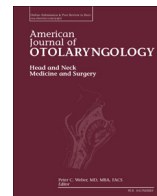




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## The effect of training level on complications after free flap surgery of the head and neck

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### ABSTRACT

**Objectives:** Analyze postoperative complications after free flap surgery based on PGY training level.

**Methods:** Data on free flap surgeries of the head and neck performed from 2005 to 2013 was collected from the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database. Cases identifying the status of resident participation in the surgery and the PGY level were included.

**Results:** There were 582 cases with primary surgeon data available. 63 cases were performed with a junior resident, 211 were performed with the assistance of a senior resident, 279 cases were performed with a fellow, and 29 cases were performed by an attending alone without resident involvement. The overall complication rate was 55.2%. There was no statistically significant difference in the rate of complications between groups (47.6%, 59.7%, 53.0%, 58.6%,  $p = 0.277$ ). After controlling for all confounding variables using multivariate analysis there was no significant difference in morbidity, mortality, readmissions, and reoperation amongst the groups. Furthermore, when comparing resident versus fellow involvement using multivariate analysis there were no significant differences in morbidity (OR = 0.768[0.522–1.129]), mortality (OR = 1.489[0.341–6.499]), readmissions (OR = 1.018[0.458–2.262]), and reoperation (OR = 0.863[0.446–1.670]).

**Conclusion:** Resident and fellow participation in microvascular reconstructive cases does not appear to increase 30-day rates of medical, surgical, or overall complications.

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### 1. Introduction

The training of surgical residents is a complex exercise in optimizing education without compromising the quality of surgical care. This process relies on attending physicians of academic institutions, who must make decisions regarding the appropriate degree of autonomy to grant residents in the OR. The subjective nature of this training in an evolving healthcare system necessitates continual investigation and discussion of resident impact on patient outcomes. The need for analysis has been magnified since the implementation of additional duty hour limitations in 2011 [1]. This effort by the Accreditation Council for Graduate Medical Education (ACGME) to mitigate resident fatigue and burnout has come with the obvious tradeoff of decreased training time, which is of particular concern in surgical disciplines [2]. It has been suggested that the lack of improvement in patient outcomes following the duty hour restrictions may be related to residents logging fewer hours in the operating room [3]. The possibility that these

restrictions of work hours may be of greater consequence for surgical subspecialties must be considered.

Recent studies examining the effect of resident participation on surgical outcomes in a variety of surgical specialties have produced mixed results, some finding that resident participation negatively impacts outcomes [4–10], and others concluding that resident participation has no significant effect [11–17]. In light of this lack of generalizable conclusion, differences in outcomes may be best assessed on a procedure-specific basis to ensure patient safety. This is especially necessary for technically difficult procedures that are performed with less frequency, such as microvascular free flap tissue transfers. These surgeries are complex, technically difficult procedures with long operative times. Rates of postoperative complications are high at 30–40% [18], with the rate of flap failure reported to be almost 10% [19]. Analysis of this procedure specifically is important as it has been previously established that resident participation causes longer operative time [20], and prolonged operative time has been associated with flap failure [21]. The impact of otolaryngology resident and fellow participation on outcomes in free flap surgery has never been analyzed.

The National Surgical Quality Improvement Program (NSQIP) is a prospective database developed by the American College of Surgeons

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(ACS) that tracks surgical outcomes in order to improve surgical quality. The database is ideal for our study because it uniquely records data on resident involvement and their post-graduate year (PGY) in addition to an array of preoperative and postoperative variables. The purpose of our study is to utilize the ACS-NSQIP to analyze the impact of resident and fellow involvement by PGY status on postoperative outcomes in free flap procedures.

**2. Materials and methods**

A retrospective analysis was performed on the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) patient data from 2005 to 2013. Current Procedural Terminology (CPT) codes (Table 1) were used to query the NSQIP database in December 2015 and select patients who had undergone free flap surgery of the head and neck. Only patients whose surgery was performed by an otolaryngologist or plastic surgeon were included in the study. Patients without a specific note of resident involvement in the surgery (Attending only vs. Attending and Resident) and post-graduate year (PGY) were excluded. Fellows (PGY > 5) were included in this study due to the fundamental nature of free flap reconstruction – these are complex cases, requiring an advanced level of skill for which training extends past primary otolaryngology residency. The remaining cases were stratified into four groups: junior residents (PGY 1–3), senior residents (PGY 4–5), fellows (PGY 6+), and attending only. The four groups were analyzed for demographics, preoperative characteristics, and postoperative outcomes. Multivariate analysis was used to account for demographics and significant comorbidities in order to identify the importance of training level as an independent risk factor associated with complications following free flap reconstruction of the head and neck.

Preoperative characteristics include diabetes mellitus, current smoker, dyspnea, current alcohol use, pneumonia, ventilator use (<48 h prior to surgery), weight loss (> 10% in the 6 months prior to surgery), chronic obstructive pulmonary disease (COPD), congestive heart failure (CHF), previous myocardial infarction, previous percutaneous coronary intervention (PCI), previous cardiac surgery, angina, history of treatment for peripheral vascular disease (PVD), hypertension (requiring medication), acute renal failure, hemiplegia, transient ischemic attack, cerebrovascular accident (CVA) with or without neurological deficit, central nervous system (CNS) tumor, disseminated cancer, steroid use (<30 days prior to surgery), bleeding disorders, dialysis (<2 weeks prior to surgery), chemotherapy (<30 days prior to surgery), radiotherapy (<90 days prior to surgery), systemic sepsis, previous operations, emergency operation, wound infection, open wound, functional status (independent/dependent), ASA (American Society of Anesthesiologists) class, and work relative value units (RVU) (Table 2).

