

Original Research Article

Patelloplasty with and without circumpatellar denervation in reducing anterior knee pain in primary total knee arthroplasty: a comparative prospective study

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ABSTRACT

Background: Anterior knee pain (AKP) following total knee arthroplasty (TKA) is one of the complication which cause dissatisfaction in patients. Incidence estimated to be 4-49%. The aim of our study is to know the efficacy of patelloplasty with circumpatellar denervation with diathermy in reducing AKP in primary TKA.

Methods: A total of 130 unilateral TKAs are divided into 2 groups. Group I (control) includes 65 patients in which only patelloplasty was done. Group II (intervention) includes 65 patients in which both patelloplasty and circumpatellar denervation with diathermy was done and analysed. Mean follow up period was 18 months. Patients were assessed both preoperatively and postoperatively at final follow up.

Results: The overall incidence of AKP at follow up (18 months) was 16.9%, with 7.7% in the intervention group and 26.1% in the control group ($p < 0.05$). Western Ontario and McMaster Universities osteoarthritis index scores were significantly better in intervention group when compared to control group (28.71 ± 3.948 vs 31.40 ± 3.860). Better results were also found in knee society scores for intervention group compared to control group (166.57 ± 7.941 vs 161.23 ± 11.219); Feller patellar score of intervention group was significantly better when compared to control group (23.28 ± 2.546 vs 20.69 ± 3.729); the range of knee flexion was similar in both the groups (94.62 ± 12.6 vs 93.54 ± 10.7). In terms of pain referred by the patient at 72 hrs postoperatively, there was statistically significant difference observed according to visual analogue scale.

Conclusions: There is statistically significant difference with respect to AKP in patients who have undergone patelloplasty with circumpatellar denervation using diathermy compared with patelloplasty alone.

Keywords: Total knee arthroplasty, Anterior knee pain, Patelloplasty, Circumpatellar denervation, Diathermy, Range of motion

INTRODUCTION

Total knee arthroplasty (TKA) is one of the most successful surgical procedure with over 90% survival rate at 10-15 year.¹⁻⁴ It provides a stable, pain free range of motion (ROM) which improves quality of life. Anterior knee pain (AKP) following TKA is one of the

complication which cause dissatisfaction in patients. Incidence estimated to be 4-49%.⁵⁻¹⁰ AKP may be related to a number of factors like degree of wear of the patellar cartilage (chondropathy), patellofemoral maltracking, prosthetic design, patient selection, operative technique used, peripatellar soft tissues (retinaculum and

synovium), infrapatellar fat pad, and the use of patellar resurfacing.^{5,6,7,11-20}

Many authors reported that the AKP is due to substance-P nociceptive afferent fibers in the peripatellar soft tissues.²¹ Denervation of these nerve fibers around the patella by diathermy have been used for treatment of anterior knee pain in TKA.^{15,22-25} The purpose our study is to know the efficacy of patelloplasty with circumpatellar denervation in reducing anterior knee pain in TKA.

METHODS

This is a prospective study that was carried out in BIRRD (T) Hospital, Tirupati, Andhra Pradesh, India between January 2018 to October 2019. Patients were followed up to 18 months. A total of 150 unilateral TKA's were included in our study which were divided into 2 groups. Group I (control) which include 75 patients in which patelloplasty alone (Figure 1) was done of which 9 patients were lost to follow up. Group II (intervention) includes 75 patients in which both patelloplasty and circumpatellar denervation with diathermy (Figure 2) was done of which 8 patients were lost to follow up. For calculation purpose we have considered only 65 patients in each group and were analysed.



Figure 1: Intraoperative image after patelloplasty alone.

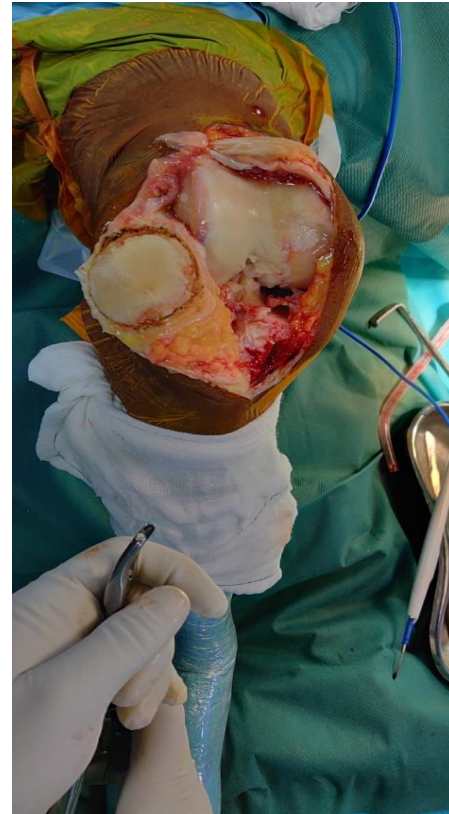


Figure 2: Intraoperative image after patelloplasty with circumpatellar denervation with diathermy.

Inclusion criteria

Patients with primary osteoarthritis, patients between 40 to 80 years, patients undergoing TKA and minimum follow up of 18 months at the time of evaluation.

