Selected Abstracts from the July Issues of the Journal of Vascular Surgery and the Journal of Vascular Surgery: Venous and Lymphatic Disorders☆

Editors: Peter Gloviczki and Peter F. Lawrence

Ischemia-induced lower extremity neurologic impairment after fenestrated endovascular aneurysm repair

Panos Kougias, MD, MSc, Bernardino C. Branco, MD, Jonathan Braun, MD, MSc, Sherene Sharath, PhD, MD, Houssam Younes, MD, Neal R. Barshes, MD, MPH and Joseph L. Mills, MD

Objective: Placement of large sheaths in the iliac system during fenestrated endovascular aneurysm repair (FEVAR) leads to lower extremity (LE) ischemia that can be associated with serious neurologic complications. We sought to determine the effect of LE ischemic time on neurologic impairment after FEVAR.

Methods: Consecutive patients who underwent FEVAR at a single institution were analyzed. LE ischemic time was calculated from the time of large sheath (≥18F) insertion to the time of sheath removal from the iliac arteries that led to continuous LE ischemia. The primary outcome was neurologic impairment defined as any new sensory or motor deficit in either LE. Outcomes were analyzed using descriptive statistics and modeled with logistic regression with interaction terms. Each individual LE was used as a unit of analysis.

Results: We examined 101 patients (202 lower extremities) who underwent FEVAR over a 5-year period. The median LE ischemic time was 2.75 hours (range, 0.8-5.2 hours). Neurologic impairment developed in 18 extremities (9%). Of those, 12 (67%) developed mild sensory loss, 6 (33%) complete sensory loss, 4 (22%) loss of proprioception, and 2 (11%) motor dysfunction. Sensory deficit was permanent in four limbs (2%) and motor dysfunction in one limb (0.5%). In all other cases, the neurologic examination returned to baseline by postoperative day 15. Duration of LE ischemic time (odds ratio, 6.3; 95% confidence interval, 3.1-12.4; $P <$ .001) and common iliac artery (CIA) stenosis to a lumen of 8 mm or less (odds ratio, 2.7; 95% confidence interval, 1.5-7.3; P = .002) were independent predictors for the development of neurologic impairment. An interaction term between LE ischemic time and CIA stenosis was statistically significant (P = .042), indicating that the presence of CIA stenosis modifies the effect of LE ischemic time. In those with CIA stenosis to a lumen of 8 mm or less, the risk of neurologic impairment increased rapidly after 2.5 hours of LE ischemia, and became nearly certain after 4 hours of ischemic time. By contrast, patients without CIA stenosis tolerated longer ischemic times and demonstrated a less steep increase in the risk for LE neurologic impairment.

Conclusions: LE neurologic impairment after FEVAR is strongly associated with LE ischemic time and CIA occlusive disease to a lumen of 8 mm or less. Our data indicate that, when the LE ischemic time is expected to exceed 2.5 hours (in patients with CIA stenosis) or 3 hours (in patients without CIA stenosis), measures to ensure LE perfusion should be given consideration.

Accuracy evaluations of three ruptured abdominal aortic aneurysm mortality risk scores using an independent dataset

Spencer K. Hansen, MD, Patrick J. Danaher, PhD, Benjamin W. Starnes, MD, Harris Whitt Hollis Jr, MD and Brandon Ty Garland, MD

Objective: To date, no single scoring system for predicting 30-day mortality in patients with ruptured abdominal aortic aneurysms (rAAAs) has been endorsed by any vascular society or proven to definitively predict treatment futility. Three recently developed scoring systems for predicting 30-day mortality in patients with rAAA have been validated by their respective institutional data. The purpose of this study was to evaluate the accuracy of these rAAA mortality risk scores using an independent community hospital dataset.

Methods: Consecutive patients presenting with rAAA at Saint Joseph Hospital between January 1, 2009, and February 28, 2017, were used for validation. Logistic regression analysis was used to evaluate the association between risk score and odds of death. Confidence intervals were calculated using the Wilson method. Comparisons were made between models by calculating the area under the receiver operating characteristic (AUC) curves.

Results: Complete data from 38 patients was used for accuracy evaluation. The AUCs for the Dutch Aneurysm Score, Harborview Medical Center score, and Vascular Surgery Group of New England (VSGNE) score were 0.762, 0.792, and 0.860, respectively, for all patients. When evaluating 30-day mortality for patients undergoing ruptured endovascular aneurysm repair, the scores were 0.802, 0.893, and 0.927, respectively. The difference between scores did not reach statistical significance. All three indexes significantly associated with the mortality rate using logistic regression.

