Does BMI affect the outcome in Total Knee Replacement?

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Abstract:

INTRODUCTION: TKA is successful for decreasing pain and increasing functional performance, but less is known about the influence of TKA on restoring overall physical activity levels. [2-4] The literature remains inconclusive as to whether obesity is an independent determinant of recovery and whether it affects changes in physical activity and quality of life after TJA. In our study we have tried to correlate the patients BMI with the outcome in terms of physical activity and Quality of life after Total Knee Replacement.

MATERIALS AND METHODS: Patients with osteoarthritis of the knee were assessed for the need of surgery. All patients were explained regarding their participation in the study and written informed consent were taken. Standardized and validated scores were used for the assessment. Pedometer was used to assess the physical activity, BMI to assess obesity and SF-36 questionnaire to assess the quality of life. The study was conducted for a duration of 1 year from June 2021 to June 2022.

CONCLUSION: Our study concludes that there is a statistically significant improvement in the pedometer values i.e., steps per day and walking distance per day in patients post Total Knee Arthroplasty. Thus providing sufficient information to prove that physical activity significantly improves post TKA. There is no significant change in the body mass index (BMI) after TKA noted in our study and also there is no significant impact of BMI on the physical activity and the functional outcome post TKA. Hence our study results demonstrates that patients with high BMI are also expected to have improved quality of life post TKA.

Keywords: BMI, TKR, TKA, Pedometer, SF-36

INTRODUCTION

Osteoarthritis is a multifactorial disease which manifests itself in a variety of clinical presentations. Two people may have the same diagnosis and radiographic classification; however, their physical exam and subjective complaints of pain, functional limitations and disability may vary significantly, making treatment both challenging and unique to each patient. [1, 2]

Many patients experiencing OA will undergo a lower extremity joint arthroplasty in their lifetime, and the number of arthroplasties will further increase in the next decades because of the aging population and an associated increasing prevalence of arthritic diseases and joint degeneration. [3, 4]

The issue in patients with OA is obesity which is a well recognised risk factor for osteoarthritis. The projected increase of obesity in the general population will have ramifications in OA and elective surgery such as TKA.

TKA is successful for decreasing pain and increasing functional performance, but less is known about the influence of TKA on restoring overall physical activity levels. [2-4]

The literature remains inconclusive as to whether obesity is an independent determinant of recovery and whether it affects changes in physical activity and quality of life after TJA. In our study we have tried to correlate the patients BMI with the outcome in terms of physical activity and Quality of life after Total Knee Replacement.

MATERIALS AND METHODS

The study was done at HOSMAT Hospital, Bangalore, which is a tertiary care referral Centre for Orthopaedics and sports medicine. Patients with osteoarthritis of the knee were assessed for the need of surgery. All patients were explained regarding their participation in the study and written informed consent were taken. Standardized and validated scores were used for the assessment. Pedometer was used to assess the physical activity, BMI to assess obesity and SF-36 questionnaire to assess the quality of life. The study was conducted for a duration of 1 year from June 2021 to June 2022.

PEDOMETER

A standard Pedometer was given to all the patients preoperatively one week before the surgery and was instructed to carry it with them for all the 7 days before surgery. The Pedometer was collected one day prior to the surgery and readings were noted. The average of the 7 days readings of steps per day and distance covered per day were used as the preoperative reading. Similar readings were taken after 6 months after surgery and used as postoperative reading for comparison with the preoperative readings. Fig.1. Pedometer



BODY MASS INDEX (BMI)

Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters. A high BMI can be an indicator of high body fatness. BMI can be used to screen for weight categories that may lead to health problems. Table 1. BMI Grading

Classification	BMI	Risk of co-morbidities
Underweight	< 18.5	Low
Normal weight	18.5-24.9	Average
Overweight	25.0-29.9	Increased
Obesity class I	30.0-34.9	Moderate
Obesity class II	35.0-39.9	Severe
Obesity class III	≥ 40.0	Very severe

THE SHORT-FORM-36 HEALTH SURVEY (SF-36)

The SF-36 is an indicator of overall health status. It has eight scaled scores; the scores are weighted sums of the questions in each section.

Scores range from 0 - 100. Lower scores = more disability, higher scores = less disability

Sections: • Vitality. • Physical functioning. • Bodily pain. •General health perceptions. • Physical role functioning. • Emotional role functioning. • Social role functioning, and • Mental health.

In our study we used a Physical Component Summary (PCS) and Mental Component Summary (MCS) obtained from the 8 domains of SF-36 scores for the easy comparison between preop and postop SF36 scores.

A correlated physical and mental health summary scores for the SF-36 (PCSc and MCSc) were obtained from a correlated (oblique) physical and mental health factor solution. This was based on the study "Correlated physical and mental health summary scores for the SF36 and SF-12 Health Survey, V.I" by Farivar et al. [5] Factor analysis of the 8 SF-36 scale scores with a two-factor oblique rotation was used to estimate the physical and mental health factor scoring coefficients (weights).

PCSc (Physical Component Summary – Correlated) was then constructed by multiplying each SF-36 scale z-score by its respective physical factor scoring coefficient and summing the eight products. Similarly, MCSc (Mental Component Summary – Correlated) was created by multiplying each SF-36 scale z-score by its respective mental factor score coefficient and summing the products.

