Thirty-Day Outcomes after Elective Percutaneous or Open Endovascular Repair of Abdominal Aortic Aneurysms

David S. Kauvar,[1,2] Eric D. Martin,[1] and Matthew D. Givens,[3] Fort Gordon, Georgia, and Bethesda, Maryland

Background: Percutaneous endovascular aneurysm repair (PEVAR) has become accepted as a suitable alternative to open EVAR (OEVAR) in the treatment of abdominal aortic aneurysms (AAAs). Direct comparisons between the 2 techniques have been infrequently reported and have predominantly focused on immediate procedural outcomes. The objective of this study was to compare contemporary 30-day postoperative outcomes between successfully completed elective PEVAR and OEVAR.

Methods: The 2012 National Surgical Quality Improvement Program database was queried for all elective primary AAA repairs. Procedures on ruptured AAAs and those involving adjunctive thoracic, abdominal, or extremity procedures were excluded. Cases completed with at least one surgical exposure of the femoral artery for access (OPEN) were compared with those completed without such exposure (PERC). Preoperative, intraoperative, and 30-day postoperative variables were compared using appropriate univariate statistical tests. A P value of ≤ 0.05 was considered significant for all comparisons.

Results: A total of 1,589 (51%) OPEN and 1,533 (49%) PERC cases met inclusion and exclusion criteria. Preoperative characteristics did not differ between groups. OPEN cases took significantly longer (150 ± 69 min) than PERC cases (134 ± 65 min, $P < 0.001$). No significant differences were found between the groups in any postoperative occurrence, but the rate of venous thromboembolism twice as high in OPEN (16, 1.0%) than PERC cases (7, 0.5%, $P = 0.07$). In addition, wound complications (36, 2.3% OPEN vs. 23, 1.3% PERC, $P = 0.11$) were more common in OPEN cases but were diagnosed a week sooner on average in PERC cases (19 days OPEN and 12 days PERC). Median postoperative length of stay was 2 days among OPEN cases versus 1 day in PERC cases ($P = 0.11$). Female gender and obesity predicted wound complications in the OPEN group but not in the PERC group.

Conclusions: Successfully completed PEVAR and OEVAR have similar rates of overall complications. Female gender and obesity predict wound complications in OEVAR but not in PEVAR, which appears to be a safe alternative to OEVAR. PEVAR has the advantage of shorter operative time and the potential for a shorter postoperative stay, and may offer the advantage of fewer wound complications in females and obese patients.

The opinions and assertions contained herein are solely those of the authors and do not represent those of the United States Government or any entity thereof.

The American College of Surgeons National Surgical Quality Improvement Program and the hospitals participating in the ACS NSQIP are the source of the data used herein; they have not verified and are not responsible for the statistical validity of the data analysis or the conclusions derived by the authors.

[1]*Department of Surgery, Dwight D. Eisenhower Army Medical Center, Fort Gordon, GA.*

[2]*Department of Surgery, Uniformed Services University of the Health Sciences, Bethesda, MD.*

[3]*Department of Radiology, Dwight D. Eisenhower Army Medical Center, Fort Gordon, GA.*

Correspondence to: David S. Kauvar, MD, Department of Surgery, DDEAMC, 300 Hospital Drive, Fort Gordon, GA 30905, USA; E-mail: davekauvar@gmail.com

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INTRODUCTION

Endovascular aneurysm repair (EVAR) has become the treatment of choice for the vast majority of abdominal aortic aneurysms (AAAs) over the past 2 decades.[1] The procedure was originally performed using open surgical exposure and control of the common femoral arteries for delivery of the graft devices via large diameter sheaths. In 1999, however, a technique for percutaneous EVAR (PEVAR) was first reported and has since been accepted as a suitable alternative to open EVAR (OEVAR).[2] PEVAR offers the opportunity to deliver even large-sheathed devices through the common femoral artery without surgical exposure or repair of the vessel.

Numerous authors have reported high-procedural success and low early complication rates with the PEVAR technique, however, with the exception of a single pilot and a single completed randomized trial,[3,4] direct comparisons of PEVAR with OEVAR have been sparingly reported and are all from single centers.[5–8] Those reports that do compare the 2 techniques typically focus on the outcomes of conversions from PEVAR to OEVAR and procedural success and immediate perioperative outcomes. There are very few reports comparing the postoperative complication rates between technically successful PEVAR and OEVAR. The objective of this study was to use a national multi-institutional surgical outcomes database to compare contemporary 30-day postoperative outcomes between successfully completed elective PEVAR and OEVAR for abdominal aortic aneurysms.

METHODS

Database

The American College of Surgeons maintains the National Surgical Quality Improvement Program (NSQIP) database of surgical outcomes from over 250 nationwide hospitals of all types. Preoperative, perioperative, and up to 30 day postoperative data for most commonly performed surgical procedures are entered on a case-identified basis by trained abstractors at each institution. These data are continuously audited and complied into participant user files (PUFs) containing over 200 data points for all cases performed during a calendar year. The PUFs are made available to participating NSQIP institution for quality improvement and research purposes. Because of the absence of patient identifiers in NSQIP, the Dwight D. Eisenhower Army Medical Center Institutional Review Board exempted this research from review.

Case Selection

Because the use of PEVAR has increased over the past 15 years, to perform a contemporary comparison of national practices, we elected to sample the 2012 NSQIP PUF for relevant PEVAR and OEVAR cases. We selected all cases in which the primary procedure was an endovascular AAA repair with a bifurcated endograft and either 1 docking limb (Current Procedural Terminology 34802), 2 docking limbs (34803), or no docking limbs (34804). Because we were interested in the outcomes of elective procedures, we excluded all cases performed emergently or with a postoperative diagnosis of ruptured AAA. Cases with concomitant thoracic aneurysm repairs were also excluded. Finally, we excluded all cases with a secondary procedure requiring a groin incision, including all femoral endarterectomies and bypasses with the femoral artery as the inflow or outflow artery.

All cases with at least one secondary procedure code for open femoral artery exposure for endograft delivery (34,812) were considered OEVAR, and cases without this code were considered PEVAR. This resulted in 2 groups, 1 in which the procedure was performed totally percutaneously (PERC-no surgical exposure, conduit placement, endarterectomy, or bypass of either femoral artery) and 1 in which cases had one or more femoral arteries surgically exposed but not for the purpose of endarterectomy, conduit placement, or bypass (OPEN). This case selection rubric eliminated the confounding effect of intraoperative conversions from PERC to OPEN and allowed comparisons of successfully completed PEVAR and OEVAR cases to be made on a patient-by-patient, rather than a groin-by-groin basis.

Variables and Analysis

We collected preoperative variables including basic demographic data and comorbidities. Obesity was defined as a body mass index (BMI) $\geq$ 30 and was treated both as a continuous (BMI) and categorical (obese versus nonobese) variable. Operative variables included operative time (in minutes) and type of anesthesia (general versus local and/or regional). Postoperative variables reflect a 30-day postoperative data collection period and included mortality, wound complications (including superficial, deep, and organ space infections and dehiscences), and other adverse occurrences. Readmission and reoperations within 30 days are categorized in the NSQIP PUF as either related or unrelated to the index procedure and admission and are reported as such.