

Resident & Fellow Involvement in Orthopedic Oncology Procedures

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Introduction

- The complexity of the operative procedures performed by orthopedic oncologists often serves as justification for the presence of surgical assistants of higher levels of training, whether they be senior residents, fellows, or additional attendings
- The association between the level of training of assistants and the rate of complications has been studied in other surgical subspecialties¹⁻² but no such published studies exist in the field of orthopedic oncology

Methods

- The Accreditation Council for Graduate Medical Education (ACGME)'s Case Log Guidelines were used to identify the Current Procedural Terminology (CPT) codes comprising the list of "case log minimums" for Musculoskeletal Oncology fellowships
- The list of CPTs was narrowed to exclude those capturing primarily non-oncologic procedures (e.g. codes for fracture treatment, arthroplasty, etc.)
- The American College of Surgeons' National Surgical Quality Improvement Program (ACS NSQIP) database was used to find procedures with these CPTs, for which data was also available on assistant level of training
- Data was collected on comorbidities, minor and major complications within 30 days, total operative time in minutes, and work relative value units (wRVUs) assigned to the procedure
- Student's t tests, Fisher's exact tests, and ANOVAs were used as appropriate for univariate analysis, and multiple logistic regressions were used for multivariate analysis.

	No resident (n=24)	PGY 1-3 (n=42)	PGY 4-5 (n=51)	PGY 6+ (n=42)	p
Any complication (%)	4 (16.7)	10 (23.8)	22 (43.1)	22 (52.4)	0.006*
Medical complication (%)	4 (16.7)	7 (16.7)	20 (39.2)	22 (52.4)	0.001*
Pneumonia (%)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.4)	0.679
Pulmonary embolism (%)	0 (0.0)	0 (0.0)	2 (3.9)	2 (4.8)	0.584
Ventilator for >= 48 hrs. (%)	0 (0.0)	1 (2.4)	0 (0.0)	2 (4.8)	0.346
Urinary tract infection (%)	0 (0.0)	1 (2.4)	0 (0.0)	0 (0.0)	0.679
Peripheral nerve injury (%)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.4)	0.679
Blood transfusion (%)	2 (8.3)	6 (14.3)	18 (35.3)	19 (45.2)	0.001*
DVT (%)	0 (0.0)	0 (0.0)	0 (0.0)	3 (7.1)	0.038*
Sepsis (%)	2 (8.3)	1 (2.4)	2 (3.9)	0 (0.0)	0.331
Surgical complication (%)	2 (8.3)	3 (7.1)	4 (7.8)	2 (4.8)	0.946
Superficial SSI (%)	0 (0.0)	1 (2.4)	0 (0.0)	0 (0.0)	0.679
Deep SSI (%)	2 (8.3)	1 (2.4)	2 (3.9)	0 (0.0)	0.331
Organ/space SSI (%)	0 (0.0)	1 (2.4)	1 (2.0)	0 (0.0)	1.000
Wound dehiscence (%)	0 (0.0)	0 (0.0)	1 (2.0)	2 (4.8)	0.544
Readmission (%)	0 (0.0)	2 (4.8)	3 (5.9)	4 (9.5)	0.520
Reoperation (%)	0 (0.0)	0 (0.0)	3 (5.9)	4 (9.5)	0.127
Death (%)	0 (0.0)	1 (2.4)	1 (2.0)	0 (0.0)	1.000
Operative time in minutes (mean (SD))	170.62 (146.60)	209.48 (155.59)	248.80 (182.36)	346.12 (222.61)	0.001*
Total wRVU (mean (SD))	36.29 (27.15)	38.27 (18.85)	50.24 (30.15)	59.94 (31.96)	0.001*

Univariate outcomes for resident involvement by group (junior (PGY 1-3), senior (PGY 4-5), and fellow and higher (PGY 6+). Outcomes in BLUE represent "major complications" per prior NSQIP studies. Fisher's exact test used for all categorical variables and Student's t-test used for all continuous variables. Bolded and starred values are significant at p < 0.05. SSI = surgical site infection.

Results

- A total of 159 cases performed 2006-2012 met inclusion criteria
- Baseline medical characteristics were similar amongst the groups: age, race, cancer dissemination, and pre-existing comorbidities
- There was a significant **increase in complications with increasing assistant training level (p=0.006)**, and this finding was **driven primarily by minor complications** such as transfusion rate (p=0.001)
- There was no difference in rates of death, deep infections, sepsis, readmission, or reoperation associated with assistant training level
- Total operative time increased with assistant level of training, from 171 minutes with no resident to 346 with a PGY6+ (p=0.001), as did total wRVU (36.29 to 59.94, p=0.001)
- Multivariate analysis revealed the rate of total complications was independently predicted by treatment comorbidity [OR 3.582, 95% CI 1.311-9.783], lower extremity tumor [OR 4.221 (1.218-14.625)], and operative time in minutes [1.004 per minute (1.001 - 1.007)]
- Neither the presence of residents/fellows, nor the level of training of assistants, persisted as independent predictors of total complications on multivariate analysis

Conclusions

- At first glance, **higher levels of surgical assistant training appears to be correlated with more 30-day complications** in procedures primarily performed by orthopedic oncologists
- However, multivariate analysis suggests that it is the **increased use of higher-level assistants in higher-complexity cases** that is primarily driving this phenomenon
- Overall, the presence of residents and fellows in oncology cases was associated with an **increased rate of minor complications, but no difference in rates of major complications**

References

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