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

Editors: Peter Gloviczki and Peter F. Lawrence

Selected Abstracts from the Journal of Vascular Surgery

Midterm results of endovascular aneurysm sealing to treat abdominal aortic aneurysm

Katherine M. Stenson, MD, MRCS, Benjamin O. Patterson, PhD, MRCS, Matthew Joe Grima, MRCS, Jorg L. De Bruin, MS, FRCS, Peter J.E. Holt, PhD, FRCS, and Ian Loftus, MD, FRCS

Background: Endovascular aneurysm sealing (EVAS) represents a novel approach to the treatment of abdominal aortic aneurysms. It uses polymer technology to achieve an anatomic seal within the sac of the aneurysm. This cohort study reports the early clinical outcomes, technical refinements, and learning curve during the initial EVAS experience at a single institution.

Methods: Results from 150 consecutive EVAS cases for intact, infrarenal abdominal aortic aneurysms are reported here. These cases were undertaken between March 2013 and July 2015. Preoperative, perioperative, and postoperative data were collected for each patient prospectively.

Results: The median age of the cohort was 76.6 years (interquartile range, 70.2-80.9 years), and 87.3% were male. Median aneurysm diameter was 62.0 mm (IQR, 58.0-69.0 mm). Adverse neck morphology was seen in 69 (46.0%) patients, including aneurysm neck length $<$10 mm (17.3%), neck diameter $>$32 mm or $<$18 mm (8.7%), and neck angulation $>$60 degrees (15.3%). Median follow-up was 687 days (IQR, 463-897 days); 37 patients (24.7%) underwent reintervention. The rates of unresolved endoleak are 1.3% type IA, 0.7% type IB, and 2.7% type I. There were no type III endoleaks. There have been seven secondary ruptures in this cohort; all but one of these patients survived after reintervention. Only one rupture occurred in an aneurysm that had been treated within the manufacturer's instructions for use (IFU).

Conclusions: The rate of unresolved endoleaks is satisfactorily low. The incidence of secondary rupture is of concern; however, when the IFU are adhered to, the rate is very low. The results of this study suggest that working within the IFU yields better clinical results.

Trends of 30-day mortality and morbidities in endovascular repair of intact abdominal aortic aneurysm during the last decade

Kanhua Yin, MD, Satinderjit S. Locham, MD, Marc L. Schermerhorn, MD, and Mahmoud B. Malas, MD, MHS, FACS

Objective: Significant research efforts have been made to improve the safety and efficacy of endovascular aneurysm repair (EVAR) in treating abdominal aortic aneurysm. This study aimed to examine the trends of perioperative outcomes of EVAR in the recent decade using a national validated database.

Methods: Patients who underwent EVAR for intact abdominal aortic aneurysm between 2006 and 2015 were identified from the National Surgical Quality Improvement Program and divided into early (2006-2010) and late (2011-2015) periods. The primary outcome of the study was 30-day mortality. Secondary outcomes included operative time, length of hospital stay, and 30-day major complications (renal, cardiopulmonary, and wound infection).

Results: A total of 30,076 patients were identified, with 11,539 in the early period and 18,537 in the late period. The 30-day mortality was kept at a low level in both periods (1.2% vs 1.2%; P = .98), whereas both the mean operation time (155.5 $\pm$ 72.6 minutes vs 141.9 $\pm$ 73.7 minutes; $P < .001$) and length of hospital stay (3.24 $\pm$ 5.32 days vs 2.81 $\pm$ 4.30 days; $P < .001$) were decreased in the late period. The 30-day major complication rate was reduced by 19.6% (5.1% vs 4.1%; $P < .0001$), with decreased renal failure (1.4% vs 1.0%; P = .003), cardiopulmonary complications (2.2% vs 1.7%; P = .006), and wound complications (2.5% vs 1.8%; $P < .001$). All the decreasing trends of mortality, any 30-day complication, and each type of major complication were statistically significant. Being treated in the late period was independently associated with decreased 30-day major complications (odds ratio, 0.75; 95% confidence interval, 0.65-0.87; $P < .001$), and this effect was confirmed in the propensity score-matched cohort (odds ratio, 0.76; 95% confidence interval, 0.66-0.90; $P < .001$).

