

Original Research Article

Incidence of patella baja following patellar eversion in total knee arthroplasty

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ABSTRACT

Background: Patella baja is a rare complication of total knee arthroplasty (TKA) leading to decreased mechanical advantage of the extensor mechanism, decreased knee range of motion, anterior knee pain and increased wear of the tibial and patellar polyethylene. There exists a lack of evidence on whether patellar eversion leads to shortening of the patellar tendon. The present study aims to determine if eversion of patella during TKA leads to patella baja.

Methods: Between August 2014 and August 2016, 55 knees undergoing primary TKA with a standard medial parapatellar arthrotomy and eversion of patella were included in this two point cross sectional study. Preoperative X-rays were taken to assess the length of the patellar tendon and Insall Salvati ratio (ISR). Postoperatively the Blackburne Peel Index (BPI), ISR and patellar tendon lengths were assessed on lateral X-rays to look for any incidence of patella baja.

Results: The postoperative change in the length of the patellar tendon was unpredictable; though most of them decreased. The pre and post op difference in the length of patellar tendon was statistically significant in females (4.43 ± 0.20 cm vs. 4.35 ± 0.24 cm; p value-0.005). Significant decrease in length of patellar tendon was seen in patients aged 66-70 years ($p=0.024$) and patients with BMI >30 kg/m². No case of true patella baja was found postoperatively. No significant correlation could be established between ISR and age, sex or BMI of the patients.

Conclusions: The different risk factors for post TKA shortening of patellar tendon include female gender and higher BMI (>30 Kg/m²). However eversion of patella during TKA may not lead to an increased incidence of true patella baja.

Keywords: Patella baja, Total knee arthroplasty, Insall Salvati ratio, TKA, Patellar eversion

INTRODUCTION

Total knee Arthroplasty (TKA) has been a promising surgical option for a number of disabling knee disorders, however the procedure is associated with its own share of complications. Post TKA patella baja is a rare complication secondary to patellar tendon shortening.¹⁻³ Surgical exposure of the knee during total knee arthroplasty requires mobilization of the patella. Eversion of the patella by twisting it along the axis of the extensor mechanism can augment surgical exposure and has been a routine part of surgical technique.⁴ The incidences of

patella baja after total knee arthroplasty including both the type of procedures, standard and minimally invasive, has been reported over a wide spectrum in different studies ranging from 0.7% to 65%.^{2,3,5,6} The incidence is very low in patients undergoing minimally invasive surgery as compared to standard surgery for total knee arthroplasty.^{7,8}

Reasons for patella baja with eversion of patella include quadriceps muscle damage due to torsion and increased tension, damage to the patellar tendon resulting in scarring and shortening.⁶⁻⁹ The effect of patella baja will

be decreased mechanical advantage of the extensor mechanism during the flexion and extension arc altering the biomechanics of the joint leading to a decrease in the range of motion, anterior knee pain and can cause an increased wear of the tibial and patellar polyethylene.^{1,3,9-13,15-17}

However there is a lack of evidence regarding the fact whether patellar eversion really leads to shortening of the patellar tendon. The present study is aimed to focus on whether a standard medial parapatellar knee arthrotomy with eversion of patella, leads to patella baja by shortening of the patellar tendon, and to estimate its incidence.

METHODS

A hospital based two point cross sectional study was carried out between August 2014 and August 2016 at our center to include 57 patients who underwent primary conventional posterior stabilized TKR. Patients with preoperative patellar baja, those developing pseudo patella baja, developing complications after the surgery i.e. infection, septic arthritis and old fractures around knee joint were excluded from the study.^{9,18}

A pre and post-operative lateral X-ray of the knee was taken at preferentially 30° or more of flexion to tension the patellar tendon.¹⁹ Conventional knee radiographic technique was adopted without any digitization of images. This enabled good visualisation of the patellar tendon and its insertion into the tibia. All measurements were made using a ruler (15 cm) with measurements done to one decimal point in centimeters. The length of the tendon was measured from its origin on the lower pole of the patella to its insertion onto the tibial tubercle. The length of patella was measured from the articular superior pole to the non-articular inferior pole. A postoperative X ray was taken one year after the surgery. The duration of follow up was fixed as one year because it was seen that there was almost no change in the length of patellar tendon after this duration.⁶

