or postoperative complications. The mean follow-up was 372 days. Six patients required additional TASMR. Two patients underwent contralateral TAFRR for neurogenic TOS. Overall, 18 patients had either complete resolution or minimal residual symptoms. All patients were able to return to school and 92% (11/12) of athletes were able to return to competition.

**Conclusions:** Surgical treatment of neurogenic TOS in adolescents may be performed with low morbidity. The majority of patients are female and anatomic anomalies are commonly identified. Almost one third of patients may require additional TASMR. Significant improvement in symptoms, the ability to return to school, and resumption of athletic competition suggests that, in carefully selected adolescent patients, results may be superior to those reported in adults.

### Hospital Volume of Thoracoabdominal Aneurysm Repair Does Not Affect Mortality in California

Anna C. Weiss, MD, Amanda Green, Katherine E. Brown, MD, David Chang, PhD, and Nikhil Kansal, MD, General Surgery, University of California – San Diego, San Diego, Calif.

**Objective:** Current literature has shown that high volume institutions have better outcomes after thoracoabdominal aneurysm repairs (TAARs). The objective of this study was to investigate the morbidity and mortality rates of TAAR in California. We hypothesized that the morbidity and mortality rates have improved over the last 15 years, and that higher volume institutions have significantly better outcomes.

**Methods:** We queried the California 100% discharge database for patients who underwent TAAR between 1995 and 2008. We performed a retrospective review comparing morbidity and mortality rates each year. Morbidities included paraplegia, myocardial infarction, stroke, respiratory failure, and renal failure. Two methods of classifying hospitals into low and high volume cohorts were used: volume each year, or 3-year averages to account for fluctuations. High volume was defined as more than eight TAARs per year. An adjusted analysis was performed correcting for the patient demographics, Charlson index, aneurysm rupture, and elective repair.

**Results:** There were a total of 1085 TAARs between 1995 and 2008. There were 117 low volume and four high-volume institutions. The morbidity and mortality rates after TAAR did not significantly improve over time ($P = .3$ and .25, respectively). On unadjusted analysis, the mortality rate at 1-year low volume institutions was 27%, compared to 20% at 1-year high-volume institutions ($P = .02$). The mortality rate at 3-year averaged high-volume institutions was 23%, compared to 25% at low-volume ($P = .353$). Adjusted analysis revealed an odds ratio of mortality of 0.385 at 1-year high-volume institutions ($P = .053$, 95% confidence interval [CI], .35-1.01). Three-year averaged high-volume hospitals had an odds ratio of mortality of 0.59 ($P = .396$; 95% CI, .175-1.99).

**Conclusions:** The morbidity and mortality rates after TAAR have not significantly changed over the past 15 years in California. Although current literature reports significantly better outcomes after TAAR at high-volume institutions, in the state of California, the mortality after TAAR is similar at both low-volume and high-volume institutions.

### Optimal Method of Obtaining Aortic Measurements for Endovascular Aneurysm Repair

Marlin Causey, Reagan Quan, Thomas Curry, and Niten Singh, Department of Surgery Residency, Madigan Army Medical Center, Ft. Lewis, Wash.

**Objective:** Accurate preoperative planning and sizing for endovascular aneurysm repair (EVAR) is essential for reduced procedural time, more efficient utilization of fluoroscopy and contrast, and prevention of latter adjunctive procedures. The current preoperative standard for EVAR is axial computed tomography (CT), but other imaging modalities such as intravascular ultrasound (IVUS), angiography, and CT reconstruction software packages have also been used. Our objective was to determine which of the above-mentioned imaging modalities is the optimal method of preoperative planning for EVAR.

**Methods:** Data was collected prospectively over a 10-month period of time on consecutive patients undergoing EVAR. Preoperatively, the surgeon of record obtained his measurements and calculations utilizing a CT-reconstruction software package (RS Software) with centerline measurements. Another surgeon, blinded to the case, obtained measurements and calculations using standard axial CT. A standardized measurement protocol was used. Both surgeons chose endografts based on their individual measurements. Intraoperatively, IVUS and angiographic measurements were obtained in a nonblinded fashion.

