Healthcare Utilization and PROMs do not vary by BMI class in medial UKA

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INTRODUCTION:

Obesity has long been considered a relative contraindication to medial unicompartmental knee arthroplasty (mUKA). However, with improved implants and techniques, this criteria for UKAs have been challenged. This study aimed to assess the association of BMI with (i) healthcare utilization and (ii) patient reported outcome measures (PROMs) in patients undergoing mUKA.

METHODS:

We prospectively enrolled 886 patients who underwent mUKA from 2016 to 2022 at a tertiary academic center in the USA. Patients were assigned into five groups based on their BMI before surgery: normal (18.5-24.9kg/m^2), overweight (25-29.9), obese I (30-34.9), obese II (35-39.9), and obese III group (≥ 40). Outcomes included length of stay (LOS), discharge disposition (DD), 90-day readmission, 90-day ED visits, 1-year and 2-year reoperation, and 1-year PROMs: Knee disability and Osteoarthritis Outcome Score for Pain (KOOS Pain), Physical function Shortform (KOOS PS), and Joint Replacement (KOOS JR). Achievement of the Minimal Clinically Important Difference (MCID) and Patient Acceptable Symptom State (PASS) threshold were assessed for each PROMs subscales. Multivariable regression models were used to compare outcomes. For LOS, DD, readmission, 1-year reoperation, 2-year reoperation, and mortality, no modeling was done due to the small event sizes and will be summarized by BMI below/above 35. All tests were two sided, assuming a significant level of 0.05. Cohort characteristics can be found in **Table 1**.

RESULTS:

There were no significant differences in LOS (p=0.627), DD (p=1.0), and 90-day readmissions after mUKA (p=0.783) between patients with BMI below and above 35 (**Table 2**). Similarly, there were no significant differences in 2-year reoperation rates between BMI <35 (4.2%) and BMI ≥ 35 (3.8%). 1-year mortality in this entire cohort was 0% (**Table 2**). A large majority of patients in each BMI group achieved MCID and PASS thresholds (**Table 3**). After adjusting for possible confounders, BMI was not associated with failing to achieve MCID in any of the KOOS subscales (**Table 3**). Similarly, BMI was not associated with PASS threshold failure in any of the KOOS domains (**Table 5**). Satisfaction at 1-year postoperatively was not significantly associated with BMI (p=0.6) (**Table 5**).

DISCUSSION AND CONCLUSION:

BMI does not significantly impact healthcare utilization, reoperation rates, or clinically significant improvements in knee pain and function following mUKA. Obese and morbidly obese patients reported similar levels of improvement as those with normal BMI. Therefore, using BMI as a relative contraindication for mUKA may be unwarranted based on these outcomes. Future research should focus on long-term implant survivorship and identifying risk factors for revisions in this patient population.

