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Complications and Readmissions Associated with First Assistant Training Level Following Elective Bariatric Surgery

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Abstract

Background: Little is known regarding the variation in training level and potential clinical impact of the first assistant in bariatric surgery. We describe the postoperative 30-day complications and readmissions following elective bariatric procedures by training level of the first assistant.

Methods: The ACS-MBSAQIP database was queried to identify patients who underwent elective sleeve gastrectomy, Roux-En-Y gastric bypass, duodenal switch, band placement, and revision from 2015 to 2016. Patients were divided into cohorts based on training level of the first assistant (attending, fellow, resident, physician assistant/nurse practitioner, none). Outcomes included 30-day death or serious morbidity (DSM) and readmission. Multivariable logistic-regression models, adjusting for patient and procedure characteristics, were estimated to examine differences in outcomes by first assistant training level.

Results: Of 410,535 procedures performed between 2015 and 2016, the training level of the first assistant included 21.3% attending, 8.7% fellow, 16.5% resident, 37.6% PA/NP, and 15.9% none. Operative time was significantly longer in the fellow and resident first assistant cohorts when compared to all other cohorts. Overall rates of 30-day DSM were low, ranging from 3.2-3.8%, while 30-day readmission rates ranged from 5.1-5.9%. Following adjustment for patient characteristics and type of procedure, first assistant training level had no significant impact on DSM or readmission.

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Conclusions: Variation in training level of the first assist during bariatric surgery had no influence on DSM or readmissions. This provides reassurance that the inclusion of a wide range of first assistants in bariatric procedures does not negatively impact patient outcomes.

Keywords

Bariatric Surgery; Outcomes; First Assistant

Introduction

Bariatric operations are the most effective and durable treatment for obesity and associated comorbidities, including diabetes, hypertension, and sleep apnea.[1,2] The number of bariatric procedures performed annual within the United States continues to increase.[3] While these procedures have been shown to have low rates of mortality and complications, there is inherent risk associated with operating on morbidly obese patients with multiple comorbidities.[4,5] As a result, the evaluation of potentially modifiable factors associated with poor outcomes following bariatric surgery is critical. One key factor that may impact outcomes is the training level of the first assistant. Depending on the setting (e.g. academic, community, outpatient surgery center), the assistant may be another attending surgeon, a resident, a fellow, a nurse practitioner (NP), a physician's assistant (PA), or there may be no assistant.

Several studies have evaluated the association between the presence of surgical trainees (e.g. residents, fellows) and postoperative outcomes. However, many of these studies evaluated a broad mix of procedures as a single cohort or were performed using data from a single institution.[3-12] Of the national studies, many have focused on only sleeve gastrectomy and Roux-en-Y gastric bypass.[13] Few have evaluated the impact of first assistants on technically complex procedures such as duodenal switch or re-operative bariatric cases. Furthermore, of the national studies evaluating trainee impact on postoperative outcomes following bariatric procedures, the majority use data from before 2012.[14-19] As a result, the current impact of surgical trainees on a broad range of bariatric procedures remains unclear. In addition, there is little evidence regarding the non-trainee first assists (e.g. attending, NP, PA) and postoperative outcomes in these procedures.

Given the importance of bariatric surgery in the management of morbid obesity, the evaluation of the impact of first assistant training level on postoperative outcomes remains essential. In this retrospective observational cohort study, we use data from the American College of Surgeons Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (ACS MBSAQIP) to (1) describe the current use of first assistants across a wide range of elective bariatric procedures, and (2) evaluate postoperative 30-day complications and readmissions by training level of the first assistant.

Materials and Methods

Data Source

Data from the 2015 to 2016 ACS MBSAQIP database were used to identify patients who underwent laparoscopic sleeve gastrectomy (SG), Roux-en Y gastric bypass (RYGB), duodenal switch (DS), band placement, and bariatric revision procedures. MBSAQIP sampling strategy, data abstraction, variable collection, and outcomes are detailed elsewhere.[13] Briefly, the MBSAQIP database maintains prospectively collected data with 100% abstraction from all accredited bariatric surgical centers on a host of clinical characteristics. These characteristics include patient demographics, comorbidities, operative details, and 30-day outcomes. The data are collected by trained surgical clinical reviewers in an established fashion. This study was deemed exempt by the Institutional Review office of Northwestern University.

