

Functional status of nursing home residents before and after abdominal aortic aneurysm repair

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Although many trials have evaluated abdominal aortic aneurysm (AAA) repair, the impact of these procedures on the functional status of frail elderly patients is not well-described. The effects of elective open AAA repair (OAR) and endovascular AAA repair (EVAR) and comorbidities were evaluated for their impact on functional trajectories after discharge. Medicare inpatient claims were linked with nursing home assessment data to identify elective admissions for OAR and EVAR. A functional score (range, 0-28; higher scores indicate greater impairment) was calculated before and after interventions. Logistic regression was used to develop a propensity score for receiving EVAR because residents were not randomized. Hierarchical linear modeling determined the effect of surgery on residents' function, controlling for prehospital function, hospital length of stay (LOS), stroke, and the propensity score. Fifty-two residents underwent OAR and 161 underwent EVAR. Most (65.3%) were men and 62.0% were from 76 to 85 years old. Mean LOS was 8.3 days for OAR and 5.1 days for EVAR. Of the residents, 47.4% had good prehospital function (activities of daily living [ADL] score of 0-10), and 48.4% were moderately impaired (ADL score of 11-20). Higher baseline ADL score, increased LOS, and stroke were associated with worse trajectories. Procedure type was not significantly related to postoperative function or the subsequent rate of improvement. OAR and EVAR were associated with similar initial declines and comparable postoperative trajectories, suggesting that less invasive EVAR was not associated with improved functional preservation compared with OAR. LOS was found to be higher than expected in the frail elderly after EVAR; longer stays were associated with poorer functional trajectories. Higher baseline ADL scores were significantly associated with inferior functional status after both procedures. Evaluation of preoperative function may assist physicians in predicting outcomes in this high-risk population. (J Vasc Nurs 2015;33:106-111)

BACKGROUND

In the United States, the number of cases for abdominal aortic aneurysm (AAA) repair has remained stable over the last 10 years.¹ However, the type of repair (endovascular or open) has changed dramatically, with recent trends moving toward an endovascular approach rather than an open approach, especially for the elderly.^{2,3} Although there is no long-term difference in survival between the endovascular AAA repair (EVAR) and open AAA repair (OAR),⁴ there are few studies regarding functional

outcomes and the impact on patients after elective operative intervention. One functional outcome that can be measured to determine the impact of AAA repair is activities of daily living (ADL). An individual's quality of life is intimately linked with independence in ADLs⁵ and, conversely, ADL impairments are associated with hospital admission,⁶ death,⁷ and persistent disability.⁸ Therefore, the purpose of this study was 2-fold: to (1) describe ADL scores of nursing home residents before and after hospitalization for elective AAA and (2) determine the effect of procedure type on the ADL scores of residents undergoing open versus endovascular repair. The specific aim of this study was to determine if procedure type was associated with either improved or worsening post-hospital trajectories of ADL function.

METHODS

Design and sample

A retrospective cohort study was performed, combining Medicare inpatient claims data with nursing home assessment data.

Population

We included patients who were admitted for EVAR or OAR. International Classification of Disease, Ninth revision, codes for selecting diagnoses and procedures are as follows: AAA, 441.4; EVAR, 39.71; OAR, 38.34, 38.44, or 38.64. Qualifying stays were

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1062-0303/\$36.00

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<http://dx.doi.org/10.1016/j.jvn.2015.02.003>

preceded by ≥ 1 Minimum Data Set (MDS) assessment within 60 days of hospital admission, had hospital length of stay (LOS) of < 31 days, admission date on or after June 1, 2006, and a discharge date before August 1, 2007. Exclusions included residents < 67 years old as of January 1, 2006; residents with any health maintenance organization membership in 2006-2007 (health maintenance organizations do not report hospital data); residents without a record in the beneficiary summary files for 2006-2007; residents with no Medicare Part A coverage for either year; residents with > 20 hospital stays in 2006-2007; and residents who died in the hospital.

Data and measures

Medicare inpatient claims for 2006-2007 were linked with nursing home MDS assessments to form a cohort of long-stay residents who were hospitalized for elective AAA repair. MDS assessments are mandated federally for all nursing homes that are certified by Medicare or Medicaid and are used to develop comprehensive care plans.⁹ Each resident's last prehospital MDS assessment and all post-hospital MDS assessments were included during 6 months after hospital discharge, up to the point of readmission or death.

