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Use of an Assistant Surgeon Does not Mitigate the Effect of Lead Surgeon Volume on Outcomes Following Open Repair of Intact Abdominal Aortic Aneurysms

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WHAT THIS PAPER ADDS

This is the first large scge scale study to evaluate the role of an assistant surgeon in the volume–outcomes relationship following open repair of abdominal aortic aneurysms (AAA). While prior studies have shown lower peri-operative mortality following AAA repair among high volume surgeons, it is now shown that the addition of an attending surgeon as assistant, even amongst low volume lead surgeons, does not improve outcomes, which adds to the existing volume-outcomes literature for aortic disease.

Objective/background: While higher lead surgeon volume has been associated with lower mortality following open abdominal aortic aneurysm (AAA) repair, little is known about the impact of using an attending surgeon as assistant surgeon. The aim of this study was to determine whether the presence of an assistant surgeon, particularly a high volume assistant, mitigates the relationship between lead surgeon volume and outcomes.
Methods: All Medicare beneficiaries who underwent intact, open AAA repair between 2003 and 2008 were evaluated and nested regression models were constructed to evaluate the relationship between surgeon and assistant volume and peri-operative mortality, adjusting for comorbid conditions and hospital volume.
Results: In total 28,590 repairs were studied, of which 19,284 (67.5%) were performed by a single surgeon and 9306 (32.5%) included an assistant surgeon. Of cases with an assistant, 12.3% included a high volume assistant surgeon. Lower volume surgeons more frequently used an assistant (lead surgeon Q1 volume: 40%; Q2: 36%; Q3: 34%; Q4: 29%; Q5: 27% [$p < .01$]). In cases with no assistant, adjusted peri-operative mortality varied monotonically with surgeon volume (Q1: 4.7%; Q2: 4.4%; Q3: 4.1%; Q4: 3.3%; Q5: 3.2%). However, the use of a high or a low volume assistant surgeon, compared with no attending surgeon as assistant, was not associated with lower peri-operative mortality in any lead surgeon volume quintile, even among those operations performed by the lowest volume lead surgeons.
Conclusion: Employing an assistant surgeon does not improve outcomes amongst any quintile of volume of the lead surgeon. As surgeons perform fewer open AAA repairs in the modern era, these data imply that even the help of a high volume assistant surgeon may not mitigate the detrimental effect of a lower volume surgeon.
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INTRODUCTION

Several national and international studies have identified lower mortality following open repair of intact abdominal aortic aneurysms (AAA) by high volume versus low volume surgeons.[1–7] This volume–outcome relationship plays a particularly important role in the modern endovascular era, in which open repairs comprise < 20% of intact, infrarenal AAA repairs.[8,9] As surgeons expand endovascular techniques into increasingly complex aortic aneurysms, their experience with open AAA repair (OAR) will continue to decline. Dua et al. predicted that <3000 OARs will be performed in the USA in the year 2020, with the average

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vascular surgery fellowship trainee completing only 1–2 open repairs throughout their training.[9]

As their open surgical experience declines, young surgeons may be ill prepared to perform open AAA repair. In an effort to compensate for their own lack of experience, many surgeons may enlist the aid of an assistant surgeon during their high risk cases. However, it is unclear whether this strategy improves mortality outcomes for lower volume lead surgeons. Therefore, the association between use of an assistant surgeon and outcomes following open AAA repair was evaluated, and whether assistant surgeon volume is associated with peri-operative mortality determined, particularly in the case of low volume lead surgeons.

