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A Study Of Surgical Management Of Closed Fractures Of Patella

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ABSTRACT

Aims and Background: Patella fractures are common in Orthopaedic practice and it comprises about one percent of all traumatic injuries of bone. Inadequate or improper management of the patella fractures will leads to disability. Surgical management of patella fractures were shifted from patellectomy to reconstruction, preservation and restoration of extensor mechanism. The functional outcome studies of closed fractures of patella were few and not studied extensively. The purpose of this study was to analyse the functional outcome of surgical management of closed patella fracture.

Methodology: This prospective observational study was carried out on 30 patients. All the adult patients with closed transverse, comminuted, polar patella fractures were included in this study while the open patella fracture and patella fracture associated with femoral condyle, tibial plateau fractures were excluded. All patients underwent various surgical management depends on the fracture pattern and the modified Bostman score was used for assessing the functional outcome.

Results: The average age in this study was forty years. Among 30 patients, ten patients were women and twenty patients were men. Majority of fractures (60%) were due to road traffic accident with large percentage of transverse patella fractures (66.6%), and more involvement of left side (73%). The average duration for radiological union was 8 weeks. 90% of patients gave excellent to good results and 10% of patients gave fair results.

Conclusions: Our prospective study concluded that closed patella fractures treated by surgical management gave good to excellent functional results in enormous percentage of patients with minimal complications.

Keywords: *Patella fracture, Tension band wiring, Partial patellectomy, Functional outcome, Bostman score*

1. INTRODUCTION

Patella is the largest sesamoid bone in our body and it has thickest articular cartilage. Patella is the most important structure in improving the quadriceps efficiency by increasing the mechanical leverage of quadriceps. The extensor mechanism includes the quadriceps muscle which inserts at the superior pole of patella and the patellar tendon starts from the inferior pole which inserts in to the tibial tuberosity. Among all traumatic injuries of bone, patella fractures constitute about one percent[1,2]. It can happen either by direct injury to patella by self fall or indirect injury to patella by road traffic accident[1,2]. Due to subcutaneous location of patella and strong quadriceps contraction, results in direct and indirect patella fractures respectively, thus disrupts the extensor mechanism. Most of the transverse patellar fractures are due to sudden contraction of quadriceps by indirect forces and also associated with extensor retinaculum tear. Alternatively, communited or stellar patella fractures are due to direct impact and usually retinaculum will be intact. If the patients were able to do active straight leg raising test in the presence of patellar fractures, then it may be due to intact extensor mechanism. Loss of joint congruity or displacement of fracture fragment greater than 3 mm warrants surgical management[3,4]. There are various operative management for patellar fractures like cerclage wiring, modified tension band wiring with or without extensor retinaculum repair, partial patellectomy with patella tendon repair and total patellectomy with patella tendon repair, but the recent trends moving towards reconstruction of extensor mechanism. Eventhough, there are so many studies on patella fractures, the

functional outcome studies were less and not studied extensively. So we aimed to assess the functional outcome by using modified Bostman score in patients who underwent operative management for the closed fractures of patella.

2. METHODOLOGY

A prospective observational study was conducted on a set of thirty patients. In this study, all skeletally mature patients with closed patella fracture (transverse, comminuted, polar fractures) were included. Patients with open patella fracture and patella fracture in association with femoral condyle fracture and/or tibial plateau fractures were excluded. All patients underwent various opeartive management like modified tension band wiring with or without extensor retinaculum repair, circlage wiring, partial patellectomy/ inferior polectomy with patella tendon repair, depends on the fracture pattern of particular patients. Modified Bostman score (including both objective assessment and subjective assessment) was used to assess the functional outcome at the end of six months.

Sample size estimation

The sample size was calculated by using the data in the medical record department in our institute. In an average, two skeletally mature patients with closed patella fracture were reported in the orthopaedic department every month. So the initial thirty patients who satisfied the study criteria were considered for this study.

