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## A functional outcome and residual knee pain following total knee arthroplasty: A retrospective study

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### Abstract

**Aim:** To identify incidence of residual knee pain and possible factors for developing RKP and functional outcome following TKA.

**Method:** A retrospective review of total 78 patients operated in JJ group of hospitals Mumbai; a tertiary hospital was done. Patients' demographics, co-morbidities, management of patella and types of implants used were reviewed as predictive factors. To measure the functional outcome patient's knee society score (KSS) and western ontario and mcmaster university index of osteoarthritis scores were analysed.

**Keywords:** Residual knee pain, functional outcome, total knee arthroplasty

### Introduction

Total knee arthroplasty has been developed in recent years as highly successful operative procedure for disabling knee pain debilitating patients of osteoarthritis hampering quality of life. Very high rate of satisfaction as much as 85.2% to 92.0% post total knee arthroplasty (TKA) have been reported [1-4]. However with up to 30% of patients describing residual knee pain post TKA [5] it has been strongly associated with dissatisfaction and impaired quality of life, post TKA. Since persistent knee pain, debilitating quality of life of patients with knee osteoarthritis is one of the main factor deciding if the patient should undergo a total knee arthroplasty, it is necessary to address the residual knee pain post-operatively and identify the predictive factors associating to it. Hence, the aim of this study is to identify the incidence, progression of residual knee pain and the functional outcome following total knee arthroplasty (TKA) and also to determine the possible predictive factors associated with residual knee pain post-total knee arthroplasty in a tertiary hospital in India.

This study was mainly evaluated in Indian population. Various studies have been performed to previously accounting such as body mass index (BMI) [15, 16, 19], diabetes mellitus (DM), cardiac diseases [24, 27], gender [15, 20, 25] and age group [13, 15, 17, 25] to look for predictive factors of residual knee pain (RKP). However, results have been contradicting from each other in these studies with some showing associations, while remaining some do not.

### Materials and methods

A retrospective review of collected data of total knee arthroplasty performed in a tertiary hospital of Mumbai was performed. The population of this study consisted from those patients who underwent total knee arthroplasty in the institution from January 2018 to December 2019, with a minimum follow up of 18 months. The inclusion criteria of this study includes patients with osteoarthritis those who underwent bilateral or unilateral TKA. The exclusion criteria were those patients with revision TKA, previous patella fracture, patellofemoral instability, patellectomy, inflammatory arthropathies, pathological fractures of the knee, osteomyelitis, septic arthritis and those patients who were lost in follow up. The predictive factors that we extracted from the database were patients' demographics (age, gender, weight, height, and body mass index (BMI)), co-morbidities (hypertension, DM and ischaemic heart disease), the management of patella (patelloplasty or patella resurfacing) and the type of implants such as posterior stabilized (PS) or posterior cruciate-retaining (PCR).

Antero-posterior (AP), lateral and skyline views of x-ray of the patients were evaluated pre-operatively, post-operatively and on every subsequent visits of follow up. Body mass index (BMI) of the patients were categorized according to guidelines of world health organisation (WHO) for Asians, i.e. risk of nutritional deficiency diseases and osteoporosis i.e. below 18.5, low risk i.e. 18.5-22.9, moderate risk i.e. 23-27.4 and high risk i.e. 27.5 and above [36, 37]. Post-operatively patients were reviewed at 6 weeks, 3 months, 6 months, 12 months and 18 months. On every visit Antero-posterior (AP), lateral and skyline views of x-ray of the patient were evaluated and enquired for residual knee pain presence of which was registered in database. Simultaneously severity of knee pain of the patient was categorized according to the sub-score for pain in the knee society score (KSS) [22] namely none, mild/occasional, mild-stairs only, mild during walking and stairs, moderate occasional, moderate continual and severe. Severity of knee pain was later sub-analyzed according to the subscore. Western Ontario and mcmaster universities index of osteoarthritis (womac) score [9] and the knee society score (KSS) was used to determine the functional outcome. The womac score was handed out to patients, explained each options and completed by patients themselves. The questionnaires assess the degree of pain (five items), functional activities (17 items) and stiffness (two items). Each item uses 5 point likert scale. The scores were ranged from worst to best (0-100). Similarly, the womac sub-scale score for pain was evaluated with 0 being the extreme pain and 100 being no pain in a scale of 0-100.

We completed the KSS score in two components, the knee score and the functional score. The knee score rates the severity of pain, range of motion and stability in a scale of 100 points, on the other hand the functional score evaluates walking ability of the patient, climbing stairs and the dependability of walking aids which is again a 100-point scale. All TKAs were performed by experienced arthroplasty surgeons in our institute. The types of implants used were PCR and PS, and for management of patella either patelloplasty or patella resurfacing was performed. For patelloplasty we remove osteophytes and as a denervation technique, circumferential cautery of the patellar rim was done. For patellar resurfacing patellar articular surface was replaced with a polyethylene implant.