Study Population

Current Procedural Terminology (CPT) codes were used to identify patients within the MBSAQIP database who underwent laparoscopic SG, RYGB, DS, band placement, and revision procedures (CPT codes 43644, 43775, 43845, 43770, 43659, or 43999). As a result, open cases were not included in the analysis. Patients were excluded if the operation was not elective (n=7,321), or the patient had an American Society of Anesthesiologist (ASA) class of V or missing (n=56). Patients were divided into cohorts based on the training level of the first assistant in the operation. The training level of the first assists included attending, fellow, resident (post graduate year 1-5), physician assistant (PA) or nurse practitioner (NP), and none. First assistant was defined as a medical professional that was scrubbed into the bariatric procedure to assistant the primary surgeon. If there were no first assistants noted, then the procedure was described as having “none.”

Outcomes

Outcomes of interest included operative time, 30-day death or serious morbidity (DSM), as well as 30-day readmission. DSM is a composite outcome including death, deep surgical site infection, organ space surgical site infection, wound dehiscence, pneumonia, reintubation, pulmonary embolism, acute kidney injury, myocardial infarct, cardiac arrest, sepsis, septic shock, return to OR, deep venous thrombosis, requiring ventilator support for 48 hours, or bleeding requiring transfusion. Previous studies have used composite scores, such as DSM, to evaluate post-operative outcomes in this and similar patient populations.[20-22]

Covariates

Patient-specific covariates were available within the dataset. These included demographic information (age, sex, race/ethnicity, BMI), comorbidities (diabetes, hypertension, hyperlipidemia, smoking status, chronic obstructive pulmonary disease [COPD], sleep apnea, and chronic steroid use), and operative characteristics (ASA, procedure type).

Statistical Analysis

Bivariate associations between patient demographics and first assistant training level were evaluated using descriptive statistics. Chi-squared tests were used to evaluate differences in categorical variables, while continuous variables were evaluated using Kruskal Wallis tests. Multivariable logistic regression models with robust standard errors were estimated to evaluate the adjusted associations between the outcomes of interest and training level of the first assistant. The multivariable models adjusted for age, sex, race (Non-Hispanic White, Non-Hispanic Black, Hispanic, Other/Unknown), BMI, pre-existing comorbidities (diabetes, hypertension, COPD, sleep apnea, and chronic steroid use), ASA, year, and procedure type. Analyses were repeated evaluating two of the most common procedures (SG and RYGB) as well as revisional procedures, independently in order to examine for potential differential associations based on type of surgery. All tests were two sided and the level of significance was set at 0.05. All analyses were performed using STATA v15.1 (College Station, TX).

Results

Of the 410,535 elective bariatric procedures performed between 2015 and 2016, the first assistant training level included 21.3% attendings, 8.7% fellows, 16.5% residents, 37.6% PA/NP, and 15.9% with no first assistant (Table 1). Patients with fellows as the first assistant more frequently had comorbidities such as diabetes (attending 24.7%, fellow 27.2%, resident 24.9%, PA/NP 24.9%, none 24.6%, $p<0.001$), hyperlipidemia requiring medication (attending 23.5%, fellow 25.4%, resident 23.5%, PA/NP 24.2%, none 23.4%, $p<0.001$), and sleep apnea (attending 34.3%, fellow 39.1%, resident 37.3%, PA/NP 35.7%, none 32.1%, $p<0.001$). Patients with a history of previous foregut or bariatric procedures more frequently had no first assistant (attending 14.9%, fellow 15.9%, resident 14.4%, PA/NP 14.2%, none 17.2%, $p<0.001$). Evaluation of patient comorbidities by case revealed that those undergoing RYGB had increased rates of diabetes, hypertension requiring medication, hyperlipidemia, and sleep apnea (Table 2).

Operative time was significantly longer in the fellow and resident first assistant cohorts when compared to all other first assistant cohorts (Table 3). When comparing operative time between cases, times were longest for RYGB, DS, and revisional procedures. Unadjusted rates of DSM were low across cohorts, ranging from 3.2-3.8%, and were significantly higher in the fellow and resident cohorts (Table 4). Rates of readmission were slightly higher than those of DSM, ranging from 5.1-5.9%. As with DSM, rates of readmission were significantly higher in the fellow and resident cohorts. Rates of death were low and did not significantly differ between first assistant training levels.