Conclusions: Each risk score accurately predicted 30-day mortality using the independent dataset. The results suggest that the VSGNE score is the most accurate; however,

☆Full articles available online at www.jvascsurg.org

1078-5884/
http://dx.doi.org/10.1016/S1078-5884(19)30510-6

differences in accuracy between each scoring system did not reach statistical significance. The Harborview Medical Center scoring system is based only on preoperative variables. Although the VSGNE score had the highest AUC in this analysis, it is dependent on intraoperative variables. The authors favor a single risk assessment tool, with consensus vascular societal approval, that incorporates preoperative variables and includes a tool for the prediction of treatment futility.

Comparison of major adverse event rates after elective endovascular aneurysm repair in New England using a novel measure of complication severity

Vincent J. Noori, MD, Christopher T. Healey, MD, Jens Eldrup-Jorgensen, MD, Elizabeth Blazick, MD, Robert E. Hawkins, MD, Paul H.S. Bloch, MD and Brian W. Nolan, MD, MS, on behalf of the Vascular Study Group of New England

Objective: Major adverse event (MAE) rates are used as an outcome measure after surgical procedures. Although MAE rates summarize the occurrences of adverse events, they do not reflect differences in severity of these events. We propose that a measure of complication severity could provide a more accurate assessment about the quality of care. We aimed to analyze and to describe the regional variation in elective endovascular aneurysm repair (EVAR) MAE rates across centers in the Vascular Study Group of New England and to create an index for describing complication severity.

Methods: Patients undergoing elective EVAR (n = 4731) at 30 Vascular Study Group of New England centers between 2003 and 2016 were studied. The MAE composite end point was defined as the occurrence of any of the following postoperative events: myocardial infarction, dysrhythmia, congestive heart failure, leg ischemia, renal insufficiency, bowel complication, reoperation, surgical site infection, stroke, respiratory complication, and no home discharge. An adjustment factor (complication severity index) was calculated as a ratio of length of stay for complicated to uncomplicated cases. Multivariate logistic regression was used to calculate predicted MAE rates. The observed and predicted MAE rates as well as complication severity index rates were compared among centers and across quintiles of center volume.

Results: Observed MAE rates varied widely, ranging from 0% to 39%. Multivariate predictors of MAE included abdominal aortic aneurysm diameter $>$6 cm (odds ratio [OR], 2.1; 95% confidence interval [CI], 2.0-2.3), female sex (OR, 2.0; 95% CI, 1.8-2.2), chronic renal insufficiency (OR, 1.9; 95% CI, 1.7-2.1), age $>$75 years (OR, 1.9; 95% CI, 1.8-2.1), congestive heart failure (OR, 1.7; 95% CI, 1.5-1.9), chronic obstructive pulmonary disease (OR, 1.5; 95% CI, 1.4-1.6), diabetes (OR, 1.4; 95% CI, 1.1-1.7), positive stress test result (OR, 1.2; 95% CI, 1.1-1.4), preoperative beta blocker (OR, 1.2; 95% CI, 1.1-1.3), and no preoperative statin (OR, 1.2; 95% CI, 1.1-1.3). Predicted MAE rates had little variation (range, 21%-29%). In comparing observed MAE rates and complication severity, there was an inverse relation between the two, suggesting that although certain centers had a greater number of MAEs, the complications were less severe.

Conclusions: MAE rates after elective EVAR vary widely. However, centers with higher MAE rates tended to have less severe complications, suggesting that observed MAE rates may not be a good measure of outcomes assessment after elective EVARs.

A multi-institutional analysis of transcarotid artery revascularization compared to carotid endarterectomy

Vikram S. Kashyap, MD, Alexander H. King, MS, Mazin I. Foteh, MD, Matthew Janko, MD, Jeffrey Jim, MD, Raghu L. Motaganahalli, MD, Jeffrey M. Apple, MD, Saideep Bose, MD and Norman H. Kumins, MD

Objective: Transcarotid artery revascularization (TCAR) is a novel approach to carotid intervention that uses a direct carotid cut-down approach coupled with cerebral blood flow reversal to minimize embolic potential. The initial positive data with TCAR indicates that it may be an attractive alternative to trans-femoral carotid artery stenting and possibly carotid endarterectomy (CEA) for high-risk patients. The purpose of this study was to present 30-day and 1-year outcomes after treatment by TCAR and to compare these outcomes against a matched control group undergoing CEA at the same institutions.

