex Endovascular Aortic Aneurysm Repair

Sean C. Hanley,[1] Daniel Obrand,[2] Oren Steinmetz,[3] Kent Mackenzie,[3] Michel Corriveau,[3] Cherrie Z. Abraham[2]. [1]Division of General Surgery, McGill University Health Centre, Montreal, Quebec, Canada; [2]Division of Vascular Surgery, Jewish General Hospital, Montreal, Quebec, Canada; [3]Division of Vascular Surgery, McGill University Health Centre, Montreal, Quebec, Canada

Objectives: Endovascular repair has revolutionized the treatment of aortic aneurysms. Although the risks of endovascular aortic aneurysm repair (EVAR) are significantly less than those of open repair, the associated morbidity may still be high, as is the case with spinal cord ischemia. Identifying patients at the highest risk of spinal cord ischemia may allow for the application of more aggressive prophylactic techniques. We sought to establish a simple scoring system to predict the risk of spinal cord ischemia.

Methods: We retrospectively analyzed all patients who underwent complex EVAR at our institution. Patient and operative variables were compared using the Student *t*-test and χ^2 tests. Significant variables on univariate analysis were entered into a stepwise logistic regression to establish a simple predictive model to estimate the risk of spinal cord ischemia.

Results: Of 109 patients who underwent complex EVAR, spinal cord ischemia developed in 12 (11%). The highest rate of spinal cord ischemia was documented in thoracoabdominal aneurysm repair. History of peripheral vascular disease, proportion of aortic coverage, number of aortic stent graft components, and total number of stent graft components were significantly associated with spinal cord ischemia. A weighted scoring system was devised using history of peripheral vascular disease and total number of stent graft components to stratify patients into low (<5%), medium (5%-10%), high (10%-20%), and very high (>20%) risk of spinal cord ischemia.

Conclusions: Patients undergoing complex EVAR can be stratified for the risk of spinal cord ischemia based on variables available preoperatively. Knowledge of a patient's individualized risk allows for a more personalized discussion of operative risks and benefits as well as identifying patients who stand to benefit the most from novel techniques designed to reduce the risk of spinal cord ischemia.

Author Disclosures: S. C. Hanley: Nothing to disclose. **D. Obrand:** Nothing to disclose. **O. Steinmetz:** Nothing to disclose. **K. Mackenzie:** Nothing to disclose. **M. Corriveau:** Nothing to disclose. **C. Z. Abraham:** Consulting Fee, Cook Medical, Atrium Medical.

McGill University Sheath-Shunt Technique (MUSST) for Avoiding Lower Limb Ischemia During Complex Endovascular Aneurysm Repair

Sean C. Hanley,[1] Simon K. Neequaye,[2] Kent Mackenzie,[3] Oren Steinmetz,[3] Daniel Obrand,[4] Michel Corriveau,[3] Cherrie Z. Abraham[4]. [1]Division of General Surgery, McGill University Health Centre, Montreal, Quebec, Canada; [2]Department of Vascular Surgery, Royal Liverpool and Broadgreen University Hospitals, Montreal, Quebec, Canada; [3]Division of Vascular Surgery, McGill University Health Centre, Montreal, Quebec, Canada; [4]Division of Vascular Surgery, Jewish General Hospital, Montreal, Quebec, Canada

Objectives: Complex aortic aneurysms are being repaired by endovascular techniques with increasing frequency. Although endovascular aortic aneurysm repair (EVAR) is generally associated with a reduction in complications compared with open repair, complex EVAR requires the use of a large-diameter introducer sheath that can occlude arterial flow to the lower limb. This fact, along with longer procedure times, suggests that complex EVAR techniques may increase the risk of lower limb ischemia and reperfusion injury.

Methods: We have adopted a technique whereby an additional 6F or 7F introducer sheath is placed distal to the stent graft introduction site in antegrade fashion. This sheath is then connected to the side arm of one of the introducer sheaths placed in the contralateral limb, allowing continuous perfusion of the limb distal to the stent graft introduction site. Arterial perfusion distal to the stent graft introduction site, before and during shunting, was assessed by duplex ultrasound imaging, and shunt flow was measured by transit-time flow measurement.

