

**Methods:** A systematic review was performed from 2003 to 2013 with a query of PubMed and EBSCOHost databases. Eleven articles fitting specified criteria were published assessing outcomes associated with elective B/FEVAR for TAAA (n = 1006 patients). Data for 30-day and long-term mortality, technical success, complications, and morbidity were gathered. SCI and protective strategies, as well as Crawford classification of extent of coverage, were also collected and pooled for categorical analysis.

**Results:** Crawford classification included type I (n = 44), type II (n = 110), type III (n = 228), and type IV (n = 624) aneurysms. The 30-day mortality was 5.4% (n = 54). The 1- and 2-year reported survival were 74.9% and 57.4%, respectively. SCI occurred in 7.1% (observed/expected, 1.41), and acute renal failure was reported in 13.4% of patients. Technical success was 96.8%, with endoleaks occurring in 18.8%, and reintervention during follow-up required in 19.0%. Branch patency rates ranged from 76.9% in early experiences to 98.0% in late experiences.

**Conclusions:** When compared with open centers of excellence, B/FEVAR for TAAA has similar perioperative mortality rates but worse SCI rates. This data suggests the branched graft TAAA repair carries a greater risk of paraplegia or less effective spinal cord protective measures are used because of the misperception of less risk.

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#### PS54.

##### ***Clostridium difficile* Infections in Vascular Surgery Patients: Evaluation of Incidence, Risk Factors and Costs**

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**Objectives:** Starting in December 2013, the Hospital Inpatient Quality Reporting Program includes *Clostridium difficile* (*C diff*) infection rates as a new publicly reported quality measure. Our goal was to review the incidence, trend, and hospital variability in *C diff* rates as well as associated risk factors and costs in vascular surgery.

**Methods:** The incidence of *C diff* diagnoses after major vascular procedures of abdominal aortic aneurysm (AAA) repair, carotid and lower extremities revascularization (LER), and LE amputation was identified using Nationwide Inpatient Sample database for 2000 to 2010. Costs were assessed using cost-to-charge ratio. Risk factors associated with *C diff* were analyzed with hierarchical multivariate logistic regression.

**Results:** During the past decade, the rates of *C diff* after vascular procedures had steadily increased by 66%, from 0.6 to 0.99%. In 2010, the highest rates were after ruptured AAA repair (2.7%), whereas the lowest rates were after carotid endarterectomy (0.1%). The incidence

of *C diff* increased after open AAA, endo-LER, and carotid endarterectomy by 141%, 115%, and 40%, respectively. In 2010, patients who had experienced *C diff* had median length of stay of 15 days (interquartile range, 9, 26 days), in-hospital mortality of 9.8%, and \$20,600 extra cost per hospitalization. The national cost associated with *C diff* treatment was ~\$86.7 million. Hospital incidence of *C diff* varied from 0% to 50%, with 3.5% of hospitals having infection rates  $\geq 5\%$ . Factors associated with *C diff* included patient advanced age, female gender, renal insufficiency, multiple chronic conditions, emergency and weekend hospitalizations, hospital transfers, surgery type, and hospital characteristics (large, urban, public, and smaller Registered Nurse full-time equivalents rates).

**Conclusions:** Despite potential reduction of infection rates, as evidenced by the experience of hospitals with effective interventions, *C diff* incidence is increasing among vascular patients and is associated with prolonged length of stay, increased mortality, and higher costs.

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#### PS56

##### **Acute Kidney Injury in Critically Ill Vascular Surgery Patients Is Associated With Increased Mortality Regardless of Severity and Type of Index Procedure**

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**Objectives:** Perioperative acute kidney injury (AKI) is common, but has only been studied in select vascular surgery subgroups. We studied the incidence, risk factors, and outcomes of AKI in a broad vascular surgery cohort.

**Methods:** This was a retrospective analysis of vascular patients from a 1-year cohort of surgical ICU admissions at a tertiary hospital. Patients were identified from a prospective APACHE (Acute Physiology and Chronic Health Evaluation) IV database. The end point was AKI by RIFLE creatinine (Cr, mg/dL) criteria (increase vs baseline: Risk,  $\geq 1.5\times$ ; Injury,  $\geq 2\times$ ; Failure,  $\geq 3\times$ ). Outcomes were inpatient and 1-year mortality, surgical intensive care unit (SICU) and hospital lengths of stay and discharge Cr. AKI and non-AKI groups were compared by univariate analysis, and AKI risk factors were assessed by multivariate regression.

