Impact of Body Mass Index Severity on Total Hip Arthroplasty Complications and Length of Stay

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INTRODUCTION: Post-operative complications are more prevalent in obese patients undergoing total hip arthroplasty (THA). There is no consensus on the types of complications faced by patients of increased body mass index (BMI) or coherent approaches to mitigate these complications. This study aims to stratify complications and length of stay data following THA in patients of various BMI categories, after adjusting for demographic factors and comorbidities.

METHODS: We reviewed the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database to identify patients between 2012-2021. Patients were filtered using the Current Procedural Terminology (CPT) code 27130, representing patients over the age of 18 who have undergone a primary THA. Patients were stratified to 6 BMI categories from underweight (<18.5) to obese class III (>50). Multivariate analysis, adjusted for demographic factors and comorbidities, was performed to determine the association between BMI class and complications. Odds ratios with 95% confidence intervals (CIs), and p-values were determined for each postoperative complication's association with BMI class. One-way analysis of variance (ANOVA) was performed to assess differences in length of stay data across BMI cohorts.

RESULTS: We identified 322,418 patients who underwent primary THA between 2012 and 2021. We adjusted for age, race, ethnicity, and ASA classification, and the complications affected by BMI class are shown in **Table 1**. Post-operative bleeding requiring transfusion (OR: 1.34, p<0.001) and death (OR: 2.66, p<0.001) were significantly greater in the underweight population relative to normal BMI population. Whereas odds of reoperation (OR: 2.56, p<0.001), wound disruption (OR: 8.28), p<0.001), prosthetic joint infections (OR: 8.37, p<0.001), and periprosthetic fractures (OR: 3.52, p<0.002) were significantly positively correlated with increasing BMI severity. When analyzing length of stay, the most statistically significant differences were seen in the underweight and Obese Class III cohorts for Days from Operation to Discharge and Total Length of Hospital Stay (**Table 2**). Rates of death were highest amongst those with class III obesity (**Figure 1**).

DISCUSSION: We show that the likelihood of specific complications, namely wound disruptions, prosthetic joint infections, periprosthetic fractures, and re-operations increase significantly as a function of rising BMI. Likewise, there are other important complications, such as post-operative bleeding requiring transfusion and death, that are significantly greater in the underweight group.

SIGNIFICANCE: Degree of obesity has been a strong consideration for THA patient selection. While instituting BMI cut-offs may reduce some complications, this also restricts patient access to surgery. The new data shows that obesity does not significantly impact post-operative complications, therefore we are able to make surgery more inclusive to patients who need it.

IMAGES AND TABLES:

Odds of Complications Stratified by BMI Category

Perioperative Data	< 18.5 OR (95% CI)	p-value	25-29.99 OR (95% CI)	p-value	30-39.99 OR (95% CI)	p-value	40-49.99 OR (95% CI)	p-value	> 50 OR (95% CI)	p-value
Reoperations	0.97 (0.67-1.37)	0.88	0.83 (0.75-0.92)	< 0.001	0.87 (0.79-0.95)	< 0.01	1.07 (0.95-1.20)	0.26	1.60 (1.33-1.91)	< 0.001
Bleed	1.02 (0.85-1.22)	0.8	0.70 (0.67-0.74)	< 0.001	0.48 (0.46-0.51)	< 0.001	0.39 (0.37-0.42)	< 0.001	0.48 (0.42-0.56)	< 0.001
DVT	0.74 (0.43-1.18)	0.23	1.02 (0.91-1.16)	0.71	0.96 (0.86-1.08)	0.51	0.77 (0.66-0.89)	< 0.001	0.73 (0.52-0.99)	0.05
Wound Disruption	2.42 (1.25-4.30)	< 0.01	0.98 (0.75-1.28)	0.87	1.27 (1.00-1.64)	0.05	1.66 (1.27-2.19)	< 0.001	2.23 (1.48-3.32)	< 0.001
Pulmonary Embolism	0.95 (0.47-1.71)	0.88	1.27 (1.06-1.52)	< 0.01	1.59 (1.35-1.88)	< 0.001	1.67 (1.38-2.03)	< 0.001	1.74 (1.22-2.43)	< 0.01
Urinary Tract Infection	1.44 (0.96-2.07)	0.06	1.08 (0.95-1.22)	0.25	1.04 (0.92-1.17)	0.56	1.09 (0.94-1.26)	0.24	1.53 (1.18-1.95)	< 0.001
Myocardial Infarction	0.85 (0.36-1.70)	0.68	0.89 (0.72-1.11)	0.28	0.75 (0.61-0.93)	0.01	0.62 (0.47-0.81)	< 0.001	0.97 (0.57-1.55)	0.9
Cardiac Arrest Requiring CPR	0.50 (0.03-2.34)	0.5	1.22 (0.83-1.86)	0.33	0.90 (0.61-1.35)	0.59	1.16 (0.74-1.84)	0.53	1.52 (0.70-3.08)	0.26
Death	1.91 (0.73-4.13)	0.14	0.95 (0.69-1.33)	0.74	0.76 (0.56-1.05)	0.09	0.76 (0.51-1.12)	0.16	1.24 (0.64-2.26)	0.5
Subcutaneous Tissue Comp (L76)	0.00 (0.00-0.00)	0.99	0.51 (0.24-1.12)	0.08	0.45 (0.23-0.96)	< 0.05	0.80 (0.35-1.87)	0.6	0.49 (0.03-2.63)	0.5
Comp and Disorders of MSKS (M96)	0.00 (0.00-0.00)	0.97	0.67 (0.41-1.13)	0.12	0.60 (0.38-0.98)	< 0.05	0.64 (0.36-1.16)	0.14	1.61 (0.66-3.59)	0.26
Periprosthetic Fracture (M97)	NULL	0.99	0.67 (0.30-1.55)	0.33	0.54 (0.26-1.21)	0.11	0.90 (0.36-2.28)	0.83	0.87 (0.05-4.77)	0.9
Prosthetic Joint Dislocation (T84.02)	4.26 (0.22-28.97)	0.2	1.65 (0.61-5.75)	0.37	1.90 (0.75-6.38)	0.23	2.05 (0.67-7.62)	0.23	3.36 (0.45-17.95)	0.17
Prosthetic Joint Infections (T84.5)	0.53 (0.09-1.69)	0.37	0.93 (0.70-1.27)	0.65	1.14 (0.87-1.52)	0.36	1.64 (1.20-2.26)	< 0.01	3.60 (2.35-5.47)	< 0.001
Hip/Thigh Muscle, Tendon, Fascia Injury S76	2.41 (0.13-13.17)	0.41	0.83 (0.37-2.01)	0.65	0.95 (0.47-2.20)	0.9	1.63 (0.73-4.02)	0.25	1.97 (0.42-7.06)	0.33
Wound Disruption, Unspecified T81.3	3.14 (1.44-6.10)	0	1.04 (0.75-1.45)	0.83	1.43 (1.07-1.96)	< 0.05	1.98 (1.43-2.78)	< 0.001	2.75 (1.70-4.40)	< 0.001
Readmissions	1.00 (0.81-1.23)	0.98	0.86 (0.81-0.91)	< 0.001	0.82 (0.78-0.87)	< 0.001	0.92 (0.86-0.98)	< 0.05	1.34 (1.19-1.50)	< 0.001

Table 1. Perioperative data comparing the odds of complications among patients undergoing total knee arthroplasty, stratified by BMI grouping

Perioperative Data	Difference Normal - Underweight (95% CI)	p-value	Difference Normal-Overweight (95% CI)	p-value	Difference Normal-Obese Class 1 (95% CI)	p-value	Difference Normal-Obese Class 2 (95% CI)	p-value	Difference Normal-Obese Class 3 (95% CI)	p-value
Hospital Admission to Operation (HOOTDAY)	-0.72	<0.001	0.05	0.26	0.05	0.21	0.09	**0.12**	0.06	0.99
Days from Operation to Discharge (DOPTODIS)	-1.19	<0.001	0.17	<0.001	0.16	<0.001	-0.12	<0.001	-0.57	<0.001
Total Lengh of Hospital Stay (TOTHLOS)	-1.81	<0.001	0.24	<0.001	0.25	<0.001	-0.03	0.79	-0.53	<0.001

Table 2. Perioperative data comparison between patients undergoing total hip arthroplasty, stratified by BMI grouping

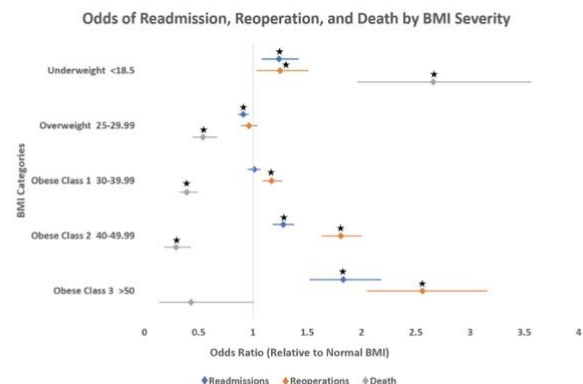### Odds of Readmission, Reoperation, and Death by BMI Severity

Figure 1: Forest plot shows ORs for readmission, reoperation and death by BMI class. (Star = statistically significant)