Complications Associated with Impaired Mobility in Patients Undergoing Weight Loss Surgery: An Analysis of the Metabolic and Bariatric Surgery Accreditation Improvement Project (MBSAQIP)

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Abstract

Introduction: Obesity and its comorbid medical conditions can significantly impact a patient's mobility. This can further negatively impact their health due to limitations on exercise and the ability to adequately care for themselves. Weight loss surgery can dramatically help people who have impaired mobility but whether or not they are at increased risks for post-operative complications is not well-defined. We aim to characterize post-operative complications in patients with impaired mobility who are undergoing weight loss surgery.

Methods: MBSAQIP patient use files, 2015-2018, were queried for all patients having undergone a primary laparoscopic Roux-en-Y gastric bypass (LRYGB) or laparoscopic sleeve gastrectomy (LSG). Complications were compared based on presence of preoperative impaired mobility. Patient characteristics were analyzed using Chi-square test to look at categorical variables. Logistic regression modeling was used to control for confounding variables. Significance was considered at p<0.05.

Results: 575,787 patients were identified who underwent primary LRYGB or LSG. After controlling for confounding variables, mobility impairment was associated with increased risks of post-operative complications including: acute renal failure, cardiac arrest, blood transfusion, unplanned intubation, unplanned admission to ICU, and 30-day rates for death, readmission and reoperation.

Conclusion: Weight loss surgery is still safe for patients who have impaired mobility. However, they are at higher risk for multiple complications and this should be considered when assessing patient's preoperative risks as well as counseling patients considering weight loss surgery.

Methods

Metabolic and Bariatric Surgery Accreditation Quality Improvement Project (MBSAQIP) is a prospectively maintained national database wherein accredited MBSAQIP centers submit bariatric procedures completed at their facility every year. Each year, deidentified patient use files are made publicly available for participating centers. It represents the most comprehensive prospective database for bariatric surgery patients that is available. We queried the MBSAQIP patient use files years 2015-2018 to identify all adult patients that had undergone non-revisional, primary laparoscopic sleeve gastrectomy (CPT code 43775) or laparoscopic Roux-en-Y gastric bypass (CPT codes 43644 or 43645). Patients with Association of Anesthesia (ASA) classification of 5 were eliminated as these represent moribund patients. Patients were considered lost to follow-up and eliminated if they were not recorded as having completed a follow-up visit within 30 days but had not been readmitted, undergone a reoperation, or intervention within 30 days. Data analyzed included patient demographics, preoperative co-morbid medical illnesses, operative characteristics and postoperative complications. Bivariate analysis was used to compare patient characteristics and rates of postoperative complications between patients with impaired mobility and those without impaired mobility. Analysis was then repeated examining LRGYB and LSG independently. Bivariate analysis was performed with Chi-square test for categorical variables and Student's independent t-test for continuous variables. Multivariate logistic regression analysis was performed to control for all confounding variables including demographic, preoperative characteristics and operative characteristics. SPSS version 26 was used to perform univariate and multivariate analysis. Statistical significance was considered at p<0.05.

Table 1. Pre-Operative Demographics

	Ambulatory (n=566655)	Decreased Ambulation (n=9132)	*P*-value
Demographics			
Sex			<0.001
Female	451540 (98.5%)	6822 (1.5%)	
Male	115115 (98.0%)	2310 (2.0%)	
Race			<0.001
American Indian or Alaska Native	2246 (98%)	47 (2.0%)	
Asian	2909 (98.9%)	31 (1.1%)	
Black or Africa American	100592 (98.4%)	1595 (1.6%)	
Native Hawaiian/Other Pacific Islander	1629 (98.8%)	20 (1.2%)	
Unknown/Not Reported	47555 (98.8%)	568 (1.2%)	
White	411724 (98.4%)	6871 (1.6%)	
Operative Procedure			<0.001
LRYGB	154212 (98.1%)	2970 (1.9%)	
LSG	412443 (98.5%)	6162 (1.5%)	
Functional Health			<0.001
Independent	562904 (98.8%)	7035 (1.2%)	
Partially Dependent	1847 (50.9%)	1782 (49.1%)	
Totally Dependent	1904 (85.8%)	315 (14.2%)	
ASA Class			<0.001
1	1879 (99.4%)	12 (0.6%)	
2	125265 (99.4%)	748 (0.6%)	
3	417777 (98.3%)	7057 (1.7%)	
4	19225 (93.9%)	1253 (6.1%)	