Exclusion criteria

Patients with previous history of patellar fracture and patella surgery, patients who have undergone high tibial osteotomy and distal femoral osteotomy, patients with inflammatory arthritis, revision total knee replacement and patients who did not give consent for surgery.

TKA was performed by one of the four surgeons using PFC Sigma (Depuy) and Optetrak (Exactech) posterior-stabilised fixed-bearing implants. After tourniquet inflated all knees exposed with standard medial parapatellar approach. Patella everted, partial fat pad excision done for better visualization of lateral tibial plateau. Proximal tibial cut was performed perpendicular to tibial mechanical axis. Distal femoral cut with 5° valgus and 3° external rotation with respect to posterior femoral condyles was performed. Damaged to patellar cartilage was assessed using outerbridge grading system.²⁶ Patellar osteophytes were removed in all patients. In intervention group circumpatellar denervation with diathermy (set to 60 Watts) to a depth of 1 to 2 mm was done superior-inferiorly at the insertion of

quadriceps and origin of patellar tendon respectively and 2 to 3mm mediolaterally. Checked for patellar tracking, if patella maltracking occur then a lateral retinacular release is performed at least 2 cm lateral to the border of the patella. cementing of the femoral and tibial components was done. Wound closed in layers in 40-50° of knee flexion over suction drain. Patient was mobilized on 1st post op day. Radiographs of both weight bearing antero-posterior, lateral and skyline views were taken. Post op rehabilitation was done for every patient. AKP was assessed using visual analogue scale (VAS) preoperatively and at 72 hrs postoperatively. Knee range of motion, knee society score (KSS), Western Ontario and McMaster Universities osteoarthritis index (WOMAC) and Feller patellar score were evaluated preoperatively and at 18 months post operatively.²⁷⁻³⁰

Statistical analysis

Preoperative and final follow-up results were used for statistical analysis. We used SPSS 20 software (SPSS® for Windows 16.0, Chicago, IL). Continuous variables were expressed as mean ±SD. The variable gender was described by absolute and relative frequency, the variables age, BMI, WOMAC, KSS, knee ROM, and VAS were described by mean. Group comparison used independent-samples t -test; pre- and postoperative values were compared by paired-samples t -test. P value <0.05 was considered significant.

RESULTS

Sixty five patients were allotted in each control and intervention group. Mean age at the time of surgery for control and intervention group was 61.32±8.65 yrs and 62.35±7.89 yrs respectively. There were 31 males and 34 females in control group; 34 males and 31 females in intervention group. Mean BMI was 27.77±2.276 kg/m² and 27.27±2.029 kg/m² in control and intervention group

respectively. There were no statistically significant differences with respective to age, sex and BMI in between both the groups (Table 1). Intraoperative cartilage status of patella (outerbridge grading) also didn't show any difference (p>0.05) (Table 2).

At 18 months of follow-up, 17 patients in control group and 5 patients in intervention group with a respective incidence of 26.1% (95% CI 20-31) and 7.7% (95% CI 3-12) reported AKP, representing an overall incidence of 16.9% (95% CI 12-20). There was statistically significant difference between two groups (p<0.05).

Mean pre-operative and post-operative ROM in control group was 83.9±10.561° and 93.54±10.7° respectively; Mean pre-operative and post-operative ROM in intervention group was 86.46±12.302° and 94.62±12.6° respectively. There was no significant difference in ROM both preoperatively and post-operatively. In both groups, KSS and feller patellar score was increased; VAS and WOMAC scores was decreased significantly in postoperative follow-up. Furthermore, on all the parameters, there was a statistically significant difference postoperatively in favour of the intervention group (Table 3).

Three knees, two in the intervention group and one in the control group, showed delayed wound healing on average it took total of 3 weeks for wound healing. In two knees, one in intervention group and another one in the control group showed stiffness (ROM<50) for which manipulation under anaesthesia was performed to improve flexion after the fourth post-operative week. These patients had obtained 90° of flexion at 18 months follow up. There were no radiological signs of patellar osteonecrosis.

Table 1: Age, sex, BMI and side distribution (n=65).

Variable	Control group	Intervention group	Statistical significance
	N (%)	N (%)	
Age group (yrs)			
41-50	11 (16.9)	2 (3.1)	$\chi^2=7.059^@$; p=0.070; df= 3
51-60	19 (29.2)	24 (36.9)	
61-70	24 (36.9)	26 (40.0)	
>70	11 (16.9)	13 (20.0)	
Mean age±SD (yrs)	61.32±8.65	62.35±7.89	t=0.710 [@] ; p=0.479 (p>0.05)
Sex			
Male	31 (47.7)	34 (52.3)	$\chi^2=0.277^@$; p=0.599; df= 1
Female	34 (52.3)	31 (47.7)	
BMI (kg/m²)			
Normal	8 (12.3)	10 (15.3)	
Overweight	50 (76.9)	51 (78.5)	
Obese	7 (10.8)	4 (6.2)	
Mean BMI±SD	27.77±2.276	27.27± 2.029	t=1.321 [@] ; p=0.189
Side (right:left)	39:26	29:36	p>0.05

@ Not significant.