**Results:** Of 628 SICU admissions, 136 (22%) were vascular patients (28% of all vascular patients). AKI developed in 65 (48%), a rate similar to nonvascular patients (234 of 492 [48%];  $P = 1.0$ ). AKI and non-AKI patients had similar baseline Cr ( $0.90 \pm 0.44$  vs  $0.96 \pm 0.46$  mg/dL;  $P = .73$ ). Independent risk factors for AKI were increasing illness severity (APACHE III  $>50$ : odds ratio,

1.3; 1.1-1.6;  $P = .01$ ) and diabetes (odds ratio, 1.2; 1.1-1.5;  $P < .05$ ). Admission urgency and surgery class (aortic, peripheral vascular, carotid or endovascular) did not predict AKI. AKI patients had higher mortality (inpatient: 20% vs 1%, 1-year: 34% vs 14%;  $P < .01$  both). Among AKI patients, mortality was increased even for mild renal dysfunction (1-year mortality: risk 33% vs injury/failure 36%;  $P = .79$ ). With AKI, lengths of stay were longer (SICU:  $8 \pm 8$  vs  $4 \pm 2$  days; hospital:  $20 \pm 15$  vs  $11 \pm 8$  days;  $P < .001$ ) and discharge Cr was higher ( $1.47 \pm 1.15$  vs  $0.92 \pm 0.49$  mg/dL;  $P < .001$ ).

**Conclusions:** AKI is common among vascular surgery patients requiring SICU admission, regardless of admission status or surgery class. All severities of renal dysfunction are associated with significantly worse outcomes. Further study with identification of early, modifiable risk factors, particularly in elective surgery patients, may prevent AKI and improve outcomes.

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## PS58

### Changes in and Factors Affecting Failure to Rescue Mortality After Elective Abdominal Aortic Aneurysm Repair: 1995-2011

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**Objectives:** Factors affecting mortality after abdominal aortic aneurysm (AAA) repair have been extensively studied, but little is known about the effects of the shift to endovascular (EVAR) vs open repair (OAR) and of interhospital transfers on failure to rescue (FTR). This study examines the impact of these factors on FTR after elective AAA surgery from 1995 to 2011.

**Methods:** Patient demographics, comorbidities, hospital volume, repair type, and patient transfer status for 491,658 patients undergoing elective AAA surgery were collected using Medicare files. Primary outcome was FTR: the percentage of deaths in patients who had a complication within 30 days of surgery. Data were analyzed using univariate and multivariate analysis.

**Results:** In parallel with shifts from OAR to EVAR, overall FTR after AAA surgery decreased from 4.5 in 1995 to 2.2% in 2011 ( $P < .001$ ), whereas FTR for OAR increased from 4.4 to 5.7% ( $P < .001$ ) and for EVAR decreased from 2.1 to 1.3% ( $P < .001$ ). FTR rates were higher in low (one to two procedures/year) vs high (>20 procedures/year) volume hospitals after either OAR (6.1% vs 3.4%) or EVAR (2.4% vs 1.1%). FTR for patients who underwent AAA surgery and management of their complication at their primary institution decreased from 4.5 to 2.1% ( $P < .001$ ) during the study time. Patients were more likely to be transferred if they had

coronary artery disease, renal failure, pulmonary disease, or needed OAR. Transferred patients experienced more postoperative cardiac (9.0% vs 4.7%,  $P < .001$ ), respiratory (18.1% vs 12.7%,  $P < .001$ ), and arterial complications (8.1% vs 4.3%,  $P < .001$ ). Transfer into high-volume hospitals of clinically complex patients was associated with decreased FTR (RR, 0.83; confidence interval, 0.72-0.96;  $P = .003$ ).

**Conclusions:** The success in AAA surgery of rescuing patients from 30-day mortality after complications has significantly improved during the last 12 years as a result of the increased volume of EVAR. Clinically complex patients were less likely to incur complications and mortality if they were treated in high-volume centers.

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## PS60

### Predicting Cerebral Hyperperfusion Syndrome With Velocity Systolic Blood Pressure Index

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**Objectives:** Cerebral hyperperfusion syndrome (CHS) is a life-threatening complication of carotid endarterectomy (CEA). The changes in the middle cerebral artery velocity (MCAV) are used to predict the occurrence of CHS, but the accuracy of this measurement is limited. Therefore, we aimed to identify the relationship between the increase in blood pressure (BP) in the early stage after surgery and CHS occurrence. Additionally, we aimed to combine the change in MCAV and the increase in BP in the early stage after surgery to create a more precise parameter to predict the patients that are at risk for CHS.

**Methods:** A prospective study was held from October 2010 to January 2013, and 185 patients were recruited. Patients were classified according to the occurrence or absence of CHS. The velocity systolic blood pressure index (VSI) was calculated from the postoperative increase ratio of the MCAV and systematic blood pressure crossing the CEA. The postoperative increase ratios of MCAV (VR), for predicting CHS occurrence were also calculated. The prediction powers of these different calculations for CHS were compared. The sensitivities, specificities, positive predictive values, and negative predictive values of these measurements were calculated. A receiver operating characteristic analysis (ROC) was performed.

**Results:** Eleven cases of CHS were diagnosed. A best-fit cutoff point of 1.7 for VSI was identified, which had 100% sensitivity and 84% specificity. This result is significantly better than the traditional parameter, VR. The sensitivity of VSI is four times higher than that of VR. The area under the receiver operating characteristic curve was 0.934 for VSI and 0.872 for VR ( $P = .008$ ).