### Statistical analysis

Database entry was done in Microsoft excel 2002 spreadsheet. All variables are presented with frequency tables and descriptive statistics where mean, median or standard deviation were used wherever appropriate. Categorical and continuous variables were presented as proportion and mean respectively. Further, comparison of categorical variables were done by chi-square test. Strength of association between two ranked variables were evaluated with spearman's correlation test and to measure the strength of linear association between the two variables was done by performing Pearson's correlation test. After the possible predictors are identified using multiple logistic regressions a multivariate analysis was performed to see which factors independently predicts the RKP after compounding effect of other variables are adjusted. All the results were finally rounded off to nearest one decimal point. P value <0.05 was accepted as

statistical significance.

### Results

From the database of time period 2018-2019, seventy-eight patients were identified which met the inclusion criterias and were subsequently evaluated. Table 1 reflects the demographics of the patients. No patients during the whole process of the study had implant failure or malposition on the radiographic assessment.

Table 2 outlines the functional scores for the patients pre-operatively and at 6 months and 18 months post operatively. At 18 months post operatively all the patients showed improvement. No significant differences were found in preoperative function scores in weight, height, BMI, presence of hypertension or DM and patellar management. However males had significantly higher womac score (63.1 vs. 56.9 p=0.001) and KSS function score (50.4 vs. 43.8 p=0.011) than the females preoperatively. No statistically significant difference were seen preoperatively in womac pain score and KSS knee score.

Regarding residual knee pain (RKP), 24 (30.8%) and 22 (28.2%) patients had RKP at 6 months and 18 months post operatively, respectively. Table 3 and 4 shows breakdown of severity of RKP at each time interval. Table 5 shows number of patients with or without RKP at 6 months and 18 months post-operative. Interestingly 9 patients who had no RKP at 6 months post-TKA developed RKP at 18 months post-TKA. Table 6 demonstrates the breakdown of this subgroup of patients. No significant difference were seen between age, gender weight, height, BMI, patellar management, hypertension or DM with presence of RKP at 6 months and 18 months post-TKA.

Males had significantly better KSS function score than females at 6 months post-TKA, however this was not significant at 18 months post-TKA (table 7). All the patients had posterior stabilizing implant. However no significant difference were seen in terms of patellar management between patelloplasty and patellar resurfacing.

**Table 1:** Patients' demographics

Demographics	N=78
Median age (range), years	62.5 (48-80)
Gender (n (%))	
male	24 (30.7)
female	54 (69.2)
Median height (range) cm	156.1 (140-178)
Median weight (range) kg	64.5 (42.6-104)
Bmi (kg/m <sup>2</sup> )	
median (range)	26.25 (15.8-40.7)
<18.5 (n (%))	2 (2.5)
18.5-22.9 (n (%))	9 (11.5)
23.0-27.4 (n (%))	34 (43.5)
>=27.5 (n (%))	33 (42.3)
Co-morbidities (n (%))	
diabetes mellitus (dm)	19 (24.3)
hypertension	47 (60.2)
Patellar management (n (%))	
Patelloplasty	4 (5.1%)
Patellar resurfacing	74 (94.8)

**Table 2:** Functional outcome pre-operatively and at 6 months and 18 months following TKA

Functional Score	Pre-operative (n(range))	6 months post-TKA (n(range))	18 months post TKA (n(range))
Womac score	42.8 (17.2-74.3)	90.4(58.3-100)	92.3 (55.2-100)
Womac pain score	54 (8-100)	98 (54.3-100)	98.4 (52.7-100)
KSS knee score	34.6 (2-78)	93.8 (48-100)	95.2 (52-100)
KSS function score	38.9(10-100)	78.2(20-100)	84.2(20-100)

**Table 3:** Severity of RKP in patients at 6 months post-TKA

No. of patients	Severity of RKP					
	Mild occasional	Mild (stairs)	Mild (walk and stairs)	Moderate occasional	Moderate continual pain	Severe pain
n=24	15	3	4	2	0	0

**Table 5:** Comparison of number of patients with residual knee pain at 6 months and 18 months post-TKA

Presence of RKP	Residual knee pain at 18 months n (no. of patients)	No residual knee pain at 18 months n (no. of patients)
Residual knee pain at 6 months	13	11
No residual knee pain at 6 months	9	45

**Table 6:** Patients with new onset of knee pain at 18 month post-TKA (without RKP at 6 months)

No. of patients	Severity of RKP					
	Mild occasional	Mild (stairs)	Mild (walk and stairs)	Moderate occasional	Moderate continual pain	Severe pain
n=9	7	0	2	0	0	0

**Table 7:** Comparison of KSS function score between males and female at pre-op, 6 months and 18 months post TKA

KSS function score gender	Pre-op	6 months post TKA	18 months TKA
Males	50.4	82.8	84.2
Females	43.8	72.6	78.3
P-VALUE	0.011	0.002	0.066