Conclusions: Although the 30-day mortality remains similar, postoperative complications in EVAR have decreased significantly during the recent decade. The continuous improvement in endograft technology and surgical skills has resulted in decreased operative time, marked reduction in

☆Full articles available online at www.jvascsurg.org

1078-5884/
http://dx.doi.org/10.1016/S1078-5884(18)30911-0

surgical complications, and shorter hospital length of stay after endovascular repair.

Transcarotid artery revascularization versus transfemoral carotid artery stenting in the Society for Vascular Surgery Vascular Quality Initiative

Mahmoud B. Malas, MB, MD, MHS, Hanaa Dakour-Aridi, MD, Grace J. Wang, MD, Vikram S. Kashyap, MD, Raghu L. Motaganahalli, MD, Jens Eldrup-Jorgensen, MD, Jack L. Cronenwett, MD, and Marc L. Schermerhorn, MD

Background: Recent evidence from the Safety and Efficacy Study for Reverse Flow Used During Carotid Artery Stenting Procedure (ROADSTER) multicenter trial in high-risk patients undergoing transcarotid artery stenting with dynamic flow reversal reported the lowest stroke rate compared with any prospective trial of carotid artery stenting. However, clinical trials have selection criteria that exclude many patients from enrollment and are highly selective of operators performing the procedures, which limit generalizability. The aim of this study was to compare in-hospital outcomes after transcarotid artery revascularization (TCAR) and transfemoral carotid artery stenting (TFCAS) as reported in the Vascular Quality Initiative (VQI).

Methods: The Society for Vascular Surgery VQI TCAR Surveillance Project (TSP) was designed to evaluate the safety and effectiveness of TCAR in real-world practice. Data from the initial 646 patients enrolled in the TSP from March 2016 to December 2017 were analyzed and compared with those of patients who underwent TFCAS between 2005 and 2017. Patients with tandem, traumatic, or dissection lesions were excluded. Multivariable logistic regression and 1:1 coarsened exact matching were used to analyze neurologic adverse events (stroke and transient ischemic attacks [TIAs]) and in-hospital mortality. Patients in the two procedures were matched on age, ethnicity, coronary artery disease, congestive heart failure, prior coronary artery bypass graft or percutaneous coronary intervention, chronic kidney disease, degree of ipsilateral stenosis, American Society of Anesthesiologists class, symptomatic status, restenosis, anatomic and medical risk, and urgency of the procedure.

Results: Compared with patients undergoing TFCAS (n = 10,136), those undergoing TCAR (n = 638) were significantly older, had more cardiac comorbidities, were more likely to be asymptomatic, and were less likely to have a recurrent stenosis. The rates of in-hospital TIA/stroke as well as of TIA/stroke/death were significantly higher in TFCAS compared with TCAR (3.3% vs 1.9% [P = .04] and 3.8% vs 2.2% [P = .04], respectively). In both procedures, symptomatic patients had higher rates of TIA/stroke/death compared with asymptomatic patients (TCAR, 3.7% vs 1.4% [P = .06]; TFCAS, 5.3% vs 2.7% [$P < .001$]). After multivariable adjustment, there was a trend of increased stroke or death rates in TFCAS compared with TCAR, but it was not statistically significant (2.5% vs 1.7%; P = .25; odds ratio, 1.75, 95% confidence interval, 0.85-3.62). However, TFCAS was associated with twice the odds of in-hospital adverse neurologic events and TIA/stroke/death compared with TCAR (odds ratio, 2.10; 95% confidence interval, 1.08-4.08; P = .03), independent of symptom status. Coarsened exact matching showed similar results.

