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Surgical resident involvement in foot and ankle surgery

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ABSTRACT

Background: Surgical resident participation in the operating room is necessary for education and progression toward safe and independent practice. However, the impact of resident involvement on patient outcomes in foot and ankle surgery is unknown.

Methods: The American College of Surgeons-National Surgical Quality Improvement Program (ACS-NSQIP) database (2005–2012) was used to identify common foot and ankle procedures (by Current Procedural Taxonomy (CPT) code) performed by orthopedic surgeons. Resident participation was determined using the NSQIP-collected variable 'pgy'; cases missing the pgy variable were excluded. Multivariate regression models were constructed to determine an association between resident involvement and 30-day morbidity (total, medical, and surgical complications) and 30-day mortality, when controlling for patient demographics, comorbidities, American Society for Anesthesiologist (ASA) status, body mass index (BMI), and smoking status.

Results: A total of 13,685 cases were analyzed for 24 common foot and ankle operations. Overall mortality rate was 3.60%. Overall complication rate was 16.9%; 10.9% had medical and 8.3% had surgical complications. Residents were involved in 55.6% of cases. In unadjusted analyses, resident cases were less likely to be emergent, but were performed on more complicated patients (i.e. higher comorbidity burden, higher ASA scores). Resident cases had increased total morbidity (18.8% vs. 14.6%, $p < 0.001$), medical complications (12.5% vs. 9.0%, $p < 0.001$), and surgical complications (8.7% vs. 7.7%, $p = 0.03$), but similar mortality frequency (3.8% vs. 3.3%, $p = 0.2$). In multivariable analyses, resident cases did not correlate with 30-day mortality, 30-day total morbidity, or 30-day surgical complications; resident cases were, however, associated with increased medical complications [Odds Ratio (OR) 1.18 (95% Confidence Interval (CI) 1.02–1.37, $p = 0.03$)] and longer length of stay [Coeff 2.38 (1.68–3.09), $p < 0.001$]. Subgroup analyses of orthopedic-only cases demonstrated no statistical association between resident involvement and mortality, total morbidity, or medical complications; a decrease in surgical complications was observed for open reduction internal fixation cases [OR 0.23 (0.06–0.82), $p = 0.02$].

Conclusions: Resident involvement in foot and ankle surgery is not associated with changes in 30-day mortality, 30-day total morbidity, or 30-day surgical complication rates. Residents operate on more medically complex patients who experience higher medical complication rates and longer postoperative length of stay; however, the cause and directionality of this relationship remains to be determined. Efforts to improve the quality of foot and ankle surgery with resident involvement should target reductions in post-operative medical complications.

Level of evidence: Prognostic study, Level II.

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1. Introduction

The current environment of medical education requires a delicate balance between surgical education and patient care. In the operative theater, the goal of the surgeon educator is to impart knowledge and experience to trainees in a supervised environment

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while mitigating the risk of patient harm to due trainees' inexperience [1]. Residency education succeeds when trainee education is optimized while the duty to care for patients is upheld.

Orthopedic training is designed to provide graduated responsibility to the trainee throughout residency in all facets of patient care, whether in the operating room, inpatient ward, or outpatient setting. Importantly, trainees must progress toward proficiency in the operating room in order to ensure a safe and independent practice following training. In the current healthcare environment that increasingly scrutinizes the social and economic costs of surgical and medical complications and readmission rates [2], resident involvement in surgery has entered the spotlight with respect to quality improvement measures [3]. Literature analyzing resident involvement in orthopedic surgery [4,5] has failed to document increases in mortality, but reports mixed outcomes for morbidity. Investigations in spine [6,7], total joint arthroplasty [8–10], and shoulder surgery [11] demonstrated that resident participation was not associated with overall post-operative complications. However, no studies have specifically investigated the effect of resident involvement in foot and ankle surgery.

We therefore aimed to study the association between resident involvement and 30-day mortality and 30-day morbidity following foot and ankle surgery, using the American College of Surgeons-National Surgical Quality Improvement Program (ACS-NSQIP) database (Table 1) We hypothesized that resident involvement would not be associated with increases in post-operative morbidity or mortality in foot and ankle surgery.