The MDS ADL long-form score¹⁰ was used to represent ADL function. The functional score is the summation of 7 variables: bed mobility, self-transfer, locomotion on unit, dressing, eating, toileting, and personal hygiene. Each component is scored from 0 (the resident is independent in performing the activity) to 4 (total dependence on others). As recommended by the authors, scores of 8, indicating that the activity did not occur during the prior week, were reassigned to 4. The total functional score ranges from 0 (complete independence in all 7 activities) to 28 (complete dependence). As little as a 1-point change in a patient's functional score can be significant clinically, because this indicates new supervision or a move toward more dependence in any 1 activity area.^{11,12}

Demographics were determined from beneficiary summary files and MDS assessments. Comorbid diagnoses present before the hospital admission were derived from Medicare data, prior MDS assessments, and the Chronic Condition Warehouse data furnished by the Centers for Medicare and Medicaid. The Cognitive Performance Scale (CPS) was used to represent residents' cognition.¹³ The CPS ranges from 0 (no cognitive impairment) to 6 (severe cognitive impairment).

Data collection

All data were obtained from the Centers for Medicare and Medicaid Services (Data Use Agreement 19189).

Statistical analysis

SAS for Windows, version 9.3 (SAS Institute, Cary, NC), was used for all analyses. Characteristics of residents who underwent endovascular or open procedures were compared using χ^2 analysis. Because patients were not randomized to procedure type, we used logistic regression to develop a propensity score¹⁴ to balance the characteristics of the open and endovascular groups. Model discrimination was evaluated with the *c*-statistic, which varies from 0.5 (no better than a coin flip) to 1 (perfect fit). Model calibration was assessed with the Hosmer-Lemeshow goodness-of-fit statistic with nonsignificant tests indicating adequate fit across the range of data. The estimated probability of receiving an endovascular procedure was divided into quartiles and used as a categorical independent variable in the ADL model. Covariate balance with and without propen-

sity adjustment was evaluated by examining the absolute standardized differences and variance ratio for each covariate.¹⁵ A standardized difference of $> 10\%$ between open and endovascular groups was regarded as evidence of imbalance.

In addition to the propensity score, residents' demographic characteristics, type of procedure, prehospital diagnoses, CPS,¹³ Charlson Comorbidity Index,¹⁶ and baseline ADL score were included as independent variables in a linear mixed model of post-hospital ADL performance. The Charlson Index reflected both previous and current diagnoses. Because the number and timing of ADL measurements varies over individuals, the ADL intercept and slope were treated as both fixed and random effects.¹⁷ Time since hospital discharge was measured in months. The initial model included all 2- and 3-way interactions involving time, diagnosis, and procedure type as well as selected covariates (demographic characteristics, prior health care utilization). We retained covariates and interaction terms that remained significant after propensity adjustment as well as age, diabetes, and the interaction between baseline ADL score and time.

Owing to the concern that truncating a resident's ADL trajectory from either death or readmission constituted informative dropout, a shared parameter model was also tested,¹⁸ where ADL trajectory and time to dropout were modeled simultaneously. Because the parameter estimates from the 2 modeling strategies were very similar, and because the focus of this paper is the comparison of expected ADL trajectories, only parameter estimates from the simpler mixed model are presented.

To compare post-hospital trajectories of various groups of residents, we plotted ADL trajectories based on chosen covariates, namely, EVAR versus OAR, baseline ADL score, and hospital LOS.

Ethical considerations

This study was a retrospective statistical review of deidentified Medicare data; therefore, no patients were subject to harm during this investigation. The Health Sciences Institutional Review Board at the University of Missouri approved this study.

RESULTS

Demographics, comorbid conditions, and hospital LOS of the derived cohort are presented in Table 1. We identified a total of 213 nursing home residents with qualifying admissions who underwent either OAR (52; 24.4%) or EVAR (161; 75.6%). The majority of patients were in the 76-85 age group (62%), 197 patients were white (92.5%), and almost two-thirds were male (65.3%). Compared with open procedures, endovascular repair was more common among those age ≥ 76 years (123; 76.9%). The CPS score was similar in both OAR and EVAR populations. The presence of comorbid conditions was similar between groups, except for prior stroke or transient ischemic attack (17.3% in OAR vs 37.9% in EVAR; $P < .05$).

Mean length LOS was 8.3 days for OAR and 5.1 days for EVAR. The majority of patients undergoing endovascular repair were discharged within 5 days of admission (70.2%), whereas only 9.6% of patients who underwent OAR stayed for < 5 days ($P < .05$). Most patients with an OAR had a hospital LOS that spanned 6-10 days (73.1%) compared with only 37 (23%) EVAR patients. Although not significant, those patients who did have a hospital stay of > 11 days tended to have an OAR (17.3%), compared with only 6.8% of patients undergoing

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