Table 1 – Demographics by BMI

Variable	Level	All (n=886)	Normal 18.5-24.9 (n=143)	Overweight 25-29.9 (n=350)	Obese I 30-34.9 (n=259)	Obese II 35-39.9 (n=103)	Obese III >40 (n=28)	P-value
Age		67.0 [59.0;73.0]	68.0 [60.0;74.0]	68.0 [60.2;74.0]	66.0 [58.0;71.0]	63.0 [56.5;70.5]	60.5 [49.0;66.0]	**<0.001**
Sex	F	454 (51.2%)	91 (63.6%)	146 (41.7%)	129 (49.8%)	69 (67.0%)	17 (60.7%)	**<0.001**
	M	432 (48.8%)	52 (36.4%)	204 (58.3%)	130 (50.2%)	34 (33.0%)	11 (39.3%)	
BMI		29.1 [25.9;32.9]	23.3 [22.1;24.1]	27.4 [26.2;28.5]	32.1 [31.1;33.6]	37.1 [36.0;38.3]	41.9 [40.4;45.0]	**<0.001**
Education		14.0 [12.0;16.0]	15.0 [12.0;16.0]	15.0 [12.0;16.0]	14.0 [12.0;16.0]	14.0 [12.0;16.0]	14.0 [12.0;16.0]	**0.006**
ADI		45.0 [26.0;66.2]	39.0 [24.0;55.0]	40.0 [22.5;64.0]	50.0 [29.0;68.8]	53.0 [38.5;75.0]	42.5 [25.8;75.2]	**<0.001**
Race	White	792 (91.5%)	130 (93.5%)	327 (94.8%)	225 (89.3%)	83 (83.0%)	24 (88.9%)	**0.010**
	Non-white	74 (8.55%)	9 (6.47%)	18 (5.22%)	27 (10.7%)	17 (17.0%)	3 (11.1%)	
Smoking	Never	512 (57.8%)	80 (55.9%)	206 (58.9%)	151 (58.3%)	58 (56.3%)	15 (53.6%)	0.970
	Quit	331 (37.4%)	59 (41.3%)	126 (36.0%)	95 (36.7%)	39 (37.9%)	11 (39.3%)	
	Current	43 (4.85%)	4 (2.80%)	18 (5.14%)	13 (5.02%)	6 (5.83%)	2 (7.14%)	
Insurance	Other	337 (43.1%)	52 (41.6%)	114 (37.6%)	106 (46.1%)	49 (50.5%)	14 (60.9%)	0.057
	Medicaid/Medicare	444 (56.9%)	73 (58.4%)	189 (62.4%)	124 (53.9%)	48 (49.5%)	9 (39.1%)	
Phenotype	P-PS-MCS-	197 (22.3%)	22 (15.4%)	61 (17.5%)	65 (25.1%)	34 (33.0%)	14 (50.0%)	**0.015**
	P+PS+MCS+	236 (26.7%)	50 (35.0%)	110 (31.5%)	57 (22.0%)	15 (14.6%)	4 (14.3%)	
	P-PS+MCS+	53 (5.99%)	7 (4.90%)	23 (6.59%)	18 (6.95%)	5 (4.85%)	0 (0.00%)	
	P+PS-MCS+	43 (4.86%)	5 (3.50%)	14 (4.01%)	15 (5.79%)	7 (6.80%)	2 (7.14%)	
	P+PS+MCS-	146 (16.5%)	27 (18.9%)	55 (15.8%)	42 (16.2%)	16 (15.5%)	4 (14.3%)	
	P+PS-MCS-	46 (5.20%)	6 (4.20%)	18 (5.16%)	16 (6.18%)	6 (5.83%)	0 (0.00%)	
	P-PS-MCS+	111 (12.5%)	16 (11.2%)	48 (13.8%)	33 (12.7%)	12 (11.7%)	2 (7.14%)	
	P-PS+MCS-	53 (5.99%)	10 (6.99%)	20 (5.73%)	13 (5.02%)	8 (7.77%)	2 (7.14%)	
Anesthesia	General	387 (43.7%)	62 (43.4%)	161 (46.0%)	111 (42.9%)	39 (37.9%)	12 (42.9%)	0.798
	Spinal	457 (51.6%)	78 (54.5%)	171 (48.9%)	135 (52.1%)	58 (56.3%)	14 (50.0%)	
	Other	42 (4.74%)	3 (2.10%)	18 (5.14%)	13 (5.02%)	6 (5.83%)	2 (7.14%)	
Diagnosis	Non-OA	5 (0.57%)	1 (0.72%)	2 (0.58%)	1 (0.39%)	0 (0.00%)	1 (3.70%)	0.264
	OA	870 (99.4%)	137 (99.3%)	344 (99.4%)	257 (99.6%)	103 (100%)	26 (96.3%)	

Continuous variables presented as Median (IQR). Categorical variables presented as N (column %).

Table 2 – Healthcare Utilization and Mortality

Variable	Level	All (n=886)	Below 35 (n=755)	35 and Above (n=131)	P-value
LOS >= 3		9 (1.02%)	7 (0.93%)	2 (1.53%)	0.627
Discharge Disposition	Non-home	5 (0.56%)	4 (0.53%)	1 (0.76%)	1.000
	Home/ home health care	881 (99.4%)	751 (99.5%)	130 (99.2%)	
90-day Readmission		27 (3.05%)	24 (3.18%)	3 (2.29%)	0.783
2-year Reoperation		37 (4.18%)	32 (4.24%)	5 (3.82%)	1.000
1-year Mortality	No	886 (100%)	755 (100%)	131 (100%)	.

Continuous variables presented as Median (IQR). Categorical variables presented as N (column %).