Following adjustment for patient and procedure characteristics, first assistant training level had no significant impact on DSM (fellow OR 0.95, 95% CI 0.88-1.03, p=0.179; resident OR 1.03, 95% CI 0.96-1.10, p=0.436; PA/NP OR 0.97, 95% CI 0.92-1.03 p=0.305, none OR 0.94, 95% CI 0.95-1.02, p=0.106; Table 5) or readmission (fellow OR 1.01, 95% CI 0.95-1.07, p=0.842; resident OR 1.04, 95% CI 0.97-1.10, p=0.154, PA/NP OR 0.96, 95% CI 0.92-1.01 p=0.102, none OR 0.95, 95% CI 0.91-1.02, p=0.106). Evaluation of LSG, RYGB, and revisional procedures alone yielded similar results, with no significant differences in

postoperative DSM or readmission following adjustment for patient and procedure characteristics.

Discussion

In this study, a national cohort of patients undergoing elective bariatric surgery was evaluated to compare postoperative outcomes by training level of the first assistant. Procedures were most commonly staffed with a PA/NP as the first assistant. Those patients with fellows as the first assistant had more comorbidities when compared to all other first assistant cohorts. Following adjustment for key patient and procedural characteristics, there were no significant differences in 30-day postoperative DSM or readmission by training level of the first assistant.

This study provides an (1) evaluation of the current use of first assistants across a broad range of elective bariatric procedures, and (2) assessment of clinical outcomes by training level of the first assistant in these cases. Our results indicate that PA/NPs are the most common first assistants across a broad set of elective bariatric procedures. This may reflect the volume of procedures performed at non-academic centers, where residents and fellows would otherwise be covering as the first assistant. Conversely, the proportion of PA/NP first assists may be indicative of the large volume of cases being performed annually, for which inadequate fellow or resident coverage may be available. This finding is relevant as the current literature has focused on the clinical impact of surgical trainee (i.e., residents and fellows) participation within bariatric procedures.[14,16,17] Given the large proportion of cases covered by a PA/NP as the first assist, describing the clinical implications of PA/NP participation within a case remains a crucial goal. Our results indicate that PA/NP participation does not negatively impact clinical outcomes; however, this is likely a heterogenous group with variable levels of surgical training and experience. Further work is needed to examine the impact of PA/NP assistant skill on surgical outcomes.

While unadjusted rates of DSM and readmission were higher in the fellow and resident cohorts, these differences were eliminated after adjusting for patient and operative characteristics. Our unadjusted results mirror previously reported elevated rates of 30-day morbidity associated with fellow or resident participation within general surgery and bariatric procedures.[16,17] Additionally, we found that cases with residents and fellows as the first assistant had significantly longer operative times. The lack of differences following adjustment for patient and operative characteristics, along with the increased operative time, remained consistent across each bariatric procedure evaluated in this study. Taken together, this may indicate that fellows and residents have a more active role as first assistants in cases, participate in more difficult cases, or operate on a more co-morbid patient population. As a result, adjustment for these key factors nullifies the previously significant differences in DSM and readmission. These results provide reassurance that the education of fellows and residents, through inclusion in common or complex bariatric procedures, does not have a negative influence on postoperative patient outcomes.

These findings should be interpreted in light of the following limitations. First, the retrospective nature of this study allows for the evaluation of the association between first

assistant training level and clinical outcomes rather than any causal relationships. Second, ACS MBSAQIP reports 30-day postoperative outcomes, limiting our ability to describe any potential long-term outcomes, such as weight loss or resolution of comorbidities, associated with first assistant training level. Third, bariatric procedures have low rates of postoperative complications and are considered relatively safe. Therefore, it may be difficult to detect significant differences between cohorts. Fourth, the role of the first assistant within each case may vary considerably. As a result, our models may be unable to account for variation in the clinical impact associated with first assistant training level.

The results of this study highlight several important points regarding the staffing of first assistants in a broad range of elective bariatric procedures. First, clinical support staff such as PAs and NPs serve an integral part in the surgical care of bariatric patients. It is likely that the number of PAs and NPs assisting in bariatric procedures will continue to grow as the field expands. Second, fellow and resident participation in these procedures leads to increases in operative length without significant increases in morbidity or mortality. This finding may reflect the supervision provided by the attending surgeon during the procedure as well as the care provided to patients by fellows and residents following the procedure. Previous studies have found improved outcomes following surgical procedures at academic centers, where fellows and residents participate in patient care, when compared to community centers.[23] Therefore, it appears as though the education of fellows and residents does not interfere with patient care for bariatric procedures. Third, despite variation in the type of first assistant, there are minimal differences in clinical outcomes following these procedures. This finding underscores the ability of surgeons to safely perform a broad range of elective bariatric procedures with a variety of first assistants.