Table 1. Preoperative characteristics comparing patients with impaired vs normal ambulation undergoing weight loss surgery.

Results

Table 2. Pre-Operative Comorbidities Associated with Ambulatory Status

Comorbidities	Ambulatory (n=566655)	Decreased Ambulation (n=9132)	P-value
Pre-Op Gerd	173874 (30.7%)	4232 (46.3%)	<0.001
History of MI	6971 (1.2%)	411 (4.5%)	<0.001
Previous PCI/PTCA	10918 (1.9%)	555 (6.1%)	<0.001
Previous Cardiac Surgery	5991 (1.1%)	296 (3.2%)	<0.001
Hypertension	272370 (48.1%)	6541 (71.6%)	<0.001
Hyperlipidemia	135006 (23.8%)	3972 (43.5%)	<0.001
Vein Thrombosis	8819 (1.6%)	631 (6.9%)	<0.001
Venous Stasis	5297 (0.9%)	594 (6.5%)	<0.001
Dialysis	1670 (0.3%)	127 (1.4%)	<0.001
Renal Insufficiency	3422 (0.6%)	321 (3.5%)	<0.001
Therapeutic Anticoagulation	14652 (2.6%)	982 (10.8%)	<0.001
	8776 (1.5%)	182 (2.0%)	<0.001
Previous Obesity/Foregut Surgery			
Insulin Dependent Diabetes	47676 (8.4%)	2024 (22.2%)	0.001
Non-Insulin Dependent Diabetes	100909 (17.8%)	1965 (21.5%)	<0.001
Current Smoker	47677 (8.4%)	852 (9.3%)	0.002
History of COPD	8938 (1.6%)	828 (9.1%)	<0.001
Oxygen Dependent	3394 (0.6%)	681 (7.5%)	<0.001
Pulmonary Embolism	6414 (1.1%)	420 (4.6%)	<0.001
Obstructive Sleep Apnea	215915 (38.1%)	5489 (60.1%)	<0.001
Pre-Op Steroid/Immunosuppressant	9695 (1.7%)	424 (4.6%)	<0.001
Pre-Op IVC Filter	3357 (0.6%)	354 (3.9%)	<0.001

Table 2. Preoperative comorbidities for individuals with decreased mobility undergoing weight loss surgery (combined sleeve gastrectomy and roux-en-y gastric bypass data)