Methods: A retrospective review of all patients who underwent TCAR at four institutions between 2013 and 2017 was performed to evaluate the use of the ENROUTE Transcarotid Neuroprotection System (Silk Road Medical, Inc., Sunnyvale, Calif). TCAR patients had high-risk factors and were either enrolled in prospective trials or treated with a commercially available TCAR device after US Food and Drug Administration approval. Contemporaneous patients undergoing CEA at each institution were also reviewed. Patients were propensity matched in a 1:1 (CEA:TCAR) fashion with respect to preoperative comorbidities. Data were analyzed using statistical models with a *P* value of less than .05 considered significant. Individual and composite stroke, myocardial infarction, and death at 30 days and 1 year postoperatively were assessed.

Results: Consecutive patients undergoing TCAR or CEA were identified (n = 663) and compared. Patients undergoing the TCAR procedure (n = 292) had higher rates of diabetes (P = .01), hyperlipidemia (P = .02), coronary artery disease ($P <$ .01), and renal insufficiency ($P <$ .01) compared with unmatched CEA patients (n = 371). Stroke rates were similar at 30 days (1.0% TCAR vs 1.1% CEA) and 1 year (2.8% TCAR vs 3.0% CEA) in the unmatched groups. After propensity matching by baseline characteristics including gender, age, symptom status (36.3%, 35.3%) and diabetes, 292 TCAR patients were compared with 292 CEA patients. TCAR patients were more likely to be treated preoperative and postoperatively with clopidogrel (preoperatively, 82.2% vs 39.4% [$P <$ .01]; postoperatively, 98.3% vs 36.0% [$P <$ .01]) and statins (preoperatively, 88.0% vs 75.0% [$P <$ .01];

postoperatively, 97.8% vs 78.8% [$P < .01$]). Stroke (1.0% TCAR vs 0.3% CEA; $P = .62$) and death (0.3% TCAR vs 0.7% CEA; P = NS) rates were similar at 30 days and comparable at 1 year (stroke, 2.8% vs 2.2% [$P = .79$]; death 1.8% vs 4.5% [$P = .09$]). The composite end point of stroke/death/myocardial infarction at 1 month postoperatively was 2.1% vs 1.7% (P = NS). TCAR was associated with a decreased rate of cranial nerve injury (0.3% vs 3.8%; $P = .01$).

Conclusions: These early data suggest that patients undergoing TCAR, even those with high-risk comorbidities, achieve broadly similar outcomes compared with patients undergoing CEA while mitigating cranial nerve injury. Further comparative studies are warranted.

Risk of emergent carotid endarterectomy varies by type of presenting symptoms

Muhammad Faateh, MD, Hanaa Dakour-Aridi, MD, Pei-Lun Kuo, MD, MPH, Satinderjit Locham, MD, Muhammad Rizwan, MD and Mahmoud Malas, MD, MHS

Background: The timing of carotid revascularization in symptomatic patients is a matter of ongoing debate. Current evidence indicates that carotid endarterectomy (CEA) within 2 weeks of symptoms is superior to delayed treatment. However, there is little evidence on the outcomes of emergent CEA (eCEA). The purpose of this study was to compare outcomes of emergency eCEA vs nonemergent CEA (non-eCEA), stratified by type of presenting symptoms.

Methods: We analyzed the Vascular Targeted-National Surgical Quality Improvement Program dataset from 2011 to 2016. Symptomatic patients were divided into two groups: eCEA and non-eCEA. Univariable and multivariable methods were used to compare patient characteristics and to evaluate stroke, death, myocardial infarction (MI), stroke/death, and stroke/death/MI within 30 days of surgery adjusting for all potential confounders. A further subgroup analysis was done to compare the outcomes of eCEA vs non-eCEA stratified by the type of presenting symptoms (amaurosis, transient ischemic attack [TIA], and stroke).