Table 2. SF 36 Physical and Mental Factors Score Coefficient

	Physic	cal	Mental			
	Orthogonal (PCS _{uc})	Oblique (PCS _c)	Orthogonal (MCS _{uc})	Oblique (MCS _c)		
Physical Functioning	0.42	0.20	-0.23	-0.02		
Role-Physical	0.35	0.31	-0.12	0.03		
Bodily Pain	0.32	0.23	-0.10	0.04		
General Health	0.25	0.20	-0.02	0.10		
Vitality	0.03	0.13	0.24	0.29		
Social Functioning	-0.01	0.11	0.27	0.14		
Role-Emotional	-0.19	0.03	0.43	0.20		
Emotional Well- Being	-0.22	-0.03	0.49	0.35		

STATISTICAL ANALYSIS

TOTAL

Data was analyzed using SPSS v.24 software. All categorical data was summarized using frequency and percentages, all continuous data was described using mean and standard deviation or median and inter quartile range based on the distribution. All clinical parameters were assessed for change after treatment using paired sample t-test or Wilcoxon sign rank test based on the distribution. The change in clinical parameter was compared by different demographic parameters using independent sample t-test or Mann Whitney U test based on the distributional assumption. For all comparison Pvalue is considered significant at 5% level of significance.

RESULTS

The study consisted of 59 patients of Osteoarthritis treated by Total Knee Arthroplasty in HOSMAT Hospital, Bangalore from June 2021 to June 2022 and the patients were followed up for 6 months after the surgery. The following were the observations made and the available data was analysed as follows.

Out of 59 patients 19 were aged less than 55 years, 25 patients were between 56 - 65 years and 15 were >65 years. 45 patients were females and 14 were males. 17 underwent bilateral staged total knee replacement, 42 patients underwent unilateral total knee replacement. Of which 25 underwent TKA on left side and 17 on the right side.

Out of 59 patients, 3 patients had normal BMI, 28 patients were overweight, 16 were obese grade I and 12 were obese grade II. Table 3. BMI distribution

BMI	NO OF PATIENTS	PERCENTAGE (%)
NORMAL	3	5.1
OVERWEIGHT	28	47.5
OBESE GR1	16	27.1
OBESE GRII	12	20.3

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COMPARISON BETWEEN CHANGES IN STEPS PER DAY AMONG THE BMI GROUPS

The changes in steps per day pre and postoperatively was compared between the BMI groups. The results showed improvement in all the groups with no statistically significant difference among the groups.

BMI	N	STEPS PER I	P-	
		MEDIAN	IQR	VALUE
NORMAL	3	-1207	(-1551,)	
OVERWEIGHT	28	-3087.5	(-5942.25, -1409)	
OBESE GR1	16	-2558.5	(-3351, - 1502.5)	0.147
OBESE GRII	12	-3033	(-5313.25, -1469)	

100.0

Table 4. Comparison between changes in steps per day among the BMI groups

Figure 2. Comparison between changes in steps per day among the BMI groups



COMPARISON BETWEEN THE CHANGES IN DISTANCE COVERED PER DAY AMONG BMI GROUPS

The changes in walking distance pre and postoperatively was compared between the BMI groups. The results showed improvement in all the groups with no statistically significant difference among the groups.

BMI	N	DISTANCE CO DAY CI	Р-	
	13	MEDIAN	IQR	VALUE
NORMAL	3	-1.06	(-1.38,)	
OVERWEIGHT	28	-2.27	(-4.79, - 1.01)	
OBESE GR1	16	-1.98	(-2.6, - 1.18)	0.204
OBESE GRII	12	-2.37	(-4.19, - 1.11)	

Table 5. Comparison between the changes in distance covered per day among BMI groups

Figure	3. Coi	nparison	between	the	changes	in	distance co	overed	per (dav	among	BMI	groun	ns
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DISCUSSION

Total Knee Arthroplasty is one of the most commonly performed surgical procedures which attracts a lot of questions on the patient's wellbeing after the surgery. TKA provides the possibility to return to a physically active lifestyle and to improve health-related quality of life for the majority of patients experiencing knee OA.

Although the patients were expected to mobilize more easily and lose weight after Total Knee Arthroplasty procedure, there was no significant change in the body mass index (BMI) after TKA noted in our study and also there was no significant impact of BMI on the physical activity and the functional outcome post TKA.

The results of our study were consistent with that performed by Stevens-Lapsley et al [6] in 2009 "Impact of Body Mass Index on Functional Performance After Total Knee Arthroplasty" which evaluated the impact of BMI on functional performance at 1, 3, and 6 months after TKA, while taking into account preoperative functional performance and concluded no meaningful relationships between BMI and functional performance in the subacute (1 and 3 months) and intermediate (6month) stages of recovery. Similar results were found by overgaard et al [7] in 2019 in their study "patient-reported 1-year outcome not affected by body mass index in 3,327 total knee arthroplasty patients" Interpreted that the degree of improvement in PROs 1 year after TKA surgery does not seem to be affected by BMI.

Though the results of our study showed no correlation between BMI and its effect on physical activity, functional recovery and outcome post TKA, it was able to substantiate that even in patients with high BMI there was significant improvement in quality of life post TKA similar to patients with normal BMI. Li, Wenjun et al [8] in their study "Functional Gain and Pain Relief after Total Joint Replacement According to Obesity Status" concluded that six months after total joint replacement (TJR), severely or morbidly obese patients reported excellent pain relief and substantial functional gain that was similar to the findings in other patients. **CONCLUSION**

Our study concludes that there is a statistically significant improvement in the pedometer values i.e., steps per day and walking distance per day in patients post Total Knee Arthroplasty. Thus providing sufficient information to prove that physical activity significantly improves post TKA. There is no significant change in the body mass index (BMI) after TKA noted in our study and also there is no significant impact of BMI on the physical activity and the functional outcome post TKA.

Hence our study results demonstrates that patients with high BMI are also expected to have improved quality of life post

TKA. REFERENCES

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