Table 3. Pre-Operative Comorbidities Stratified By Operation

Comorbidities	Sleeve			Bypass		
	Ambulatory	Decreased Ambulation	P-Value	Ambulatory	Decreased Ambulation	P-Value
Pre-Op Gerd	114335 (98.8%)	2624 (2.2%)	<0.001	59539 (97.4%)	1608 (2.6%)	<0.001
History of MI	4660 (94.0%)	297 (6.0%)	<0.001	2311 (95.3%)	114 (4.7%)	<0.001
Previous PCI/PTCA	7405 (95.0%)	388 (5.0%)	<0.001	3513 (95.5%)	167 (4.5%)	<0.001
Previous Cardiac Surgery	4404 (95.5%)	206 (4.5%)	<0.001	1587 (94.6%)	90 (5.4%)	<0.001
Hypertension	191450 (97.8%)	4373 (2.2%)	<0.001	80920 (97.4%)	2168 (2.6%)	<0.001
Hyperlipidemia	90600 (97.2%)	2565 (2.8%)	<0.001	44406 (96.9%)	1407 (3.1%)	<0.001
Vein Thrombosis	6012 (93.5%)	420 (6.5%)	<0.001	2807 (93.0%)	211 (7.0%)	<0.001
Dialysis	1405 (92.9%)	108 (7.1%)	<0.001	265 (93.3%)	19 (6.7%)	<0.001
Renal Insufficiency	2477 (91.5%)	230 (8.5%)	<0.001	945 (91.2%)	91 (8.8%)	<0.001
Therapeutic Anticoagulation	10485 (93.9%)	683 (6.1%)	<0.001	4167 (93.3%)	299 (6.7%)	<0.001
Previous Obesity/Foregut Surgery	6039 (98.0%)	126 (2.0%)	<0.001	2737 (98.0%)	56 (2.0%)	NS
Insulin Dependent Diabetes	26600 (95.6%)	1235 (4.4%)	<0.001	21076 (96.4%)	789 (3.6%)	<0.001
Non-Insulin Dependent Diabetes	68059 (98.1%)	1294 (1.9%)	<0.001	32850 (98.0%)	671 (2.0%)	<0.001
Current Smoker	35166 (98.3%)	612 (1.7%)	<0.001	12511 (98.1%)	240 (1.9%)	NS
History of COPD	6091 (91.5%)	568 (8.5%)	<0.001	2847 (91.6%)	260 (8.4%)	<0.001
Oxygen Dependent	2184 (83.3%)	439 (16.7%)	<0.001	1210 (83.3%)	242 (16.7%)	<0.001
Pulmonary Embolism	4490 (94.1%)	283 (5.9%)	<0.001	1924 (93.4%)	137 (6.6%)	<0.001
Obstructive Sleep Apnea	148504 (97.7%)	3564 (2.3%)	<0.001	67411 (97.2%)	1925 (2.8%)	<0.001
Pre-Op Steroid/Immunosuppressant	7298 (96.1%)	295 (3.9%)	<0.001	2397 (94.9%)	129 (5.1%)	<0.001
Pre-Op IVC Filter	2406 (91.6%)	222 (8.4%)	<0.001	951 (87.8%)	132 (12.2%)	<0.001

Table 3. Preoperative comorbidities for individuals with decreased mobility undergoing weight loss surgery stratified by sleeve gastrectomy or roux-en-y gastric bypass

Table 4. Rates of Complications in Patients with Intact vs. Decreased Mobility

Complications	Ambulatory	Decreased Ambulation	*P*-value
Acute Renal Failure	370 (0.1%)	36 (0.4%)	<0.001
Intra-Op or Post-Op Cardiac Arrest	220 (<0.1%)	18 (0.2%)	<0.001
Stroke	64 (<0.1%)	5 (0.1%)	<0.001
Deep Surgical Site Infection	12 (<0.1%)	2 (<0.1%)	<0.001
Myocardial Infarction	168 (<0.1%)	8 (0.1%)	0.002
Ventilator >48 hours	9 (<0.1%)	1 (<0.1%)	0.03
Organ Site Infection	32 (<0.1%)	3 (<0.1%)	0.001
Post Operative Pneumonia	29 (<0.1%)	2 (<0.1%)	0.03
Progressive Renal Insufficiency	358 (0.1%)	21 (0.2%)	<0.001
Pulmonary Embolism	621 (0.1%)	29 (0.2%)	0.002
Superficial Surgical Site Infection	25 (<0.1%)	3 (<0.1%)	<0.001
Transfusion	3774 (0.7%)	124 1.4%)	<0.001
Unplanned Intubation	760 (0.1%)	62 (0.7%)	<0.001
Wound Disruption	280 (<0.1%)	12 (0.1%)	0.001
Unplanned ICU Admission	3773 (0.7%)	227 (2.5%)	<0.001
Intra-Op or Post-Op Death w/n 30 Days	504 (0.1%)	45 (0.5%)	<0.001
Death Likely Related to Operation	270 (<0.1%)	28 (0.3%)	<0.001
Reoperation w/n 30 Days	7093 (1.3%)	210 (2.3%)	<0.001
Readmission w/n 30 Days	22052 (3.9%)	688 (7.5%)	<0.001
Intervention w/n 30 Days	7260 (1.3%)	199 (2.2%)	<0.001