All the surgeries were performed by experienced arthroplasty surgeons. All patients received a combined spinal epidural anaesthesia with standard peri-operative antibiotic prophylaxis and a tourniquet was used throughout the procedure. The standard medial parapatellar arthrotomy with eversion of the patella was done as shown in Figure 1. Tibia was subluxated anteriorly with retraction of patella as given in Figure 2 and the infrapatellar fat pad was partially excised to facilitate exposure of the proximal tibia. The flexion and extension gaps were balanced using standard techniques as required.²⁰ The patellae were selectively resurfaced as per the judgement of operating surgeon. Standard postoperative rehabilitation protocols were followed in all the cases.

On the preoperative X ray as seen in Figure 3, the length of the patellar tendon was calculated and Insall Salvati ratio (ISR) was calculated to rule out preoperative patella baja.¹⁹ Postoperatively the Blackburne Peel index (BPI) as given in Figure 4 was calculated to rule out cases of pseudo patella baja initially followed by ISR on lateral X rays.²¹

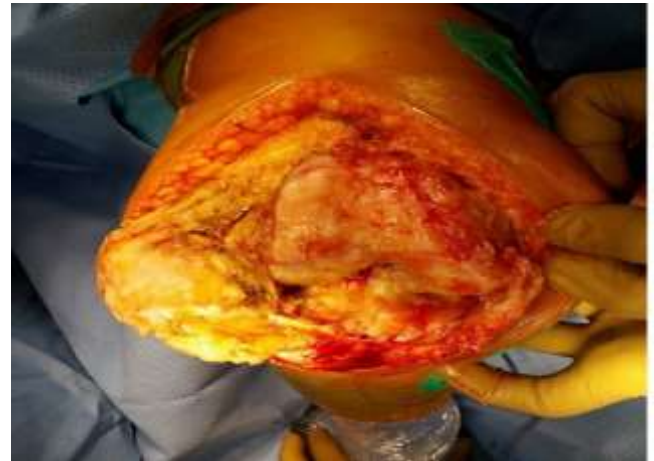


Figure 1: Eversion of patella during exposure for TKA.



Figure 2: Retraction of patella while taking tibial cut.



Figure 3: Preoperative X-ray.



Figure 4: Postoperative X-ray.

If the Blackburne Peel index was more than 0.54, only then further calculation of Insall Salvati ratio was done and recorded.²⁸ Patella baja was defined as Insall Salvati ratio less than 0.8 or a decrease in length of the patellar tendon by 10% or more of preoperative value.^{12,19}

Statistical analysis

Data analysis was performed by using SPSS (Statistical package for social sciences) version 20.0. Students paired t-test was used for analysis of the change in the length of the patellar tendon post operatively and its correlation with age, sex and BMI of the patient. Cross tabulation analysis, Chi Square test and Fisher’s exact test was used to find any significant correlation between the type of changes in the patellar tendon i.e. no change, increase or decrease with age, sex, BMI of the patient and the

indications for undergoing total knee arthroplasty. The p value of ≤ 0.05 was considered significant.

RESULTS

A total of 57 patients were included in the study, who were fulfilling the inclusion criteria. Four patients underwent bilateral total knee arthroplasty. 61 consecutive total Knee arthroplasties done were considered for the study. 6 patients were lost to follow-up, so final study was done on 51 patients with 55 knees. 29 knees in women and 26 knees in men were included in the study with a mean age of 62.3 years (range, 51–73 years). The mean body mass index (BMI) was 26.66 kg/m² (range, 21.6– 34.6 kg/m²). The diagnosis was osteoarthritis in 49 knees, rheumatoid arthritis in 05 knees and gouty arthritis in one knee.

The mean length of patellar tendon preoperatively was found to be 4.80 cm (SD±0.49) and postoperatively was 4.75 cm (SD±0.54). The change in the length of the patellar tendon was unpredictable; as in some cases there was no change in the length, whereas some showed an increase but the majority of them showed a decrease as given in Figure 5.