Table 3 – Summary statistics of achievement of MCID and PASS Thresholds by BMI

Variable	Level	All (n=886)	Normal 18.5-24.9 (n=143)	Overweight 25-29.9 (n=350)	Obese I 30-34.9 (n=259)	Obese II 35-39.9 (n=103)	Obese III >40 (n=28)	P-value
Pain MCID 7.99	Improved	810 (92.5%)	128 (91.4%)	326 (93.7%)	231 (90.6%)	95 (93.1%)	28 (100%)	0.179
	Failure	66 (7.53%)	12 (8.57%)	22 (6.32%)	24 (9.41%)	7 (6.86%)	0 (0.00%)	
PS MCID 8.04	Improved	698 (81.7%)	114 (81.4%)	281 (83.6%)	196 (79.0%)	83 (83.8%)	22 (78.6%)	0.694
	Failure	156 (18.3%)	26 (18.6%)	55 (16.4%)	52 (21.0%)	16 (16.2%)	6 (21.4%)	
JR MCID 6.76	Improved	677 (89.7%)	107 (89.2%)	278 (93.6%)	187 (84.6%)	84 (90.3%)	20 (90.9%)	**0.020**
	Failure	78 (10.3%)	13 (10.8%)	19 (6.40%)	34 (15.4%)	9 (9.68%)	2 (9.09%)	
PASS Pain 77.7	Improved	600 (68.5%)	105 (75.0%)	247 (71.0%)	167 (65.5%)	60 (58.8%)	20 (71.4%)	0.053
	Failure	276 (31.5%)	35 (25.0%)	101 (29.0%)	88 (34.5%)	42 (41.2%)	8 (28.6%)	
PASS PS 70.3	Improved	568 (66.5%)	98 (70.0%)	230 (68.5%)	159 (64.1%)	61 (61.6%)	18 (64.3%)	0.689
	Failure	286 (33.5%)	42 (30.0%)	106 (31.5%)	89 (35.9%)	38 (38.4%)	10 (35.7%)	
PASS JR 70.3	Improved	497 (65.8%)	88 (73.3%)	207 (69.7%)	133 (60.2%)	54 (58.1%)	15 (68.2%)	**0.011**
	Failure	258 (34.2%)	32 (26.7%)	90 (30.3%)	88 (39.8%)	39 (41.9%)	7 (31.8%)	
PASS		703 (80.6%)	115 (81.0%)	285 (82.6%)	202 (79.8%)	78 (77.2%)	22 (78.6%)	0.300

Table 4 – Multivariable logistic regression model, using **failure to reach MCID improvements in KOOS Pain, PS, and JR** as outcomes.

	Pain MCID (Failure)			PS MCID (Failure)			JR MCID (Failure)		
Predictors	*OR [95%CI]*	*P-value*	*Overall P*	*OR [95%CI]*	*P-value*	*Overall P*	*OR [95%CI]*	*P-value*	*Overall P*
BMI (Overweight v Normal)	0.62 (0.26 – 1.47)	0.279	0.179	1.07 (0.57 – 1.99)	0.839	0.124	0.72 (0.32 – 1.61)	0.421	**0.02**
BMI (Obese I v Normal)	1.52 (0.67 – 3.47)	0.319		1.94 (1.02 – 3.67)	0.043		2.12 (0.97 – 4.61)	0.059	
BMI (Obese II v Normal)	0.94 (0.31 – 2.82)	0.906		1.40 (0.63 – 3.13)	0.406		1.18 (0.43 – 3.25)	0.750	
BMI (Obese III v Normal)	0.00 (0.00 – 80.00)	0.753		1.62 (0.45 – 5.87)	0.463		1.18 (0.20 – 6.76)	0.856	

This model was adjusted for Age, Sex, Race, Education, Smoking, ADI, CCI, Insurance, Diagnosis, Anesthesia, CCI, and PROM Phenotype.

Table 5 - Multivariable logistic regression model results, using **failure to reach attainment of PASS thresholds in KOOS Pain, PS, JR** and Satisfaction as outcomes.

	Pain PASS (Failure)			PS PASS (Failure)			JR PASS (Failure)			Satisfaction (Failure)		
Predictors	OR [95%CI]	P-value	Overall P	OR [95%CI]	P-value	Overall P	OR [95%CI]	P-value	Overall P	OR [95%CI]	P-value	Overall P
BMI (Overweight v Normal)	1.10 (0.64 – 1.87)	0.730	0.2394	1.02 (0.61 – 1.71)	0.942	0.4746	1.20 (0.70 – 2.05)	0.505	0.3559	0.90 (0.50 – 1.62)	0.725	0.6013
BMI (Obese I v Normal)	1.36 (0.78 – 2.38)	0.278		1.27 (0.74 – 2.18)	0.381		1.49 (0.86 – 2.61)	0.158		1.16 (0.63 – 2.13)	0.629	
BMI (Obese II v Normal)	1.43 (0.75 – 2.74)	0.277		1.08 (0.57 – 2.07)	0.813		1.36 (0.70 – 2.61)	0.364		1.16 (0.57 – 2.36)	0.689	
BMI (Obese III v Normal)	0.47 (0.15 – 1.45)	0.189		0.53 (0.18 – 1.53)	0.240		0.62 (0.21 – 1.84)	0.387		0.48 (0.12 – 1.86)	0.288	

This model was adjusted for Age, Sex, Race, Education, Smoking, ADI, CCI, Insurance, Diagnosis, Anesthesia, CCI, and PROM Phenotype.