endoleak. This endovascular aortic strategy is particularly appealing for those patients presenting with symptomatic or ruptured aortic aneurysms until reliable off-the-shelf solutions become widely available.

Table. Operative details

Variable	*Mean (range)*
Aneurysm diameter, mm	65 (55-91)
Proximal neck length, mm	4.8 (2-11)
Manufacture time, minutes	59 (31-78)
Procedure time, minutes	166 (96-378)
Fluoroscopy time, minutes	45 (19.7-164)
Total contrast, mL	65 (30-120)
Estimated blood loss, mL	200 (20-1000)
Length of stay, days	5.8 (1.3-23.7)

Endoleaks After Endovascular Repair of Ruptured Abdominal Aortic Aneurysm: Should They Be Treated?

Nam T. Tran, Brandon Tyler Garland, Elina Quiroga, Benjamin Starnes, MD, and Thomas Hatsukami. Department of Surgery, University of Washington, Seattle, Wash

Objective: The management of ruptured abdominal aortic aneurysm has undergone significant changes within the last decade, with endovascular repair (rEVAR) now the preferred operative approach. We hypothesized that some endoleaks after rEVAR can be managed expectantly, whereas others require urgent intervention to due to ongoing hemorrhage.

Methods: In an Investigational Review Board-approved study, all patients admitted with the diagnosis of rAAA from July 2007 to December 2011 were entered into a prospectively maintained database. Patients with rEVAR and computed tomography angiography (CTA) performed within the first 30 days of repair were included in the analysis. Images were analyzed by attending radiologists for presence and type of endoleak as well as aneurysm size. Relevant patient data, such as hemodynamic status, hematocrit level, transfusion requirement, hospital length of stay, and outcome, were analyzed.

Results: Sixty-three patients (79% men) were identified who had undergone rEVAR, and in 34, CTA was performed ≤30 days of the procedure. The mean age was 74.5 years. Four type I endoleaks, one type III endoleak, and seven type II endoleaks were identified. The overall endoleak rate was 35.2% (12 of 34). Two of four type I endoleaks required urgent reintervention due to hemodynamic instability. The patient with type III endoleak was stable, but follow-up imaging demonstrated a retroperitoneal hematoma and the sac diameter had increased in size and thus underwent reintervention. No type II endoleaks required further intervention. At 2 years, all endoleaks except two of seven type II have resolved.

Conclusions: The rate of endoleak after rEVAR is higher than that reported for elective endovascular repair. Type II endoleaks resolved spontaneously over time and should be managed conservatively. Conversely, type I and III endoleaks can lead to continual rapid hemorrhage and should undergo intervention. CTA should be performed on all rEVAR patients before discharge.

Determinants of Abdominal Aortic Aneurysm Sac Enlargement After Endovascular Aneurysm Repair with a Long-Term Follow-Up to 15 Years

Carlos E. Donayre, MD, Faidzal Othman, MD, George E. Kopchok, BS, Ali Khoynezhad, MD, and Rodney A. White, MD. Department of Surgery/Division Vascular Surgery, Harbor–University of California-Los Angeles Medical Center, Torrance, Calif

Objective: Studies have documented abdominal aortic aneurysm (AAA) enlargement in up to 41% of patients 5 years after endovascular repair (EVAR). Noting limitations of patient selection and length of follow-up, the current analysis was undertaken to assess AAA enlargement in an unselected patient cohort with follow-up for up to 15 years after repair.

Methods: Between 1996 and 2011, 586 consecutive patients (mean age, 73.9 ± 9.0 years; 89.5% male; mean AAA diameter, 58 ± 12 mm) underwent EVAR. Of these, 196 (59%) were part of an investigational device exemption (IDE) study and 137 (41%) received a commercially available device (CAD). Centralized three-dimensional imaging computed tomography surveillance (M2S, West Lebanon, NH) was available in 333 patients (56%) over a median follow-up of 36 months (range, 1-180 months). Multivariate and univariate Cox regression models were used to assess time to AAA enlargement (≥5 mm vs baseline), estimating the hazard ratio (HR) and 95% confidence intervals (CI) for AAA enlargement compared with baseline.