Conclusions: Compared with patients undergoing TFCAS, patients undergoing TCAR had significantly more medical comorbidities but similar stroke/death rates and half the risk of in-hospital TIA/stroke/death. These results persisted despite rigorous adjustment and matching of potential confounders. This initial evaluation of the VQI TSP demonstrates the ability to rapidly monitor new devices and procedures using the VQI. Although it is preliminary, this is the first study to demonstrate the benefit of TCAR compared with TFCAS in real-world practice. These results need to be confirmed by a clinical trial.

A comparative analysis of long-term mortality after carotid endarterectomy and carotid stenting

Jesse A. Columbo, MD, Pablo Martinez-Camblor, PhD, Todd A. MacKenzie, PhD, Ravinder Kang, MD, MS, Spencer W. Trooboff, MD, MBA, Philip P. Goodney, MD, MS, and A. James O'Malley, PhD

Background: The value of carotid intervention is predicated on long-term survival for patients to derive a stroke prevention benefit. Randomized trials report no significant difference in survival after carotid endarterectomy (CEA) vs carotid artery stenting (CAS), whereas observational studies of "real-world" outcomes note that CEA is associated with a survival advantage. Our objective was to examine long-term mortality after CEA vs CAS using a propensity-matched cohort.

Methods: We studied all patients who underwent CEA or CAS within the Vascular Quality Initiative from 2003 to 2013 (CEA, n = 29,235; CAS, n = 4415). Long-term mortality information was obtained by linking patients in the registry to their respective Medicare claims file. We assessed the long-term rate of mortality for CEA and CAS using Kaplan-Meier estimation. We assessed the crude, adjusted, and propensity-matched (total matched pairs, n = 4261) hazard ratio (HR) of mortality for CEA vs CAS using Cox regression.

Results: The unadjusted Kaplan-Meier estimated 5-year mortality was 14.0% for CEA and 18.3% for CAS. The crude HR of all-cause mortality for CEA vs CAS was 0.75 (95% confidence interval [CI], 0.70-0.81), indicating that patients who underwent CEA were 25% less likely to die before those who underwent CAS. This survival advantage persisted after adjustment for age, sex, and comorbidities (adjusted HR, 0.75; 95% CI, 0.69-0.82). This effect was

confirmed on a propensity-matched analysis, with an HR of 0.76 (95% CI, 0.69-0.85). Finally, these findings were robust to subanalyses that stratified patients by presenting symptoms and were more pronounced in symptomatic patients (adjusted HR, 0.69; 95% CI, 0.61-0.79) than in asymptomatic patients (adjusted HR, 0.80; 95% CI, 0.71-0.90).

Conclusions: During the last 15 years, patients who underwent CEA in the Vascular Quality Initiative have a long-term survival advantage over those who underwent CAS in real-world practice. Despite no difference in long-term survival in randomized trials, our observational study demonstrated a survival benefit for CEA that did not diminish with risk adjustment.

Outcome of drug-eluting balloon angioplasty versus endarterectomy in common femoral artery occlusive disease

Tzu-Ting Kuo, MD, Po-Lin Chen, MD, Chun-Yang Huang, MD, Chiu-Yang Lee, MD, Chun-Che Shih, MD, PhD, and I-Ming Chen, Md, PhD

Objective: Common femoral artery (CFA) occlusive disease remains a debatable site for endovascular therapy, and the outcome of drug-eluting balloon (DEB) angioplasty in treating CFA occlusive disease is largely unknown. This study compared the efficacy, safety, and short-term patency rate of DEB angioplasty and femoral endarterectomy for treatment of CFA occlusive disease.

Methods: From March 2013 to June 2016, there were 100 patients with symptomatic CFA occlusive disease who were retrospectively reviewed. Forty patients were treated with DEB angioplasty and 60 were treated with femoral endarterectomy. Each patient received regular follow-up. Patency rate, ankle-brachial index, target lesion revascularization, and adverse events were assessed.