METHODS

Study population

Comprehensive data from the Medicare program were used to identify all cases of open AAA repair in patients aged 67 years and older that occurred between 2003 and 2008. As in prior studies of Medicare beneficiaries,[10,11] patients with a discharge diagnosis by International Classification of Diseases, Ninth Revision, Clinical Modifications (ICD-9-CM) of AAA without rupture (441.4) who also had a procedure code for open surgical repair, including 38.44 (resection of abdominal aorta with replacement) and 39.25 (aorto-iliac-femoral bypass) were determined. All those with diagnosis codes for aneurysm rupture (441.3), thoracic aneurysm (441.1, 441.2), thoraco-abdominal aortic aneurysm (441.6, 441.7), or aortic dissection (441.0), or those with procedure codes for repair of the thoracic (38.35, 38.45, 39.73) or visceral aorta (38.46, 39.24, 39.26) were excluded. Only those beneficiaries with both Part A (hospital insurance and inpatient care) and Part B (medical insurance, including doctors' services, preventative care, laboratory and radiographic tests) coverage were included. While only intact AAA repairs were included for the outcomes analysis, all open repairs of both intact and ruptured abdominal and thoraco-abdominal aneurysms were accounted for in volume counts.

Lead surgeon, assistant surgeon, and hospital volume

The analysis was limited to cases with no more than two surgeons (<1% had more). The performing physician was identified using the unique physician identification number or national provider identification number listed on each patient's Medicare claim. The Healthcare Common Procedure Coding System modifier code 80 or 82, which indicates full assistance by a board eligible surgeon to the primary surgeon, distinguished assistant surgeon from lead surgeon. Surgeon and hospital volume were assessed over the 2 year period preceding each operation. Hospital volume was obtained from the provider of service codes contained in the Medicare administrative database.

Lead surgeon volume was divided into quintiles using cut off points that most closely separated the patients into groups of equal size. The quintiles were set using average 2 year volume across all the years, which would allow for a shift in volume over time as fewer open repairs were performed. Frequency of lead (A) and assistant surgeons (B) for each 2 year volume are demonstrated in Fig. 1. For certain analyses, a high volume lead surgeon was defined as one in quintile 5 (≥13 cases/year), and a low volume lead surgeon as anyone with <13 cases/year (Table 1). Assistant volume was stratified into high volume (≥13 cases/year) and low volume (<13 cases/year), to correspond with the thresholds used for lead surgeon volume.

Outcomes assessment

The primary outcome was peri-operative mortality, defined as death within the index hospitalization, including contiguous transfers to other acute care facilities, or within 30 days of the date the procedure was performed. Mortality was assessed using the Medicare Beneficiary Summary File.

Statistical analysis

Surgeon and assistant surgeon volumes were examined for open AAA repair over the years 2003–08 and then the admission characteristics of those patients who had an assistant surgeon to those without an assistant surgeon compared using the chi-square test for categorical variables and the Student *t* test for continuous variables. Nested multivariate models were then constructed, adjusting for hospital, lead surgeon, and assistant surgeon volume. These models included baseline beneficiary demographic and clinical characteristics obtained from claims during the 1

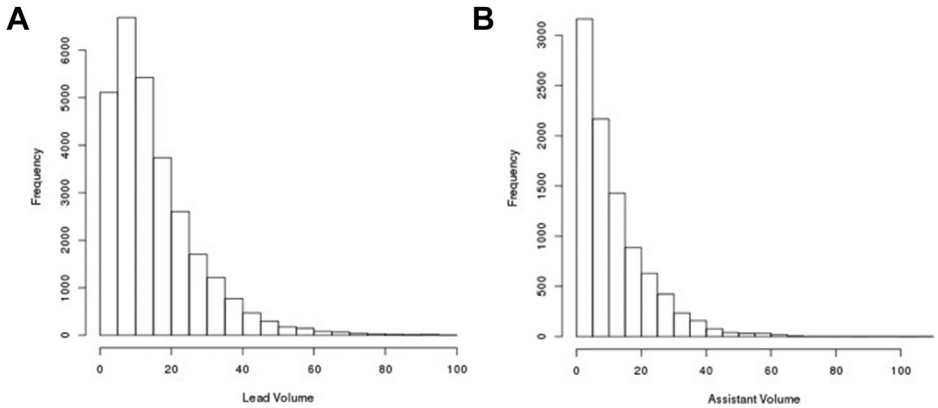

Figure 1. Number of (A) lead surgeons and (B) assistant surgeons with each 2-year volume count.

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