Results: The proportion of patients who developed AAA enlargement at 1, 3, 5, and 8 years after repair was 4.5%, 12.5%, 21.6%, and 31.7%, respectively (Fig). Mean time to enlargement was 42 ± 38 months. Multivariable analysis identified age (HR 1.045; 95% CI, 1.011-1.081; $P = .01$) and common iliac diameter (HR 1.047; 95% CI, 1.016-1.078; $P = .002$) as predictors of enlargement. At 15 years, enlargement occurred in 57 patients (17.1%), with secondary interventions required in 25 (endovascular in 22 and open conversion in three). Only one rupture occurred in this group. Outcome in the IDE and CAD groups did not differ with respect to AAA enlargement or the frequency of secondary interventions.

Conclusion: This single-center, unselected patient cohort with long-term CT follow-up documented AAA enlargement in a smaller proportion of patients than has been reported in other series. Certain baseline patient characteristics can be identified that are associated with AAA enlargement, but the risk of enlargement did not differ in IDE vs CAD groups.

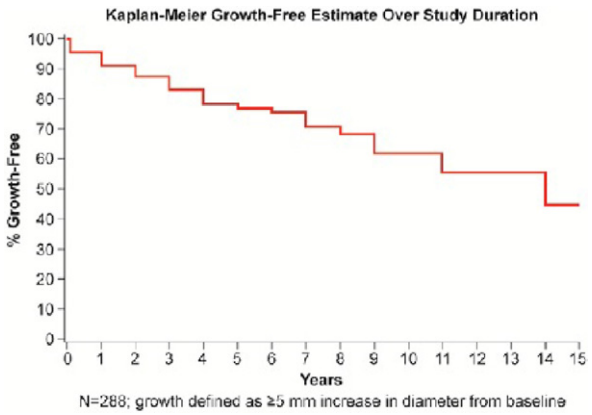

Fig.

Case-Specific Endovascular Aneurysm Repair Simulation: A Pilot Comparison of Simulated Aneurysm Repair with Actual Live Cases

Venita Chandra, MD,[2] Robert Gowing, MD,[1] Amy Peruzarro, BS,[2] and Jason T. Lee, MD[2]. [1]Vascular Surgery, McMaster University Medical Center, Hamilton, Ontario, Canada; and [2]Stanford University Medical Center, Stanford, Calif

Objective: Patient-specific endovascular aneurysm repair (EVAR) simulation has the potential to allow the operative team, particularly trainees, to rehearse an entire case on the patient's actual anatomy before performing the actual procedure. To better understand how closely outcomes of live cases measured up to simulated ones, we analyzed the operative metrics of EVAR simulations compared with previously performed cases.

Methods: Four completed actual EVAR cases were selected at random to be "simulated." Digital Imaging and Communications in Medicine data from preoperative computed tomography images were rendered into the PROcedure Rehearsal Studio system, and the simulated cases were performed by a similarly experienced operative team of faculty and fellows. In both the actual and simulated cases, interval times to critical steps were recorded along with device components, repeat interventions, contrast amounts, and fluoroscopy times.

Results: Compared with the actual live cases, the metrics simulated cases were similar, including mean total operating room time (69 min), fluoroscopy time (22.8 min), and contrast usage (83.5 mL). Deployment of the contralateral limb was used as a surrogate for cannulation complexity, which showed these times were significantly faster in the simulation group (completed at 39 vs 50.5 minutes). Total number of device components used was similar; however, the main body and iliac limb diameters were frequently different, with iliac limb lengths equivalent. The simulated cases had a higher incidence of type Ia endoleak that required additional proximal ballooning (no cuffs) compared with the actual cases.

Conclusions: Rehearsal of actual EVAR cases is feasible using current simulation technology, with standard operative metrics replicated accurately in the simulation group. Certain steps were easier on the simulator, indicating room for improvement in simulation technology, but overall procedural conduct of the cases was similar to live case timelines. The potential educational benefits and increased procedural efficiency to both trainees and experienced EVAR users requires further investigation.