## Discussion

The main results of this study shows that there is significant proportion of patients with RKP at 18 months of post op and female gender were associated with poorer functional outcome and/or development of residual knee pain. Looking at the prevalence of residual knee pain, 24 (30.8) and 22 (28.2%) patients had residual knee pain at 6 months and 18 months post-TKA, respectively. This is in comparable with the prevalence given in literature which is cited to be between 7 and 44% [8, 11, 32, 37, 39]. Thirteen (54.2%) patients of those having RKP at 6 months continued to have RKP at 18 months post-TKA. Of note, 9 patients who had no pain at 6 months developed RKP at 18 months post-TKA, however most of them had only mild pain (n 7; 77.8%). This is in contrast to what was previously understood about the progression of pain after uncomplicated TKA which has been shown to continually decrease even up to 5 years post-surgery [10, 11] this could be due to other causes not studied in this paper, which includes psychological stress. It is estimated that 25% of those undergoing TKA had some form of psychological distress which hampers significantly their post-operative pain and functional outcome [30]. This could explain the development of RKP at 18 months post operatively. Many studies have attempted to determine if there is crucial role of patient factor in poor functional outcomes or residual knee pain post-TKA. Gender is one widely studied factor. Ritter *et al.* [34] found in his study that men had better pain scores than women both preoperatively and post-operatively, over a 5-year of time period. Similar results were observed by macdonald *et al.* [31] and singh *et al.* [35]. No correlation between the gender and presence of RKP was found in this paper. However males had significantly better pre-operative womac and KSS function scores compared to the females, although their KSS function score being significantly higher at 6 months (82.8 vs. 72.6; p=0.002) was not significant at 18 months post operatively. Similarly, lingard and fort in their respective papers reported females generally tend to delay undergoing surgery and hence contributing to poorer outcome in their preoperative score [18,29]. Such factors may therefore have contributed to poorer outcomes initially post operatively. No correlation or significant difference between age and presence of RKP or functional outcome scores

post-operatively could be identified. This is in contrast to most papers in the literature, where most studies conclude that younger patients tend to have more RKP post-TKA compared to the elderly [13, 35]. For instance, Singh *et al.* reported that at 2 years post-TKA, patients aged younger than 60 had significantly greater complaints of moderate–severe pain compared to those aged 60 and above. Elson *et al.* Also found that 17% of those below 60 had complaints of painful TKAs, compared to just 6 and 4 in those aged from 60 to 70 and older than 70 years old. This difference was postulated to be due to the higher level of activity in the young, as well as higher pain tolerance and presence of greater peripheral neuropathy in the elderly [35].

There are very few studies in the literature which attempted to correlate each co-morbid factor in assessing for RKP or functional outcomes post-TKA [24, 27] as many of them assessed for outcome based on the number of co-morbidities suffered [17, 21, 25, 26, 29]. One of the few studies that actually evaluated individual co-morbid factors was conducted by Kaupilla *et al.* In their study they found that the outcomes of TKA was not significantly affected by patients having underlying cardiovascular disease. Jones *c* in his study also found that cardiac disease and diabetes were not independent risk factors for poorer joint function and pain in post-TKA patients. Similarly in this study we found functional outcome post-TKA was not affected by presence of DM or HTN.

All the patients in this study had undergone posterior stabilizing implant, hence it couldn't be compared with PCR implant. In terms of patellar management, no significant difference in functional outcome was found between those who underwent patelloplasty and those who had patellar resurfacing. Management of patella in TKA has been a controversial one with some authors advocating for it [11, 28, 33] while some other do not [6, 12, 14]. Furthermore, most authors believe that the patellar management has a greater impact on the development of anterior knee pain (AKP) rather than RKP. However KSS and womac scores in this study are not patella-specific questionnaires and hence does not evaluate for AKP. Therefore, they may not be useful tools to conclude the significance of either technique. One of the limitations of the study includes its retrospective nature. The TKAs were performed by multiple surgeons in the

institution which may inherently introduce bias. Results of patella management on RKP and functional outcome scores may be confounded by the difference in prosthesis design such as whether a patella-friendly implant was used. Despite these, internationally validated functional outcome scores were used with a moderate-term follow-up. The study also reflects results from an Indian perspective which could shed some light on the incidences and progression of RKP post-TKA in the Indian

population. This study is clinically relevant because physicians will be able to address their patients' expectations both pre- and post-operatively by identifying the progression of knee pain, functional outcome and predictive factors in the development of RKP. Additionally, by identifying patients who are more likely to develop RKP post-TKA, physicians can take preventive steps in their management plan.

**Table 4:** Severity of RKP in patients at 18 months post-TKA

No. of patients	Severity of RKP					
	Mild occasional	Mild (stairs)	Mild (walk and stairs)	Moderate occasional	Moderate continual pain	Severe pain
n=22	16	1	3	1	1	0

## Conclusion

It is essential to identify and understand the factors associated with poor functional outcomes post uncomplicated TKA for the surgeon. Almost a third of patients in this study had residual knee pain at 18 months post TKA with factor such female gender associated with development of RKP and/or poorer functional outcome.

## Conflict of interest

The authors declare that they have no conflict of interest.

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