3. PROCEDURE

Once the patient was admitted, details like demographic data, mode of injury, side of injury and duration were recorded. Preoperative work-up for surgery was done and anaesthetic fitness was obtained. All the patients were operated within one week of admission. Meanwhile, knee was aspirated and cylinder slab was applied. All patients were kept under oral antibiotics till the day of surgery. On the day of surgery, under parenteral antibiotic coverage, in supine position, with or without tourniquet, longitudinal incision in midline was made for all the patients. Then extensor retinaculum was examined for tear, fracture site hematoma was removed and the fracture pattern assessed for comminution. In case of transverse fractures, fracture fragments were reduced and fixed with two 2 mm k-wires parallel to each other, which were driven from inferiorly to exit at the proximal fragments. Both the k-wires were bent proximally and then pulled from the distal ends of the k-wire, so that the bent end will come close to the bone. Then bent ends were cut and the distal ends were cut without bending. Reduction of articular surfaces were assessed by palpating the articular surface through the torn retinaculum or by making a rent on lateral aspect of joint. Then 18 gauge stainless steel wire used over the k-wires to compress the fracture site in a figure of eight fashion. Stainless steel wire was buried into quadriceps after tensioning in the lateral aspect. In case of comminuted or stellate patella fracture, 18 gauge stainless steel wire was used for encirclage around the patella and buried into quadriceps after tensioning in the lateral aspect. In case of small polar fractures or comminuted inferior pole fractures, the fracture fragments were removed while preserving the large articulated portion of patella and the patella tendon was repaired with ethibond sutures without tilting of the proximal fragment. For all patients, if the retinaculum is torn, it was repaired by using No.1 vicryl. Stability of the fracture site and patella tendon repair integrity were checked by knee flexion and extension. Thorough wound wash was given and the wound was closed in layers with a drain. Then sterile dressing was applied.

Fig 1: Transverse patella fracture with extensor retinaculum tear

Fig 2: Modified tension band wiring with extensor retinaculum repair

Postoperative rehabilitation

Immediately after surgery, posterior cylinder slab in knee extension was applied to all patients. Static quadriceps exercises, leg raising with slab, ankle pump exercises and full weight bearing started on second postoperative day with cylinder slab. Patients who underwent tension band wiring were advised to do static and dynamic quadriceps strengthening exercises from third post-operative day. Patients who underwent encirclage and partial patellectomy were advised to do static quadriceps exercises. At the end of six weeks, once the radiological union was confirmed, dynamic exercises were initiated. Suture removal was done at the end of two weeks and cylinder slab was replaced with long knee immobilizer. Patients were allowed for ambulation with crutches till active muscular control of the leg. Active knee ROM exercises were started after three weeks and progressive resistance exercises were started after 6 to 8 weeks, once the knee brace was discontinued.

Follow-up

Patients were reviewed for every two weeks for the first month and then advised to visit monthly. At every follow-up, both objective assessment and subjective assessment were done. This included knee range of motion, extensor lag, quadriceps efficiency, thigh circumference, knee effusion and pain, giving way or any slipping sensation of knee, ambulation with use of walking aid like crutches or walker, climbing stairs, squatting.

Table 1: Modified Bostman Score

Modified Bostman Score		
Variables		**Points**
Pain	None or pain on minimal on exertion	6
	Pain on moderate on exertion	3
	Pain in daily activity	0
Range of movement (ROM)	Full extension with flexion >120 degree or While comparing with normal side, ROM loss should be within 10 degree of the normal side	6
	Full extension with ROM between 90 and 120 degree	3
Quadriceps atrophy, difference of	<12 mm	4

circumference of thigh 10 cm proximal to the patella	12 to 25 mm	2
	>25 mm	0
Walking Aids	Not using crutches	4
	Crutches usage- part of the time	2
	Crutches usage- all the time	0
Work	Doing original job	4
	Doing different job because of the fracture	2
	Not able to work	0
Giving way/ Slipping sensation	None	2
	Sometimes	1
	In daily life	0
Climbing stairs	Climbing stairs normally	2
	Climbing stairs - Disturbing	1
	Climbing stairs - Disabling	0
Knee effusion	None	2
	Reported to be present	1
	Present	0
Total score	Excellent	30 to 28
	Good	27 to 20
	Fair / Unsatisfactory	<20

4. RESULTS

In this study, among thirty patients, twenty patients (66.6%) were men and ten patients (33.3%) were women with the patients age ranges from eighteen to seventy years. 7% (2) patients were less than 20 years, 10% (3) patients were more than 60 years and remaining 83% (25) patients falls under twenty to sixty years category. This study shows high incidence on left sided fractures (73%) than right side (27%). Indirect trauma by road traffic accident is the main cause of injury and it accounts for 60% of patella fractures and remaining 40% occurred due to self fall. Out of thirty patients, twenty patients (66.6%) had transverse patella fractures, four patients (13.3%) had stellate or comminuted fractures and six patients (20%) had polar fractures. In this study, 80% of patients underwent osteosynthesis either by modified tension band wiring technique or encirclage technique and achieved radiological union for 12% patients by the end of four weeks, 80% patients by the end of eight weeks and 8% patients by the end of twelve weeks. The average time taken to achieve radiological union was eight weeks. 86% of patients had persistent pain at four weeks follow-up, which was declined to 33% at eight weeks and 10% at twelve weeks. Out of thirty patients, seventy percent patients gave excellent results, twenty percent gave good results and ten percent gave fair results.