**Results:** Twenty EVARs were performed during the study period (3 women and 17 men) with a mean age of 72 ± 5.5 years using an average of 94.5 mL of contrast and 22 minutes of fluoroscopy. Aortic measurements are listed in Table I comparing the different modalities. There was no statistically significant difference in diameter measurement between different modalities. However, centerline measurements from the RS were significantly longer than either the CT or IVUS lengths and did correlate with the actual length and ultimately the graft used (Table II). The ultimate endograft chosen correlated with the endograft in the RS software in 15 of 17 patients while only 1 of 3 was sized appropriately from axial CT.

**Conclusions:** The ideal method to measure the aorta before deployment of an abdominal aortic endograft is evolving as technology improves. We believe using reconstructive software of axial CTs allows for more accurate preoperative planning, particularly with the length of grafts chosen.

**Table I.** EVAR diameters at different levels

| *Level* | *CT (mm)* | *M2S (mm)* | *IVUS (mm)* | P *value* |
|---|---|---|---|---|
| Renal arteries | 23.7 ± 0.9 | 23.8 ± 0.8 | 22.8 ± 0.7 | .731 |
| 5 mm | 24.1 ± 0.9 | 24.5 ± 1.1 | | .986 |
| 10 mm | 24.2 ± 0.9 | 25.8 ± 1.2 | 24.9 ± 1.2 | .921 |
| 15 mm | 25.9 ± 1.0 | 26.4 ± 1.2 | | .811 |
| 20 mm | 26.9 ± 0.8 | 27.2 ± 1.2 | 26.3 ± 1.2 | .812 |
| Bifurcation | 23.0 ± 1.1 | 24.9 ± 1.7 | 22.8 ± 1.5 | .822 |
| R CIA seal | 12.8 ± 0.7 | 13.7 ± 0.6 | 12.0 ± 0.6 | .272 |
| L CIA seal | 13.0 ± 0.8 | 12.3 ± 0.4 | 11.7 ± 0.6 | .413 |

*CT,* Computed tomography; *IVUS,* intravascular ultrasound; *L CIA,* left common iliac artery; *R CIA,* right common iliac artery.

**Table II.** Centerline measurements comparing different modalities

| *Centerline measurements* | *CT (mm)* | *RS (mm)* | *Angiography (mm)* | P *value* |
|---|---|---|---|---|
| Aorta to bifurcation | 104 ± 3.3 | 103 ± 9.5 | 102 ± 7.5 | .812 |
| Aorta to left hypogastric | 160 ± 4.7 | 184 ± 6.1 | 156 ± 9.8 | .019 |
| Aorta to right hypogastric | 161 ± 4.0 | 183 ± 7.0 | 160 ± 9.3 | .012 |

*CT,* Computed tomography.

### Significant Clinical Predictors of Postoperative Mortality Following Endovascular Abdominal Aortic Aneurysm Repair

Nhan-Vu Nguyen, MD, Linda Chun, MD, Clarence W. Cole, MD, and Kevin Patel, MD, Kaiser Permanente-Los Angeles Medical Center, Los Angeles, Calif.

**Objectives:** The purpose of this study was to show the relationships between endovascular aneurysm repair and the causes for long-term postoperative death in order to identify significant predictors of mortality.

**Methods:** A retrospective review of a multi-institution database of all patients that underwent EVAR between May 2003 and June 2010 was performed. Comparisons of patient demographics and clinical characteristics between deceased and alive patients were evaluated.

**Results:** Five hundred eighty-eight patients (68 women and 520 men) underwent EVAR during the study period. There were a total of 82 deaths (13.9%). The causes of death were distributed as follows: 12 (14.6%), 6 (7.3%), 25 (30.5%), 3 (3.7%), 7 (8.5%), and 29 (35.4%) in pulmonary, cardiac, cancer, postoperation, other, and unknown, respectively. The average age of patients was 77.8 + 7.8 years for those who died and 73.9 + 8.1 years for those who were alive. Adjusting for all the other variables in the models, for each year increase in age, there was an 8% increase risk of death. In addition, positive and significant relationships were found between age, end-stage renal disease (ESRD), chronic obstructive pulmonary disease (COPD), postoperative pulmonary event, and risk of all cause mortality. Patients with ESRD or COPD had approximately 4 and 2 times higher risk of death compared to those without ESRD and COPD. There was a protective relationship between the patients on acetylsalicylic acid (ASA) or preoperative statin and risk of all cause mortality. Those on an ASA or statin before operation were 50% and 46% less likely to die than those patients who did not.

**Conclusions:** Patient age at time of EVAR and the presence of ESRD or COPD were significant risk factors for long-term post repair mortality. Perioperative ASA and statin use were protective.