Table 2: Outerbridge grading system for patellar cartilage status (n=65).

Outer bridge grading system	Group		P value
	Control	Intervention	
0	0	0	p>0.05
1	0	1	
2	11	3	
3	38	44	
4	16	17	

p>0.05; not significant.

Table 3: Mean pre-operative and post-operative parameters in control and intervention group (n=65).

Parameters	Group	Control	Intervention	Mean difference	P value
ROM	Pre-op flexion	83.9±10.561	86.46±12.302	-2.615	@P>0.05
	Postop flexion	93.54±10.7	94.62±12.6	-1.077	@P>0.05
VAS score	Pre-operative	7.95±0.975	8.54±0.849	-0.59	P<0.001
	Post-operative (72 hrs)	1.89±2.425	0.68±1.501	1.21	P<0.001
WOMAC score	Pre-operative	68.82±6.798	68.86±7.514	-0.046	@P>0.05
	Post-operative	31.40±3.860	28.71±3.948	2.692	P<0.001
KSS	Pre-operative	27.88±8.728	25.26±7.081	2.615	@P>0.05
	Post-operative	161.23±11.219	166.57±7.941	-5.338	P<0.001
Feller patellar score	Pre-operative	11.45±2.784	11.54±2.257	-0.092	@P>0.05
	Post-operative	20.69±3.729	23.28±2.546	-2.585	P<0.001

**p<0.001 significant; @ Not significant.

DISCUSSION

AKP following TKA is one of the complication which cause dissatisfaction in patients. It has been evaluated in a number of studies by different authors but many aspects of AKP after TKA yet to be furthermore analysed. Etiology of AKP is multifactorial, which may be due to wear of the patellar cartilage, inflammation of peripatellar soft tissues (retinaculum and synovium), impingement of infra patellar fat pad, surface incongruities (patellofemoral maltracking), prosthetic design and operative technique used. Different procedures were used for prevention and treatment of AKP after TKA which includes patelloplasty alone, patelloplasty with circumpatellar denervation, lateral retinacular release or patellar resurfacing but their effectiveness is still debatable. Cemil et al did a prospective study on 46 patients (49 knees), performed patelloplasty alone and followed for an average of 41.1 months. They noticed improvement in postoperative KSS and Feller patellar score. This study concluded that, patelloplasty in TKA is an option for the reduction of AKP.³¹ Wang et al also conducted a retrospective study with 132 patients, did patelloplasty alone in all the patients and followed up for a mean of 7.8 years. There was improvement in postoperative KSS and patellar score. Author stated that, the patellar retention with a patelloplasty may be better option even in knees with advanced patellofemoral arthritis.³² Krompinger and Fulkerson reported that lateral retinacular release is indicated in patients with AKP.³³ But Witonski and Wagrowska- Danielewicz stated that substance-P positive fibers appear to be more prevalent in

the fat pad and medial retinaculum. They concluded that lateral retinacular release was not as effective as expected.³⁴ Maralcan et al stated that the patella has two nerve supplies, passing within the substance of the vastus medialis and lateralis in superomedial and superolateral quadrants respectively. Denervation of these nerves and their branches to be performed to prevent postoperative AKP.³⁵ So in our study we performed both patelloplasty and circumpatellar denervation among patients who have undergone TKA to know its efficacy. Altay et al performed a randomized control study in 2012 which included 35 knees each in intervention and control group. They reported that there is a definite advantage with patellar denervation.³⁶ In a study conducted by Balinga et al the outcome following circumpatellar denervation was assessed based on oxford knee score (OKS) and AKP using VAS. This study showed statistically significant improvement in the OKS and VAS among the patella denervation group.³⁷ Jonberger performed a study in 2008 which included 131 patients in each control (no denervation) and intervention (denervation) group followed for a period of 1 year. They showed that patellar denervation using electrocautery improves the outcome. The intervention group had a better WOMAC score (16.3 vs 21.6, p value 0.04). Knee society score (92.4 vs 90.4, p value 0.14) was similar in both the group.³⁸ But a randomized control trial conducted by the same author showed that the initial clinical improvement with electrocautery denervation of patella in TKA is not maintained at a mean follow up of 3.7 years.³⁹ In a meta-analysis conducted by Cheng et al reported that there is no strong evidence either for or against circumpatellar

denervation with electrocautery compared with no denervation in TKA.⁴⁰ In our study we therefore performed patelloplasty with circumpatellar denervation and observed that postoperative knee ROM, VAS, KSS, WOMAC and Feller patellar score were significantly better in the denervation group. These findings indicate that patellar denervation by diathermy decreases AKP and improves clinical outcome after TKA without patellar resurfacing. Limitations in our study are small sample size, patients operated by multiple surgeons, use of different implant designs and short follow-up duration.

CONCLUSION

There is a statistically significant difference between final outcome of patients who underwent patella denervation using circumpatellar diathermy and those without denervation with respect to AKP among patients who have undergone TKA. Further larger long-term prospective comparative series are needed to support these results.

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Ethical approval: The study was approved by the institutional ethics committee

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