Results: In our initial experience with seven patients undergoing complex EVAR with confirmed occlusion of the native arterial system by the stent graft introduction site, occlusion time was 169 ± 55 minutes. Use of the sheath-shunt technique resulted in pulsatile flow in all patients, with an average flow of 45 ± 10 mL/min. There were no complications related to the use of this technique.

Conclusions: In patients undergoing complex EVAR who are at increased risk of lower limb ischemia and reperfusion injury, the McGill University Sheath-Shunt Technique (MUSST) results in continued perfusion of a limb that would otherwise be ischemic for a significant amount of time. Given the limited risk of this technique, coupled with the potential benefit, we propose its use in all patients undergoing complex EVAR.

Author Disclosures: S. C. Hanley: Use of custom-made thoracoabdominal branched graft made with paraplegia-prevention branches (not approved) and bridging limb using Atrium covered stents (off-label use). **S. K. Neequaye:** Nothing to disclose. **K. Mackenzie:** Nothing to disclose. **O. Steinmetz:** Use of custom made thoracoabdominal branched graft made with paraplegia-prevention branches (not approved) and bridging limb using Atrium covered stents (off-label use). **D. Obrand:** Use of custom made thoracoabdominal branched graft made with paraplegia-prevention branches (not approved) and bridging limb using Atrium covered stents (off-label use). **M. Corriveau:** Use of custom made thoracoabdominal branched graft made with paraplegia-prevention branches (not approved) and bridging limb using Atrium covered stents (off-label use). **C. Z. Abraham:** Use of custom made thoracoabdominal branched graft made with paraplegia-prevention branches (not approved) and bridging limb using Atrium covered stents (off label use); consulting fee, Cook Medical, Atrium Medical.

Effects of Nonaxial Angulated Pullout Forces on Aortic Stent Graft Fixation

Sara Rahmani,[1] Inderraj S. Grewal,[2] Aydin Nabovati,[3] Matthew G. Doyle,[4] Graham Roche-Nagle,[1] Leonard W. Tse[1]. [1]Division of Vascular Surgery, Toronto General Hospital, PMCC, UHN, University of Toronto, Toronto, Ontario, Canada; [2]MacDonald Dettwiler Space and Advanced Robotics (MDA), Toronto, Ontario, Canada; [3]Advanced Micro Devices (AMD) Inc, Toronto, Ontario, Canada; [4]Department of Mechanical and Industrial Engineering, Faculty of Applied Science and Engineering, University of Toronto, Toronto, Ontario, Canada

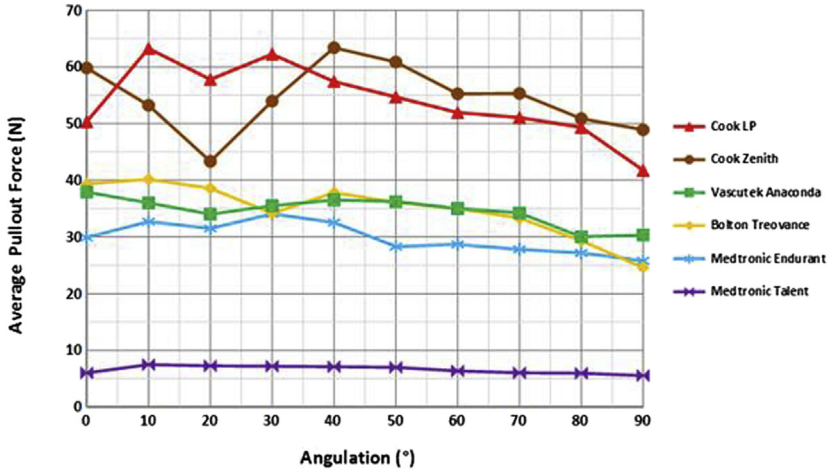

Fig. Plot of average pullout forces at different degrees of angulation for six different stent grafts.