Results: Technical success was 100% in all patients. The DEB group had a lower 1-year primary patency rate (75.0% vs 96.7%; *P* = .003), but the secondary patency rate was similar between the two groups (97.5% vs 98.3%; *P* = 1.000). At 2-year follow-up, the primary patency was lower in the DEB group (57.1%) than in the endarterectomy group (94.1%; *P* = .001), whereas the secondary patency rate had no significant difference (90.5% vs 97.1%; *P* = 1.000). Both groups had significant improvement in ankle-brachial index. Freedom from target lesion revascularization was lower in the DEB group both at 1 year (75.0% vs 96.7%; *P* = .003) and at 2 years (57.1% vs 94.1%; *P* = .001). There was no significant difference in the incidence of complications and adverse events.

Conclusions: Femoral endarterectomy has a better primary patency rate compared with DEB angioplasty in treating CFA occlusive disease without significant increase in complications. In patients not suitable for endarterectomy, DEB angioplasty provides a similar secondary patency rate and could be considered an alternative treatment.

Meta-analysis of the accuracy of contrast-enhanced ultrasound for the detection of endoleak after endovascular aneurysm repair

Dimitrios Kapetanios, MD, Nikolaos Kontopodis, MD, PhD, Dimitrios Mavridis, PhD, Richard G. McWilliams, FRCR, Athanasios D. Giannoukas, MD, MSc, PhD, FEBVS, and George A. Antoniou, MD, PhD, MSc, FEBVS

Objective: The purpose of this systematic review and meta-analysis was to investigate the diagnostic accuracy of contrast-enhanced ultrasound (CEUS) for detection of endoleak after endovascular aneurysm repair (EVAR).

Methods: We searched electronic bibliographic databases for original articles comparing concurrent CEUS and computed tomography angiography for detection of endoleak after EVAR. We assessed the methodologic quality of the studies with the Quality Assessment of Diagnostic Accuracy Studies-2 tool. We constructed 2×2 contingency tables for all selected studies including true-positive, false-positive, false-negative, and true-negative results for all endoleaks and for type I and type III endoleaks. We used a mixed-effects logistic regression model to estimate summary sensitivity and specificity. We developed hierarchical summary receiver operating characteristic curves and calculated the area under the curve (AUC).

Results: We identified 26 studies reporting a total of 2638 paired scans in 2217 patients. The major risk of bias of the selected studies pertained to blinding for the index test and the reference standard. The pooled sensitivity and specificity of CEUS for all endoleaks were 0.94 (95% confidence interval [CI], 0.89-0.97) and 0.93 (95% CI, 0.89-0.96), respectively. The AUC was 0.98 (95% CI, 0.93-0.99). The summary estimate of sensitivity and specificity for type I and type III endoleaks was 0.97 (95% CI, 0.8-1.00) and 1.00 (95% CI, 0.99-1.00), respectively. The AUC was 1.00 (95% CI, 0.99-1.00).

Conclusions: CEUS has a high sensitivity and specificity in the detection of endoleaks after EVAR. CEUS is a useful tool in EVAR surveillance.

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

Compression therapy after invasive treatment of superficial veins of the lower extremities: Clinical practice guidelines of the American Venous Forum, Society for Vascular Surgery, American College of Phlebology, Society for Vascular Medicine, and International Union of Phlebology

Fedor Lurie, MD, PhD, Brajesh K. Lal, MD, Pier Luigi Antignani, MD, John Blebea, MD, MBA, Ruth Bush, MD, JD, MPH, Joseph Caprini, MD, Alun Davies, MD, Mark Forrestal, MD, Glenn Jacobowitz, MD, Evi Kalodiki, MD, Lois Killewich, MD, Joann Lohr, MD, Harry Ma, MD, Giovanni Mosti, MD, Hugo Partsch, MD, Thom Rooke, MD, and Thomas Wakefield, MD

Summary: Guideline 1.1: Compression after thermal ablation or stripping of the saphenous veins.

When possible, we suggest compression (elastic stockings or wraps) should be used after surgical or thermal procedures to eliminate varicose veins. [GRADE - 2; LEVEL OF EVIDENCE - C]

Guideline 1.2: Dose of compression after thermal ablation or stripping of the varicose veins.