Table 4. Bivariant analysis of complications in individuals with decreased mobility prior to weight loss surgery. Significant values are shown. Complications found to be not statistically significant were coma >24 hours, peripheral nerve injury, sepsis, septic shock, UTI, and venous thrombosis requiring therapy.

Table 5. Rates of Complications in Patients with Intact vs. Decreased Mobility Stratified by Operation

Complications	Sleeve			Bypass		
	Ambulatory	Decreased Ambulation	P-Value	Ambulatory	Decreased Ambulation	P-Value
Acute Renal Failure	198 (91.2%)	19 (8.8%)	<0.001	172 (91.0%)	17 (9.0%)	<0.001
Intra-Op or Post-Op Cardiac Arrest	131 (91.6%)	12 (8.4%)	<0.001	89 (93.7%)	6 (6.3%)	0.002
Coma>24 Hours	12 (100.0%)	0 (0.0%)	NS	3 (100.0%)	0 (0.0%)	NS
Stroke	54 (93.1%)	4 (6.9%)	0.001	10 (90.9%)	1 (9.1%)	NS
Deep Surgical Site Infection	6 (100.0%)	0 (0.0%)	NS	6 (75.0%)	2 (25.0%)	<0.001
Myocardial Infarction	97 (93.3%)	7 (6.7%)	<0.001	71 (98.6%)	1 (1.4%)	NS
Ventilator >48 hours	3 (75.0%)	1 (25.0%)	<0.001	6 (100.0%)	0 (0.0%)	NS
Organ Site Infection	16 (100.0%)	0 (0.0%)	NS	16 (84.2%)	3 (15.8%)	<0.001
Post Operative Pneumonia	17 (89.5%)	2 (10.5%)	0.001	12 (100.0%)	0 (0.0%)	NS
Peripheral Nerve Injury	11 (91.7%)	1 (8.3%)	0.05	20 (100.0%)	0 (0.0%)	NS
Progressive Renal Insufficiency	195 (94.2%)	12 (5.8%)	<0.001	163 (94.8%)	9 (5.2%)	0.001
Pulmonary Embolism	362 (96.0%)	15 (4.0%)	<0.001	259 (98.1%)	5 (1.9%)	NS
Sepsis	9 (100.0%)	0 (0.0%)	NS	9 (90.0%)	1 (10.0%)	NS
Septic Shock	4 (100.0%)	0 (0.0%)	NS	2 (100.0%)	0 (0.0%)	NS
Superficial Surgical Site Infection	16 (94.1%)	1 (5.9%)	NS	9 (81.8%)	2 (18.2%)	<0.001
Transfusion	2095 (97.0%)	64 (3.0%)	<0.001	1679 (96.5%)	60 (3.5%)	<0.001
Unplanned Intubation	413 (92.4%)	34 (7.6%)	<0.001	347 (92.5%)	28 (7.5%)	<0.001
Urinary Tract Infection	74 (96.1%)	3 (3.9%)	NS	51 (98.1%)	1 (1.9%)	NS
Post-Op Vein Thrombosis	779 (98.5%)	12 (1.5%)	NS	274 (97.9%)	6 (2.1%)	NS
Wound Disruption	150 (95.5%)	7 (4.5%)	0.002	130 (96.3%)	5 (3.7%)	NS
Unplanned ICU Admission	2090 (94.9%)	113 (5.1%)	<0.001	1683 (93.7%)	114 (6.3%)	<0.001
Intra-Op or Post-Op Death w/n 30 Days	287 (92.0%)	25 (8.0%)	<0.001	217 (91.6%)	20 (8.4%)	<0.001
Death Likely Related to Operation	144 (88.9%)	18 (11.1%)	<0.001	126 (92.6%)	10 (7.4%)	<0.001
Reoperation w/n 30 Days	3568 (97.4%)	96 (2.6%)	<0.001	3525 (96.9%)	114 (3.1%)	<0.001
Readmission w/n 30 Days	12736 (97.2%)	369 (2.8%)	<0.001	9316 (96.7%)	319 (3.3%)	<0.001
Intervention w/n 30 Days	3594 (97.5%)	91 (2.5%)	<0.001	3666 (97.1%)	108 (2.9%)	<0.001