Table 2: Complications

Complications	**Patients**	**Remarks**
Restriction of flexion (terminal flexion of 20 degree)	3	Physiotherapy (2 patients improved, 1 patient did not improve even after six months).
Extensor lag (10 degree)	2	1 patient reported in partial patellectomy and another in encirclage

Superficial infection	2	Completely subsided after parenteral antibiotics and regular dressing
Hardware prominence	1	Occurred in TBW procedure at 6 months follow-up and the implant was removed due to persistent pain.
Hardware breakage	0	
Migration of k wire	0	
Ossification of tendon	0	
Osteoporosis	0	

5. DISCUSSION

Patella fractures constitutes about one percent of all skeletal injuries. Often these patella fractures results in operative management with various techniques like osteosynthesis with or without extensor retinaculum repair, inferior polectomy or partial patellectomy with patella tendon repair and total patellectomy with patella tendon repair, depends on the fracture pattern. In this prospective observational study, thirty patients with closed patella fractures were operated by either osteosynthesis (tension band wiring or encirclage) or partial patellectomy. Modified Bostman score (including both objective assessment and subjective assessment) was used to assess the functional outcome at the end of six months.

In this study, the average age was forty years which was comparable to studies by Bostman O et al[5] and Levack et al[6], where the average age was forty-two years and forty-nine years respectively. Left sided patella fractures (73%) were more than right sided (23%) patella fractures which was comparable with the study given by Maini PS et al[7], where left sided fractures were more. This indicates that non-dominant side (left side) was more vulnerable. The incidence of patella fractures were more in men (66.33%) than women (33.33%), which was comparable to the study by Wilkinson J [8] , where 68% were men and 32% were women. Similarly, the study conducted by Maini PS et al[7]and Srinivasulu K et al[9] also noted more male predominance as 75% and 81.8% respectively. This reflects men were more exposed to traumatic injuries.

Indirect trauma by road traffic accident was the main etiology of injury in this study and accounts for sixty percent of patella fractures and remaining forty percent of patella fractures were due to self fall by direct trauma. Studies by Pandit,Shah[10] and Wolfgang G Burke F, Bush D[11] also reflected high percentage of indirect trauma as eighty percent and ninty-three percent respectively.

In this study, all patients underwent osteosynthesis had achieved union within three months. The average time taken to achieve radiological union was eight weeks. Complications like non-union, hardware breakage were not reported.

80% patients had grade 5 quadriceps strength and remaining 20% patients had grade 4 quadriceps strength. Both osteosynthesis and partial patellectomy patients had same quadriceps strength due to preservation of large patella fragment which in turn preserves the biomechanics. But the best results were given by patients treated with modified tension band wiring technique. In 1984, Srinivasulu K et al[9] conducted a study in which 93% of patients had normal quadriceps power. Also, the study done by Jakobsen et al[12] in 1985 and Edwards et al[13] in 1989 reported that quadriceps power were reduced upto 33% and 44% respectively. In this study three patients had limitation of terminal twenty degree of flexion, whereas the study conducted by Srinivasulu K et al[9] had full range of movements in all patients.

The functional outcome results were categorized according to the modified Bostman criteria. Out of thirty patients, seventy percent patients had excellent results, twenty percent had good results and ten percent had fair results.

Table 3: Comparison of functional outcome of this study with other studies.

Serial No	Study	Total patients	OUTCOME		
			Excellent	Good	Fair
1	This study	30	70%	20%	10%
2	Marya SK[3]	30	80%	13.33%	6.33%
3	Liang et al[14]	27	88.88%	7.40%	3.7%
4	Levack et al[6]	14	50%	35.71%	14.28%

6. LIMITATION OF THE STUDY

Short-term follow-up and the small number of samples were the significant drawbacks to this research.

7. CONCLUSION

Our prospective study concluded that closed patella fractures treated by surgical management gave good to excellent functional results in enormous percentage of patients with minimal complications.

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