**Table 1**  
Current procedural terminology code.

Free flap reconstruction	CPT code
Free muscle or myocutaneous flap with microvascular anastomosis	15756
Free skin flap with microvascular anastomosis	15757
Free fascial flap with microvascular anastomosis	15758
Free jejunum transfer with microvascular anastomosis	43496
Free omental flap with microvascular anastomosis	49006
Free omental flap with microvascular anastomosis	49906
Free osteocutaneous flap with microvascular anastomosis; other than iliac crest, metatarsal, or great toe	20969
Bone graft with microvascular anastomosis; fibula	20955
Bone graft with microvascular anastomosis; iliac crest	20956
Bone graft with microvascular anastomosis; metatarsal	20957
Bone graft other than fibula, iliac crest, or metatarsal	20962
Free osteocutaneous flap with microvascular (iliac crest)	20970
Free osteocutaneous flap with microvascular (metatarsal)	20972
Free osteocutaneous flap with microvascular (great toe)	20973
Partial esophagectomy, cervical, with free intestinal graft	43116
Graft for facial nerve paralysis; free muscle graft by microvascular anastomosis	15842

**Table 2**  
Patient demographics and characteristics in free flap surgery patients by PGY level.

	PGY 1–3 (Junior) N = 63	PGY 4–5 (Senior) N = 211	PGY 6+ (Fellow) N = 279	Attending only N = 29	p
Age cohorts (%)					
≤ 40 years	3.2	8.5	7.5	10.3	0.505
41–60 years	36.5	37.4	39.1	34.5	0.945
61–80 years	57.1	48.8	41.6	55.2	0.075
> 80 years	3.2	5.2	11.8	0.0	<b>0.006</b>
Sex (%)					
Male	81.0	69.5	65.6	82.8	<b>0.040</b>
Female	19.0	30.5	34.4	17.2	
Race (%)					
White	82.4	87.8	84.4	82.1	0.661
Black	11.8	4.4	8.4	17.9	<b>0.047</b>
Other	5.9	7.8	7.1	0.0	0.492
Unknown	19.0	14.7	19.4	3.4	0.117
Admission status					
Inpatient	88.9	97.6	98.6	96.6	<b>0.001</b>
Outpatient	11.1	2.4	1.4	3.4	
Obese (BMI > 30, %)	28.6	19.0	21.9	13.8	0.300
Comorbidities (%)					
Diabetes	9.5	10.4	11.5	3.4	0.597
Current smoker	25.4	23.2	25.4	34.5	0.620
Dyspnea	9.5	7.1	8.6	20.7	0.115
Alcohol	9.5	10.4	11.5	6.9	0.868
Pneumonia	0	0.5	0	0	0.623
Weight loss	11.1	13.3	12.2	3.4	0.497
COPD	7.9	7.1	6.8	10.3	0.909
CHF	0	0.5	0.7	0.0	0.872
MI	0	0.5	0.7	0.0	0.872
Previous PCI	3.2	10.0	5.4	0.0	0.049
Previous cardiac surgery	4.8	6.6	4.7	3.4	0.752
PVD	0.0	0.9	1.1	3.4	0.506
Hypertension	47.6	46.4	46.6	34.5	0.643
Hemiplegia	0	0.5	1.1	0.0	0.707
TIA	4.8	3.8	2.2	3.4	0.622
CVA	1.6	1.4	1.4	3.4	0.865
CVA w/no deficit	1.6	1.4	1.4	6.9	0.183
CNS tumor	0.0	0.5	1.4	0.0	0.523
Disseminated cancer	3.2	9.5	7.9	10.3	0.421
Wound infection	9.5	6.6	10.8	3.4	0.302
Steroid use	4.8	2.4	5.7	3.4	0.335
Bleeding disorders	6.3	2.4	3.6	0.0	0.320
Dialysis	0	0	0.7	0	0.536
Chemotherapy	3.2	4.3	8.6	0.0	0.066
Radiotherapy	1.6	1.9	1.4	6.9	0.234
Previous operations	3.2	6.2	5.0	10.3	0.519
Emergency operation	0.0	0.0	0.7	0.0	0.536
Open wound	33.3	20.0	18.7	16.1	0.697
Recent Transfusion	0.0	0.9	1.1	0.0	0.809
Functional status					
Independent	96.8	99.1	96.8	100	0.287
Totally or partially dependent	3.2	0.9	3.2	0.0	
ASA class (%)					
1 and 2	28.6	23.7	15.5	20.7	<b>0.042</b>
3 and 4	71.4	76.3	84.5	79.3	
Work relative value units	29.72 ± 11.84	30.51 ± 11.2	26.80 ± 10.46	26.03 ± 13.53	<b>0.001</b>

Bold Text = Statistically Significant.

Postoperative variables included surgical complications, medical complications, overall complications, overall mortality, reoperation rates, readmission rates, unplanned readmission rates, total operating time, and length of stay (Table 3). Surgical complications consisted of superficial, deep, and organ/space surgical site infections (SSI), wound disruption, and bleeding requiring blood transfusion within 72 h of the postsurgical period. Medical complications included pneumonia, pulmonary embolism (PE), ventilator use for >48 h, unplanned reintubation, urinary tract infection (UTI), deep vein thrombosis (DVT), renal insufficiency (increase in creatinine >2 mg/dL above preoperative value), acute renal failure, CVA with neurological deficit,

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