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Resident participation and postoperative outcomes in adrenal surgery

Raghunandan Venkat, MD, MPH,[a,*] *Patricio L. Valdivia, PhD,*[a] *and Marlon A. Guerrero, MD, FACS*[a,b]

[a] *Department of Surgery, University of Arizona, Tucson, Arizona*
[b] *Arizona Cancer Center, University of Arizona, Tucson, Arizona*

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ABSTRACT

Background: The changing paradigm of surgical residency training has raised concerns about the effects on the quality of training. The purpose of this study is to identify if resident participation in laparoscopic adrenalectomy (LA) and open adrenalectomy (OA) cases is associated with deleterious outcomes.

Materials and methods: This is a retrospective study using the American College of Surgeons National Surgical Quality Improvement Program database. Data from patients undergoing LA and OA from 2005 to 2010 were queried. Preoperative variables as well as intra- and postoperative outcomes for each procedure were evaluated. Multivariate logistic regression was used to analyze if resident participation was associated with significant differences in outcomes, compared with no resident participation. Subset analysis was done to determine possible differences in outcomes based on the level of resident participating, divided into junior (Post Graduate Year [PGY]1–3), senior (PGY4–5), or fellow (≥PGY6) levels.

Results: A total of 3219 adrenalectomies were performed. Of these, 735 (22.8%) were OAs and 2484 (77.2%) were LAs. Residents were involved in 2582 (80.2%) surgeries, which comprised 1985 (76.9%) LAs and 597 (23.1%) OAs. Senior residents or fellows performed majority of the cases (85.2%). Mean operative time was significantly higher with resident participation in LA ($P < 0.0001$) and OA group ($P < 0.0001$). On multivariate analysis, resident participation was not associated with significant differences in the operative outcomes of 30-d mortality or postoperative complications after laparoscopic or OA.

Conclusions: Although resident participation does increase operative time in LA and OA, this does not appear to be clinically significant and does not result in adverse patient outcomes.

1. Introduction

Surgical residents today face the challenge of learning complex skills in a limited time frame in a society that is increasingly conscious of the efficiency, quality, and financial viability of health care delivery. Concern regarding resident inexperience during surgery as a contributing factor to unfavorable patient outcomes has long been debated. At present, there is a paucity of reliable data in the literature to address this issue.

Surgical resident education is evolving. Resident duty hour limitations, changes in American Board of Surgery requirements, and data-driven public health initiatives have increased scrutiny of surgical training programs [1]. Metrics used to measure the quality of graduate surgical education

* *Corresponding author*. Department of Surgery, University of Arizona, Tucson, AZ 85724. Tel.: +1 520 626 7747; fax: +1 520 626 2247.
E-mail address: raghunandan86@gmail.com (R. Venkat).
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have included measures such as American Board of Surgery qualifying and certifying examination pass rates [2], American Board of Surgery in-service Training Examination scores [3], operative case logs [4,5], and more recently, the Fundamentals of Laparoscopic Surgery training examination pass rates [6]. The generation of an appropriate organizational framework for surgical education will require a clear understanding of the interactions that exist between resident participation in surgical procedures and outcomes such as morbidity and mortality.

Studies have previously addressed the interaction between resident participation and outcomes, with contrasting results [7–9]. Differences in results likely relate to differences in the research question, setting of the study, research strategy, and outcome measures. Furthermore, most of these studies addressed this issue indirectly and failed to correctly adjust for potential confounders. Using the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database from 2005 to 2010, we sought to examine the effects of resident involvement in laparoscopic adrenalectomy (LA) and open adrenalectomy (OA). We hypothesized that resident involvement does not affect patient outcomes.

2. Material and methods

The ACS NSQIP collects standardized data on 135 variables from participating institutions, including both academic and community centers. This includes preoperative demographics, preoperative risk factors, preoperative laboratory values, intraoperative variables, and postoperative 30-d morbidity and mortality outcomes. Surgical clinical reviewers specifically trained for this task collect the data. This data is compliant with the Health Insurance Portability and Accountability Act of 1996 and not identifiable to specific institution or surgeon.