Results: A total of 9271 patients were identified, of which 10.7% were eCEA vs 89.3% non-eCEA. Comparing eCEA vs non-eCEA, the two groups were similar in age (70.8 vs 70.5), female gender (36.3% vs 36.9%), diabetes (26.2% vs 28.9%), and smoking status (31.9% vs 28.7%; all $P > .05$). Patients undergoing eCEA were less likely to be hypertensive (76.2% vs 80.2%; $P = .025$), but more likely to belong to non-white race (51.5% vs 20.5%; $P < .001$). The eCEA patients were less likely to be on preprocedural medication vs non-eCEA (antiplatelets, 76.8% vs 89.2%; statins, 74.2% vs 79.9%; beta-blockers, 44.6% vs 50.4%; all $P < .05$). The 30-day outcomes comparing eCEA vs non-eCEA were: stroke, 6.2% vs 3.1%; death, 2% vs 1%; and stroke/death, 6.9% vs 3.7% (all $P < .05$). After risk adjustment, perioperative stroke (odds ratio [OR], 2.04; 95% confidence interval [CI], 1.36-3.0), stroke/death (OR, 1.66; 95% CI, 1.13-2.45), and stroke/death/MI (OR, 1.58; 95% CI, 1.18-2.23) were higher after eCEA (all $P < .01$). When stratified by the type of presenting symptom, eCEA vs non-eCEA stroke outcomes were similar in patients who presented with stroke or amaurosis fugax. However, in the subset of patients presenting with TIA, eCEA had much worse outcomes compared with non-eCEA (stroke, 8.3% vs 2.5%; stroke/death, 8.3% vs 3.2%) and had significantly higher odds of stroke (OR, 3.12; 95% CI, 1.71-5.68) and stroke/death (OR, 2.24; 95% CI, 1.25-4.03) in the adjusted analysis (all $P < .05$).

Conclusions: In patients presenting with stroke, eCEA does not seem to add significant risk compared with non-eCEA. However, patients presenting with TIA might be better served with non-emergent surgery as their risk of stroke is tripled when CEA is performed emergently.

Analysis of the retrograde tibial artery approach in lower extremity revascularization in an office endovascular center

Samuel H. Lai, MS, Jordan Fenlon, BS, Benjamin B. Roush, BS, John Munn, MD, Mark Rummel, MD, Daniel Johnston, MD, Chris Longton, RN and Krishna M. Jain, MD

Abstract

Objective: The objective of this study was to evaluate the safety and efficacy of a retrograde tibial approach in revascularization of lower extremities for treatment of ischemia in anatomically challenging patients.

Methods: This is a retrospective study of 57 procedures performed between 2012 and 2016 using the retrograde approach to treat patients with flush occlusion, inability to cross the lesion, failed bypass, or hostile groin. Demographic data, Rutherford classes, vessels treated, and approach were noted. Type of procedure, complications, amputations, deaths, and patency of access tibial vessels and treated vessels were recorded. Ultrasound-guided tibial access was achieved through the anterior tibial artery, posterior tibial artery, or peroneal artery. Technical success was defined as residual stenosis of $<$30%. Restenosis was defined as two times increase in velocity at the site of treatment. In follow-up, access vessel patency and treated vessel patency were evaluated by physical examination and ultrasound. Kaplan-Meier survival curves were used to assess proportional hazards before using the marginal Cox model to determine statistical significance in risk of postintervention occlusion.

Results: In 53 patients (32 men) with an average age of 67 $\pm$ 10.6 years, Rutherford categories were as follows: class 2, n = 1; class 3, n = 37; class 4, n = 5; class 5, n = 12; and class 6, n = 2. Tibial arteries were successfully accessed in all limbs. Lesions were crossed in 56 of 57 limbs. One procedure was terminated because of local arterial dissection. Revascularization was achieved in 55 of 57 limbs. Within 30 days of the procedure, 2 of 2 Rutherford class 6 patients and 1 of 12 class 5 patients needed major amputation because of pre-existing disease. There was no 30-day mortality.

Of 103 vessels treated, technical success was achieved in 97 (94%). Secondary patency for 103 vessels was 79% with mean follow-up of 6.66 $\pm$ 5.4 months. The primary patency

was 90% compared with a primary assisted patency of 51%. There was no statistically significant difference in access vessel primary patency in follow-up: 86% (30/35) for anterior tibial artery, 80% (16/20) for posterior tibial artery, and 100% (2/2) for peroneal artery. In addition, in follow-up, there was no significant difference in incidence of occlusion of target vessels based on choice of access vessel used (P = .109).

Conclusions: In this group of anatomically challenging patients, a retrograde tibial approach was safely used. Accessing the tibial artery does not usually cause access vessel occlusion and resulted in no adverse outcomes. The majority of access vessels remained patent for future bypass if necessary.