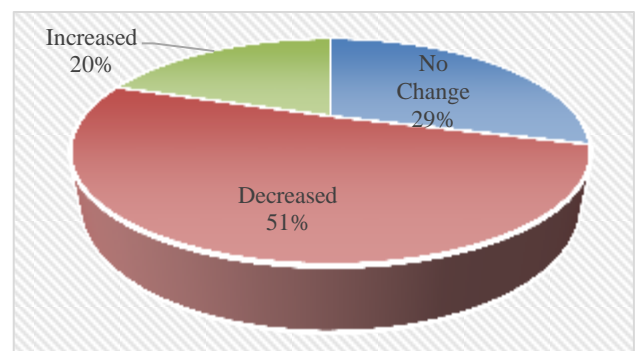


Figure 5: Type of changes in the patellar tendon observed.

Table 1: Correlation of gender with change in patellar tendon.

Sex	Length of patellar tendon (LT)	Mean	SD	p- value
Male	LT preoperative	5.207692	0.3825421	p- value= 0.476
	LT postoperative	5.184615	0.4369827	
Female	LT preoperative	4.431034	0.2001846	p- value= 0.005
	LT postoperative	4.355172	0.2443449	

In males, the mean length preoperatively was 5.20 cm (SD ±0.38) and postoperatively was 5.18 cm (SD ±0.43). In females the mean length of the tendon preoperative was 4.43 cm (SD ±0.20) and postoperatively was 4.35 cm (SD±0.24). The pre/post-operative difference was found to be statistically significant in females as presented in Table 1.

When age was correlated with the change in length of patellar tendon post operatively, there was a statistically

significant decrease in the 66-70y age group (4.77±0.49 cm vs. 4.66±0.46 cm) (p=0.024) as shown in Table 2. On correlating the body mass index of the patients with change in the length of the patellar tendon a statistically significant decrease was found in patients with BMI >30 kg/m². On analysis of the correlation between the type of change in the length of patellar tendon i.e. no change, decrease or increase and the age of the patient, sex, BMI and indication of surgery, no statistically significant correlation was found between the parameters as shown in Table 3.

The Insall Salvati ratio was calculated preoperatively and compared with postoperative values. No case of true patella baja was found in the study post-operatively.

However, the correlation of the ISR with age, sex and BMI of the patients was analyzed and no significant association was established.

Table 2: Correlation of age of patient with change in length of patellar tendon.

Age group	Frequency	Length of patellar tendon (LT)	Mean	SD	p-value (<0.05)
51-55	08	LT preoperative	4.75	0.49	0.064
		LT postoperative	4.66	0.50	
56-60	12	LT preoperative	4.58	0.50	0.309
		LT postoperative	4.53	0.50	
61-65	19	LT preoperative	4.95	0.50	0.6
		LT postoperative	4.93	0.62	
66-70	10	LT preoperative	4.77	0.49	0.024
		LT postoperative	4.66	0.46	
>70	6	LT preoperative	4.88	0.42	0.99
		LT postoperative	4.88	0.47	

Table 3: Correlation of BMI with change in length of tendon.

BMI in Kg/m ²	Frequency	Length of patellar tendon (LT)	Mean	SD	p-value
<24.9	17	LT preoperative	4.67	0.49	0.095
		LT postoperative	4.62	0.47	
25-29.9	32	LT preoperative	4.91	0.49	0.488
		LT postoperative	4.89	0.56	
>30	06	LT preoperative	4.57	0.36	0.003
		LT postoperative	4.35	0.36	

DISCUSSION

Several studies in the literature have suggested that TKA may be associated with a high incidence of patellar tendon shortening and resultant patella baja.^{2,3,12,22} The suggested reasons for patella baja were extensive surgical exposure and patellar eversion. Despite use of a standard TKA technique with routine eversion of the patella at our center, a high incidence of patella baja was not observed as mentioned in the literature. This cross-sectional study was designed to evaluate the effect of patellar eversion on development of patella baja following TKA as evaluated by ISR. The results were also correlated with patient parameters i.e. age, sex and BMI.