According to the data use agreement of the ACS, the 2005–2010 NSQIP participant use files were queried. The American Medical Association current procedural terminology (CPT) codes for LA (CPT 60650) and OA (CPT 60540, 60545) were used to query the data only for initial operation. The need for conversion to open was not recorded.

The recorded discharge International Classification of Diseases codes were then mapped to the following categories, "benign nonfunctional," "functional," and "malignancy." International Classification of Diseases categories that were incomplete or that did not fit into one of these divisions were mapped to an "other benign" or "other malignant" category.

The preoperative characteristics studied included patient demographics (age, sex, and body mass index), medical comorbidities (American Society of Anesthesiologists [ASA] class, diabetes, hypertension, and cardiopulmonary disease), smoking history, and steroid use. Residents were subdivided into junior (R1–R3 y), senior (R4–R5), and fellow (≥R6) levels. Surgical times were defined as the time between incision for surgical procedure (surgery start time) and the time when all instrument and sponge counts were completed and verified, all dressings were secured, and the surgeon completed all procedure-related activities on the patient (surgery finish time).

Outcome measures included return to the operating room within 30 d, postoperative complications, serious morbidity, and overall morbidity. Postoperative complications were categorized in the following groups: (1) wound complications (dehiscence, organ space surgical site infection [SSI], superficial SSI, and deep incisional SSI), (2) cardiopulmonary complications (cardiac arrest requiring cardiopulmonary resuscitation, myocardial infarction, ventilator dependence longer than 48 h, pulmonary embolism, unplanned intubation, and cerebrovascular accident), (3) bleeding complication requiring transfusion, and (4) septic complications (septic shock, and sepsis). Serious morbidity was defined as per Ingraham *et al.* [10] as having documentation of at least one of the following ACS-NSQIP complications: organ space SSI, wound dehiscence, neurologic event (cerebrovascular accident or coma lasting >24 h), cardiac arrest, myocardial infarction, bleeding requiring transfusion of >4 U of packed red cells or whole blood, pulmonary embolism, ventilator dependence longer than 48 h, progressive or acute renal insufficiency, and sepsis or septic shock. Overall morbidity was defined as documentation of a serious morbidity or at least one of the following ACS-NSQIP complications: superficial SSI, deep SSI, pneumonia, unplanned intubation (without preoperative ventilator dependence), urinary tract infection, peripheral neurologic deficit, or deep vein thrombosis.

Descriptive statistics were computed and examined for all variables of interest. Categorical variables are reported as frequency and percentage, and continuous measures are reported as mean and standard deviation. Comparison of outcomes between cases with resident involvement and those without resident involvement were performed using *t*-test, analysis of variance or the Wilcoxon rank-sum test for continuous variables and the chi-squared or the Fisher exact test for categorical variables, as appropriate. Stepwise multivariate logistic regression analysis was performed with a probability of rejection $P = 0.25$ to be included in the final model. We controlled for preoperative factors of age, gender, body mass index, ASA class, diabetes, congestive heart failure, chronic obstructive pulmonary disease, history of myocardial infarction, and steroid use. A *P* value of 0.05 in the final model was considered statistically significant. We analyzed the outcomes of 30-d mortality, serious morbidity, overall morbidity, and complications to evaluate whether resident participation was an independent predictor of adverse outcomes. Statistical analysis was performed using Intercooled Stata, version 12.0 (StataCorp, College Station, TX).

3. Results

From 2005 to 2010, a total of 3219 adrenalectomies were performed. Of these, 735 (22.8%) were OAs and 2484 (77.2%) were LAs. Mean age was 52.8 ± 13.8 y for the LA group and 54.2 ± 15.0 y for the OA group. Majority of the patients were female (62% [$n = 1540$] for LA and 58.9% [$n = 433$] for OA). Mean body mass index was 30.7 ± 8.0 kg/m^2 for the LA group compared with 30.1 ± 8.9 kg/m^2 for the OA group. Majority of the patients were ASA class III (LA: 55.8%, $n = 1386$ *versus* OA