Table 5. Postoperative complications for individuals with decreased mobility undergoing weight loss surgery stratified by sleeve gastrectomy or roux-en-y gastric bypass

Table 6. Association of Complications with Impaired Mobility

Complications	Confidence Interval		Odds Ratio	P-Value
	Lower	Upper		
Acute Renal Failure	1.12	2.53	1.69	0.01
Intra-Op or Post-Op Cardiac Arrest	1.19	3.54	2.05	0.01
Coma>24 Hours	<0.001	6.624E+26^1	<0.001	NS
Stroke	0.66	5.25	1.86	NS
Deep Surgical Site Infection	0.56	29.86	4.1	NS
Myocardial Infarction	0.34	1.72	0.77	NS
Ventilator >48 hours	0.07	16.76	1.07	NS
Organ Site Infection	0.34	8.87	1.75	NS
Post Operative Pneumonia	0.99	19.34	4.38	NS
Peripheral Nerve Injury	0.1	7.73	0.88	NS
Progressive Renal Insufficiency	0.55	1.55	0.92	NS
Pulmonary Embolism	0.79	2.07	1.28	NS
Sepsis	0.3	19.83	2.42	NS
Septic Shock	0.001	0.00	<0.001	NS
Superficial Surgical Site Infection	0.7	11.94	2.89	NS
Transfusion	1.05	1.56	1.28	0.02
Unplanned Intubation	1.14	2.15	1.57	0.005
Urinary Tract Infection	0.33	2.87	0.98	NS
Post-Op Vein Thrombosis	0.54	1.43	0.88	NS
Wound Disruption	0.9	3.34	1.74	NS
Unplanned ICU Admission	1.17	1.62	1.38	<0.001
Intra-Op or Post-Op Death w/n 30 Days	1.09	2.32	1.59	0.02
Death Likely Related to Operation	1.22	3.19	1.97	0.006
Reoperation w/n 30 Days	1.08	1.47	1.26	0.004
Readmission w/n 30 Days	1.25	1.49	1.36	<0.001
Intervention w/n 30 Days	0.95	1.31	1.11	NS

Table 6. Multivariate analysis of post-operative complications in individuals undergoing either sleeve gastrectomy or Roux-en-Y gastric bypass.

Complications w/ *P*<0.05

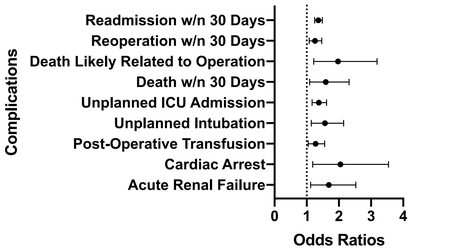


Figure 2. Multivariate analysis demonstrating complications that independently associated with decreased mobility in patients undergoing sleeve or gastric bypass.

Conclusion

- Patients with impaired mobility have increased rates of complications after laparoscopic sleeve gastrectomy and laparoscopic Roux-en-Y gastric bypass
- These procedures are still safe even in patients that may be a higher surgical risk patient due to conditions that limit their mobility
- Even when controlling for other preoperative and demographic patient characteristics, impaired mobility is still independently associated with certain postoperative complications
- When patients with impaired mobility are considering weight loss surgery, these additional risks should be considered
- Preoperative prehabilitation may help improve postoperative outcomes but further research is needed