Conclusion

In this retrospective cohort study, we found that despite variation in training level of the first assist, there were no significant differences in adjusted rates of 30-day postoperative DSM or readmission following a broad set of elective bariatric procedures. The inclusion of a wide range of first assistants in bariatric procedures does not appear to negatively influence clinical outcomes.

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Table 1.

Patient and operative characteristics

	Attending	Fellow	Resident	PA/NP	None	p-value
	n (%)					
Total	87,559 (21.3)	35,711 (8.7)	67,690 (16.5)	154,239 (37.6)	65,336 (15.9)	-
Sex						
Male	18,045 (20.6)	7,310 (20.5)	13,066 (19.3)	30,345 (19.7)	12,384 (18.9)	<0.001
Female	69,514 (79.4)	28,401 (79.5)	54,624 (80.7)	123,894 (80.3)	52,952 (81.1)	
Age (mean, SD)	45 (12)	45 (12)	44 (12)	45 (11)	45 (11)	<0.001
Race						
White	56,138 (64.1)	21,736 (60.9)	36,681 (54.2)	107,830 (69.9)	45,161 (69.1)	<0.001
Black	13,076 (14.9)	6,643 (18.6)	14,141 (20.9)	23,685 (15.4)	11,050 (16.9)	
Hispanic	11,071 (12.6)	4,462 (12.5)	9,901 (14.6)	15,723 (10.2)	6,375 (9.8)	
Other/Unknown	7,274 (8.3)	2,870 (8.0)	6,967 (10.3)	7,001 (4.5)	2,750 (4.2)	
BMI (mean, SD)	44.7 (8.5)	44.9 (8.6)	44.7 (8.4)	44.8 (8.4)	44.3 (8.9)	<0.001
Preoperative anticoagulation						
Yes	2,098 (2.4)	1,300 (3.6)	1,829 (2.7)	3,736 (2.4)	1,529 (2.3)	<0.001
Previous obesity/foregut surgery						
Yes	13,078 (14.9)	5,682 (15.9)	9,744 (14.4)	21,835 (14.2)	11,229 (17.2)	<0.001
Diabetes						
Yes	21,617 (24.7)	9,712 (27.2)	16,836 (24.9)	38,351 (24.9)	16,082 (24.6)	<0.001
HTN medication						
Yes	41,361 (47.2)	17,387 (48.7)	31,641 (36.7)	73,643 (47.8)	31,922 (48.9)	<0.001
Hyperlipidemia						
Yes	20,595 (23.5)	9,061 (25.4)	15,935 (23.5)	37,321 (24.2)	15,315 (23.4)	0.004
Smoker						
Yes	7,356 (8.4)	2,946 (8.3)	5,618 (8.3)	14,357 (9.3)	5,667 (8.7)	<0.001
COPD						
Yes	1,525 (1.7)	718 (2.0)	1,105 (1.6)	2,999 (1.9)	1,110 (1.7)	<0.001
Sleep Apnea						
Yes	30,030 (34.3)	13,955 (39.1)	25,215 (37.3)	55,038 (35.7)	20,975 (32.1)	<0.001

	Attending	Fellow	Resident	PA/NP	None	p-value
			n (%)			
Chronic Steroids						
Yes	1,500 (1.7)	680 (1.9)	1,291 (1.9)	2,417 (1.6)	1,027 (1.6)	<0.001
ASA						
1 to 2	22,077 (25.3)	9,082 (25.5)	19,249 (28.5)	35,650 (23.3)	15,877 (24.4)	<0.001
3 to 4	65,342 (74.8)	26,549 (74.5)	48,305 (71.5)	117,359 (76.7)	49,292 (75.6)	
Procedure						
RYGB	19,278 (24.6)	12,603 (39.9)	18,112 (29.9)	41,283 (29.8)	12,442 (22.7)	<0.001
SG	55,921 (71.3)	18,227 (57.8)	40,717 (67.2)	92,292 (66.6)	38,995 (71.1)	
DS	746 (1.0)	378 (1.2)	305 (0.5)	1,549 (1.1)	528 (1.0)	
Band	2,218 (2.8)	226 (0.7)	1,262 (2.1)	2,905 (2.1)	2,589 (4.7)	
Revision	266 (0.3)	130 (0.4)	212 (0.4)	472 (0.3)	277 (0.5)	
Robotic Approach						
Yes	**2,968 (3.4)**	**2,481 (6.9)**	**11,819 (7.7)**	**2,880 (4.3)**	**4,541 (6.9)**	**<0.001**

Abbreviations: Physician Assistant (PA), Nurse Practitioner (NP), Hypertension (HTN), Chronic Obstructive Pulmonary Disease (COPD), American Society of Anesthesia (ASA), Roux-En-Y Gastric Bypass (RYGB), Sleeve Gastrectomy (SG), Duodenal Switch (DS).