2. Methods

2.1. Overview

The 2005–2012 national ACS-NSQIP databases were combined and queried for patients undergoing one of twenty-four common foot and ankle procedures performed by orthopedic surgeons. Procedures were flagged in the ACS-NSQIP database by their CPT code. Table 1 summarizes the procedures included in the analysis. Procedures were identified by Current Procedural Terminology

(CPT) codes. Cases were divided into two groups: “Resident” and “No Resident”, depending on whether a resident of any post-graduate year (PGY) level was scrubbed in the case. “Resident” was defined as a training surgeon, regardless of specialty. Patients who did not undergo one of these procedures, or who did not belong to one of the two study groups, were excluded from analysis.

2.2. ACS-NSQIP

The ACS-NSQIP methodology of data abstraction was previously described and repeatedly validated [12,13]. In brief, operative data from participating hospitals were collected on a wide range of pre-specified preoperative, intraoperative, and postoperative variables. The data collection process was standardized, and performed systematically and prospectively by a trained and dedicated nurse.

2.3. Study groups: “Resident” vs. “No Resident”

The study population was further stratified into two groups. The “Resident” group included all cases in which a trainee of any level participated. The “No Resident” group included all cases in which no trainee participated. To determine resident participation, cases were screened for the ACS-NSQIP variable “pgy” (post graduate year), which indicates the PGY level of a trainee involved in an operative procedure. The “pgy” variable ranges from 0 to 11 in the database, where “pgy = 0” means no resident was present (i.e. attending only), whereas “pgy = 1,2,3, . . . , 11” represents the actual PGY level of the resident involved in the case. Cases with “pgy = 1,2,3, . . . , 11”, inclusive, were therefore assigned to the “Resident” group, whereas cases with “pgy = 0” were assigned to the “No Resident” group. Cases in which the “pgy” variable was missing (i.e. –99 or Null) were excluded from analysis.

2.4. Outcomes

Primary outcomes were 30-day mortality, 30-day total morbidity, 30-day surgical complications, and 30-day medical complications. The “30-day” window was counted from the date of surgery. Total morbidity was defined as any post-operative

Table 1
Foot and ankle procedural codes.

CPT code	Procedure name	Total cases	Cases by orthopedic surgeon	Cases by non-orthopedic surgeon
27620	Ankle arthrotomy, +/- removal of loose body	29	28	1
27650	Achilles tendon repair	463	462	1
27654	Achilles reconstruction/reattachment	86	85	1
27658	Peroneal tendon repair (primary)	35	35	0
27659	Peroneal tendon repair (secondary)	12	12	0
27680	Achilles debridement	32	31	1
27698	Brostrom lateral ligament reconstruction	151	149	2
27702	Total ankle arthroplasty	119	119	0
27703	Revision total ankle arthroplasty	25	25	0
27766	ORIF medial malleolus fracture	217	216	1
27769	ORIF posterior malleolus fracture	16	16	0
27792	ORIF lateral malleolus fracture	861	856	5
27814	ORIF bimalleolar fracture	953	952	1
27822	ORIF trimalleolar fracture without posterior lip fracture	547	544	3
27823	ORIF trimalleolar fracture with posterior lip fracture	154	154	0
27880	Below the knee amputation	6903	319	6584
27886	Revision below the knee amputation	693	38	655
28805	Transmetatarsal amputation	2084	75	2009
29891	Ankle arthroscopy with microfracture of osteochondral lesion	83	83	0
29892	Ankle arthroscopy with osteochondral defect repair	16	16	0
29894	Ankle arthroscopy with loose body removal	17	17	0
29895	Ankle arthroscopy with partial synovectomy	41	41	0
29898	Ankle arthroscopy with extensive debridement	125	125	0
29899	Arthroscopic ankle arthrodesis	23	23	0
	Totals	13,685	4421	9264

ORIF: open reduction internal fixation; CPT: current procedural terminology.

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