If compression dressings are to be used postprocedurally in patients undergoing ablation or surgical procedures on the saphenous veins, those providing pressures >20 mm Hg together with eccentric pads placed directly over the vein ablated or operated on provide the greatest reduction in postoperative pain. [GRADE - 2; LEVEL OF EVIDENCE - B]

Guideline 2.1: Duration of compression therapy after thermal ablation or stripping of the saphenous veins.

In the absence of convincing evidence, we recommend best clinical judgment to determine the duration of compression therapy after treatment. [BEST PRACTICE]

Guideline 3.1: Compression therapy after sclerotherapy.

We suggest compression therapy immediately after treatment of superficial veins with sclerotherapy to improve outcomes of sclerotherapy. [GRADE - 2; LEVEL OF EVIDENCE - C]

Guideline 3.2: Duration of compression therapy after sclerotherapy.

In the absence of convincing evidence, we recommend best clinical judgment to determine the duration of compression therapy after sclerotherapy. [BEST PRACTICE]

Guideline 4.1: Compression after superficial vein treatment in patients with a venous leg ulcer.

In a patient with a venous leg ulcer, we recommend compression therapy over no compression therapy to increase venous leg ulcer healing rate and to decrease the risk of ulcer recurrence. [GRADE - 1; LEVEL OF EVIDENCE - B]

Guideline 4.2: Compression after superficial vein treatment in patients with a mixed arterial and venous leg ulcer.

In a patient with a venous leg ulcer and underlying arterial disease, we suggest limiting the use of compression to patients with ankle-brachial index exceeding 0.5 or if absolute ankle pressure is >60 mm Hg. [GRADE - 2; LEVEL OF EVIDENCE - C]

Characteristics and outcomes of stent occlusion after iliocaval stenting

Arjun Jayaraj, MD, William Crim, MS, Alexander Knight, BS, and Seshadri Raju, MD

Abstract: Objective: With increasing use of iliocaval stenting, complications have become more noticeable. Stent occlusion is one such outcome that has not been studied in detail. Characteristics of stent occlusion in addition to outcomes after recanalization are presented.

Methods: An analysis of 3468 initial iliocaval stents placed during an 18-year period from 1997 to 2015 was performed. A total of 102 stent occlusions were identified, amounting to a 3% stent occlusion rate. Characteristics evaluated included onset after stent placement, techniques used for restoring patency, and their outcome. Kaplan-Meier analysis was used to assess stent patency. Regression analysis was used to evaluate risk factors for stent occlusion.

Results: Stent occlusions occurred at a median of 5.8 months after placement. The occluded stent could be reopened after a wide range of intervals, the longest being 14 years. The majority (69%) of occlusions were chronic ($>$30 days) and the remainder (31%) were acute; 77% of the occlusions occurred in post-thrombotic limbs. The most common technique used to recanalize the acutely occluded stent was pharmacomechanical thrombectomy, whereas wire recanalization with balloon angioplasty was the technique most used for chronic occlusions. Of the 102 occluded stents, patency was achieved in 75 of 88 (84%) attempts. After successful recanalization, the median primary patency was 7 $\pm$ 1.9 months, median primary assisted patency was 7.5 $\pm$ 3.5 months, and median secondary patency was 25 $\pm$ 8.3 months. Clinically, there was improvement in the visual analog scale pain scores from a median of 3.5 to 1 ($P < .01$), in the median grade of swelling from 2 to 1 ($P < .01$), and in the mean Venous Clinical Severity Score from 6.4 to 3.8 ($P < .01$) after recanalization. A 40% ulcer healing rate was noted after recanalization during a median follow-up period of 17 months. There were no significant adverse events or mortality. Regression analysis revealed stent placement for native vein occlusion as the only statistically significant predictor of stent occlusion.

Conclusions: Stent occlusion after iliocaval stenting is a rare occurrence. Recanalization of occluded stents can be performed with minimal morbidity even months to years after occlusion with good outcomes. Long-term patency of occluded stents that were recanalized is poor compared with patency of the initially placed stent.