In the present study, patella baja was not seen in any of the cases. The mean preoperative ISR was 1.06 (SD \pm 0.07; Range 0.93 - 1.19). No change was found in the mean postoperative ISR value, i.e., 1.06 (SD \pm 0.07; Range 0.91 - 1.20). The overall mean pre-op and post-op values of length of patellar tendon were 4.80 cm (SD \pm 0.49) and 4.75 cm (SD \pm 0.54) respectively. However the change in the length of the patellar tendon post-op was unpredictable as in some cases it remained unchanged and in some it increased although it decreased in majority of cases. Similar findings were observed in a study by Sharma et al wherein the incidence of postoperative patella baja was 0.7% (1 in 135 knees).⁶ In their study, there was a mean increase of 0.6 mm (range, -6 to 10 mm; SD, 3.3) in length of the patellar tendon postoperatively as compared with the preoperative length.

Koshino et al and Weale et al also reported lengthening of the patellar tendon after TKA.^{2,3} A possible explanation for this lengthening may be improvement in the biomechanics after surgery leading to the correction of patellar tendon shortening, caused by degenerative process.

Koshino et al performed 94 TKA in 61 women, the ISR decreased by more than 10% of its preoperative value in 61 knees (64.9%).² Although lateral release was performed in all patients, the fat pad was not resected. However in our study lateral release was not done in any of the cases. In a prospective randomized controlled trial by Grana et al on 84 patients who had either TKA or UKA, 34% (14 of 41) of the TKA group developed patella baja, defined as 10% or more shortening of the patellar tendon postoperatively, compared with 5% (two of 43) in the UKA group.^{13,14} The authors associated restricted motion and knee pain with patella baja; lateral release was linked to the development of patella baja (six of seven). In a retrospective review of 1055 consecutive TKAs in 720 patients done by Meneghini et al, the incidence of patella baja was 9.8% (92 of 943).¹² However, the surgical technique used was not discussed.

Meneghini et al reported, twice as many female patients as males developing a postoperative patella baja.¹³ In our study, association between gender and the changes in the patellar tendon length and ISR showed a consistent decrease in the post-op length of the patellar tendon, however this change was statistically significant only in

females though the decrease didn't qualify for patella baja. No statistically significant decrease was noted in ISR. The reason for these findings may be due to the anatomical variations of knee in the genders. The mean age of the patients in this study was 62.3 years. While correlating age with change in the length of patellar tendon, a statistically significant decrease was found in the age group 66-70 years. Anagnostakos et al and Peterson et al defined the risk factors for the development of patella baja after unicompartmental knee arthroplasty is age over 65 years and male gender.^{23,24} But there also exist studies which show no correlation between age and incidence of patella baja.²⁵ The average BMI in the study is 26.66 (SD \pm 2.90). A statistically significant decrease in the length of patellar tendon was seen in the group with BMI \geq 30 kg/m². However, no statistically significant difference was noted in the ISR pre and postoperatively. Fernández et al reported that obesity has a protective effect and the incidence of patella baja is lower in these patients.²⁶ In our study, findings are not corroborating with the observations made by Fernandez et al showing a lower incidence. The reason for the decrease in the length of the patella tendon in patients with higher BMI may be due to the increased requirement of soft tissue dissection and associated tissue response leading to increased fibrosis. Irrespective of the pre-op diagnosis, no statistically significant change in length of patellar tendon was noted in our study.

To comment on the true incidence of patella baja is really difficult as there is no general consensus and different studies report a varied incidence. In this study, there was not a single case of patella baja found, which is contrary to the high incidences reported in earlier studies. However, this study is limited by the fact that it is an observational study with a small sample size.

CONCLUSION

In this study, no patella baja was observed. However, there were some very interesting findings pointing towards the different risk factors for developing patella tendon shortening following TKA viz., female gender and higher BMI (>30 Kg/m²). It can be concluded that even with patellar eversion the incidence of patella baja is low contrary to the observations made by several other studies. However an elaborate, population based prospective comparative study with a larger sample size needs to be designed comparing different approaches for TKA and involving the study of all the parameters mentioned above to arrive at a firm conclusion.

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Ethical approval: The study was approved by the institutional ethics committee, Armed Forces Medical College, Pune

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