Table 2.

Evaluation of patient characteristics by procedure type

	RYGB	LSG	DS	Band	Revision	p value
Diabetes						
Yes	35,356 (34.1)	56,166 (22.8)	1,090 (31.1)	1,768 (19.2)	313 (23.1)	<0.001
HTN medication						
Yes	54,670 (52.7)	115,808 (47.1)	1,819 (51.9)	4,160 (45.2)	653 (48.1)	<0.001
Hyperlipidemia						
Yes	30,082 (29.0)	55,849 (22.7)	818 (23.3)	2,022 (21.9)	322 (23.7)	<0.001
Smoker						
Yes	8,639 (8.3)	21,667 (8.8)	331 (9.4)	873 (9.5)	138 (10.2)	<0.001
COPD						
Yes	2,147 (2.1)	4,178 (1.7)	84 (2.4)	135 (1.5)	37 (2.7)	<0.001
Sleep Apnea						
Yes	43,687 (42.1)	87,048 (35.4)	1,472 (42.0)	2,326 (25.3)	448 (33.0)	<0.001
Chronic Steroids						
Yes	1,570 (1.5)	4,310 (1.8)	54 (1.5)	129 (1.4)	23 (1.7)	<0.001
ASA						
1 to 2	18,386 (17.8)	62,553 (25.6)	435 (12.5)	2,834 (30.9)	387 (28.6)	<0.001
3 to 4	85,157 (82.2)	182,281 (74.5)	3,053 (87.5)	6,353 (69.2)	966 (71.4)	

Abbreviations: Hypertension (HTN), Chronic Obstructive Pulmonary Disease (COPD), American Society of Anesthesia (ASA), Roux-En-Y Gastric Bypass (RYGB), Sleeve Gastrectomy (SG), Duodenal Switch (DS).

Table 3.

Procedure length by first assistant level

	Attending	Fellow	Resident	PA/NP	None
	Operation length (min)				
Procedure	Median (IQR)				
RYGB	102 (75-137)	142 (114-179)	132 (104-169)	104 (78-138)	105 (81-137)
SG	62 (46-88)	82 (63-109)	81 (63-107)	63 (48-86)	63 (47-87)
DS	126 (99-179)	221 (163-286)	171 (140-207)	150 (98-212)	128 (107-167)
Band	43 (28-61)	71 (52-94)	52 (41-73)	45 (35-61)	50 (37-74)
Revision	103 (64-152)	125 (96-186)	122 (90-180)	108 (74-165)	81 (42-123)

Abbreviations: Physician Assistant (PA), Nurse Practitioner (NP), Roux-En-Y Gastric Bypass (RYGB), Sleeve Gastrectomy (SG), Duodenal Switch (DS).

Table 4.

Unadjusted rates of DSM, Death, and Readmission by first assistant training level

	Attending	Fellow	Resident	PA/NP	None	p-value
			n (%)			
DSM	2,939 (3.4)	1,360 (3.8)	2,397 (3.5)	5,168 (3.4)	2,110 (3.2)	<0.001
Death	114 (0.1)	53 (0.1)	90 (0.1)	164 (0.1)	66 (0.1)	0.124
Readmission	4,582 (5.2)	2,119 (5.9)	4,013 (5.9)	7,913 (5.1)	3,336 (5.1)	<0.001

Abbreviations: Physician Assistant (PA), Nurse Practitioner (NP), Death or Serious Morbidity (DSM).

Table 5.

Association between first assistant training level and DSM as well as Readmission adjusted for patient characteristics

	DSM			Readmission		
	Rate (%)	**OR (95% CI)**	**p-value**	**Rate (%)**	**OR (95% CI)**	**p-value**
Attending	3.4	1	REF	4.9	1	REF
Fellow	3.8	0.95 (0.88-1.03)	0.179	5.6	1.01 (0.95-1.07)	0.842
Residents	3.5	1.03 (0.96-1.10)	0.436	5.6	1.04 (0.97-1.10)	0.154
PA/NP	3.4	0.97 (0.92-1.03)	0.305	4.9	0.96 (0.92-1.01)	0.102
None	3.2	0.94 (0.95-1.02)	0.106	4.7	0.95 (0.91-1.02)	0.106

Abbreviations: Physician Assistant (PA), Nurse Practitioner (NP), Death or Serious Morbidity (DSM).