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Surgical resident involvement differentially affects patient outcomes in laparoscopic and open colectomy for malignancy

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Abstract

BACKGROUND: We evaluated effect of resident involvement on outcomes after laparoscopic and open colon resection for malignancy.

METHODS: Patients undergoing colectomy were queried using the American College of Surgeons' National Surgical Quality Improvement Program. "Attending alone" and "Resident" cohorts were compared with primary end point of overall morbidity.

RESULTS: Of 37,330 patients, residents were involved in 26,190 (70.2%) cases. Attending alone patients were older with higher vascular, cardiac, and pulmonary comorbidity. Univariate analysis demonstrated increased operative time (181.0 ± 98.4 vs 138.7 ± 77.0, $P < .001$), reoperation (5.7% vs 5.2%, $P = .041$), and readmission rates (11.9% vs 9.6%, $P = .037$) with resident involvement. Serious (16.0% vs 13.9%, $P < .001$), minor (17.5% vs 14.1%, $P < .001$), and overall morbidity (26.4% vs 22.5%, $P < .001$) were higher with resident participation. Mortality (2.0% vs 2.8%, $P < .001$) and failure to rescue (.8% vs 1.2%, $P < .029$) were lower with resident involvement. Resident involvement showed independent association with overall morbidity in both laparoscopic (odds ratio, 1.2; 95% confidence interval, 1.13 to 1.38, $P < .001$) and open cases (odds ratio 1.3, 95% confidence interval, 1.18 to 1.35, $P < .001$).

CONCLUSIONS: Resident participation in colectomy for malignancy is associated with lower mortality at the expense of higher overall morbidity.

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Since the imposition of resident duty hour restrictions by the Accreditation Council for Graduate Medical Education in 2003, surgeon educators and leaders have labored to develop a more robust and efficient training environment.[1–8] Simultaneously, governmental and societal pressures have championed a renewed focus on delivery of high-quality, cost-effective care using metrics, such as readmission, length of stay, and compliance, with Surgical Care Improvement Project benchmarks.[9,10] Given the pressures of decreasing physician reimbursement, reduced time for training and mentoring, and societal need for continued high-quality surgical care, it behooves surgeons to develop a robust training system addressing all areas. Unfortunately, the myriad roles played by surgeons greatly contribute to the complexity of training, especially when consideration is given to the broad range of training environments (ie, academic, community, rural).

To help address obstacles in creation of an efficient resident training system, we need to better understand the effect of residents on patient care. Although technological advances allow for simulation and competency-based assessment of skills without ill-patient effect, most are neither widely available nor practiced.[11–14] Additionally, evaluation of residents in the operative setting is nonstandardized, making it difficult to objectively assess competency.[15–19] As such, when a patient asks what effect a resident's presence has on his outcome, some blithely discard the question and answer that minimal effect exists.[20–26] However, recent data suggest that residents are responsible for worsened outcomes in certain populations after surgical procedures.[27–32] In patients with diagnosed malignancies, these worsened 30-day outcomes may produce dire long-term effects on receipt of subsequent treatment and overall survival.[33–37] Despite minimal literature addressing this subject, the question of resident involvement for particular patient populations and procedures is of paramount importance.

In our present study, we sought to elucidate what role surgical residents may play in postoperative outcomes. Specifically, we aimed to evaluate the effect of resident involvement on 30-day postoperative morbidity. We hypothesized that resident participation would be associated with worse outcomes.

Methods

The American College of Surgeons' National Surgical Quality Improvement Program (ACS-NSQIP) database participant use file was used as a data source for this study. This is a national database with data entered by trained clinical reviewers. It includes preoperative risk factors, laboratory values, intraoperative variables, and 30-day postoperative morbidity and mortality data.[38–40] The ACS-NSQIP administration periodically audits the data to ensure high reliability. Patients were included if postoperative diagnosis, using *International Classification of Diseases, Ninth Edition*, codes, indicated malignancy (Index 1). Current Procedural Terminology (CPT) codes were used to identify patients who underwent either laparoscopic or open colon (CPT 44140, 44141, 44143, 44144, 44145, 44146, 44147, 44150, 44151, 44160, 44320; CPT 44204, 44205, 44206, 44207, 44208, and 44210, respectively) procedures from 2005 to 2012. Patients were excluded if the procedure was performed emergently. Combined multivisceral operations (colectomy + hepatectomy) were excluded from analysis. ATTEND variable was used, defining "attending alone" as follows: "Attending alone: Staff practitioner performed the procedure; resident not present." Additionally, we cross-referenced ATTEND against the variable PGY, defined as "highest PGY of resident who scrubbed for the surgical procedure. Choose from 1 to 10. Enter "0" if no resident is scrubbed." This ensured attending alone cases were truly free of resident involvement. Importantly, the data set defines presence or absence of a resident for a given case but does not quantify or qualify resident involvement. Patients were excluded from analysis if either variable was missing.

Baseline demographics included age, body mass index, gender, calendar quarter of admission, and the presence of comorbid disease. Vascular comorbidities included history of hypertension, amputation or revascularization procedure, rest pain, and gangrene. Cardiac comorbidities were defined as congestive heart failure within 30 days, myocardial infarction within 6 months or history of angina within 1 month before the index procedure, and previous percutaneous coronary intervention or cardiac surgery. Pulmonary comorbidities included chronic obstructive pulmonary disease, current pneumonia, and preoperative ventilator dependence. Neurologic comorbidities included impaired sensorium, coma, transient ischemic attack, cerebral vascular accident, hemiplegia, paraplegia, quadriplegia, and tumor involving the central nervous system. Hepatic comorbidities included ascites and esophageal varices. Renal comorbidities included renal failure and the need for renal replacement therapy. In previous reports, Spaniolas et al[41,42] used similar groupings of comorbidities for analysis. Diabetes, history of active smoking, steroid use, and weight loss greater than 10% within 6 months were analyzed individually. American Society of Anesthesiology classification of patient's physical condition was also analyzed, comparing those with scores 1 and 2 vs 3 and 4.

The primary outcome assessed was 30-day overall morbidity. This included surgical site infection, organ space infection, sepsis, septic shock, wound disruption, pneumonia, deep venous thrombosis or thrombophlebitis, pulmonary embolism, unplanned reintubation, ventilator dependence greater than 48 hours after surgery, progressive renal insufficiency, acute renal failure, urinary tract infection, stroke, coma, peripheral nerve injury, cardiac arrest requiring cardiopulmonary resuscitation, myocardial infarction, blood transfusion for bleeding, and graft,

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