

# Management of comminuted extraarticular inferior pole patella fractures with partial patellectomy and patellar tendon repair by transosseous sutures

Konchada Srikant, Debasish Mishra, Vijoy Kumar Sinha, Sandeep Pradhan

Department of Orthopaedics, Kalinga Institute of Medical Sciences, KIIT University, Bhubaneswar, Odisha, India

Correspondence to: Debasish Mishra, E-mail: drdmishra@gmail.com

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## ABSTRACT

**Background:** Lower pole patella fractures are not uncommon and are often comminuted and not amenable to traditional fixation methods as difficult to reduce and fix. Optimal method of treatment is still debatable. We present the results of managing such cases with the technique of partial patellectomy and patellar tendon repair by transosseous sutures. **Objective:** To evaluate the outcome of comminuted inferior pole fractures of patella treated with partial patellectomy and patellar tendon repair by transosseous sutures. **Materials and Methods:** In this prospective study between February 2014 and July 2016, we treated 12 patients, 10 were male and 2 were female. Postoperatively, knee was immobilized in knee brace with no flexion in 1<sup>st</sup> week; every next week then knee flexion was increased in the increments of 30 degree till 4 weeks postoperative. Quadriceps strengthening was then encouraged. **Results:** Outcome at final follow-up was assessed with Bostman scoring system. Average Bostman score was 25.6. Excellent results were seen in 67% cases. One patient had an episode of superficial infection. There were no reports of rerupture and all patients returned to their pre-injury activity level. **Conclusion:** Partial patellectomy and patellar tendon repair using transosseus sutures is very effective method in the management of comminuted extraarticular inferior pole patella fractures which are not normally amenable to conventional fixation methods. It is simple and easier to perform with producible excellent results with no hardware related complications. Further studies are required to validate this technique with larger sample size and controls.

**KEY WORDS:** Inferior Pole Patella; Comminuted; Transosseous; Partial Patellectomy; Patellar Tendon


## INTRODUCTION

The patella forms an important constituent of the extensor mechanism of knee by increasing its lever arm.<sup>[1]</sup> It is the largest sesamoid bone<sup>[2]</sup> and its fracture accounts for approximately 1% of all fractures in adults.<sup>[3]</sup> Either a direct or indirect mechanism leads to the fractures of patella. High level of distraction forces along patella bone

makes it a surgical challenge thus extensor mechanism, articular congruity should be restored for early and better outcome.<sup>[4]</sup>

Lower pole patella fracture constitutes 9-22% of operated cases of patella fractures.<sup>[5]</sup> Lower pole fractures of patella are commonly avulsion injury due to unexpected sudden flexion of knee joint against a violent contraction of the quadriceps muscle. They are classified as separate entity in most of the classifications described for fractures of patella. In AO-ASIF system of classification they are classified as 34-A1.<sup>[6]</sup>

They are often comminuted and treatment becomes difficult to reduce and fix and ideal treatment has not yet been identified.<sup>[7]</sup> Various methods have been advocated for

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the management these fractures ranging from excision of lower pole with patellar tendon repair to various forms of internal fixation.<sup>[8]</sup> Treatment goal of any modality should be restoring extensor mechanism and early mobilization. This article aims to highlight our experience of managing 12 cases of comminuted lower pole avulsion fractures with traditional method of partial patellectomy with patellar tendon repair by transosseus sutures as there is not much of published data.

## MATERIALS AND METHODS

This prospective study was undertaken between February 2014 and July 2016. 12 patients were operated during this period and considered for the study who met the inclusion criteria. Inclusion criteria were comminuted lower avulsion patella fractures, age 18-60 years, closed injury. Exclusion criteria were open injuries, ipsilateral lower limb other bone fractures. All were operated with the same technique of partial patellectomy with patellar tendon repair by transosseus sutures by a single surgeon at our hospital.

### Operative Technique

All patients were operated under spinal anesthesia with tourniquet on. A standard midline longitudinal incision from superior pole of patella to tibial tuberosity was given. After rising flaps fracture ends, torn retinaculum (if any) and patellar tendon were exposed. Saline irrigation was done to clear hematoma and clots. Loose and small pieces of bone of lower pole were removed. Any big chunk of bone if attached to patellar tendon was preserved for better healing of tendon-bone repair. Using non-absorbable suture (Polyester No. 2) tied to patellar tendon in krackow fashion in its central, medial, and lateral ends, three pairs of these sutures were raised. Needles of respective suture are removed. Using a long 2 mm smooth pin with one end sharp and other end having an eye is drilled into the proximal bone in its central, medial, and lateral thirds. The drill was made just anterior to articular surface of proximal fragment and parallel proximally directed. This pin acted as both drill bit and a suture passer, and the respective pair of sutures were taken through bone to the upper pole. All were tied together with knot with knee in hyperextension so that the tendon margin is opposed to the bone (Figures 1-6). Any torn retinaculum was repaired with absorbable sutures. On table Knee flexion was checked and to see if any gaping of the repair. The wound was closed in layers in standard manner and a long knee brace was applied.

Postoperatively, knee was immobilized in easily removable long knee brace. Static quadriceps strengthening and ankle pumping exercises were taught to do from post-operative day 1. They were allowed to walk only with brace on. Sutures were removed in 2 weeks. Knee bending was avoided till 1<sup>st</sup> week. Every next week then knee flexion was increased in the increments of 30 degree. At the end of 4 weeks, with 90 degree flexion brace



**Figure 1:** Intraoperative image showing comminuted lower pole avulsion fracture of patella



**Figure 2:** Polyester No. 2 (nonabsorbable) tied to patellar tendon in krackow fashion



**Figure 3:** Drill driven proximal directed just anterior to articular surface of proximal fragment

was removed and resistance quadriceps strengthening exercises were encouraged. Extensor lag if any were noted and quadriceps strengthening was stressed on. Postoperative rehabilitation was done under the guidance of a physiotherapist.

Patients were followed up for at least 6 months at 1<sup>st</sup>, 3<sup>rd</sup>, and 6<sup>th</sup> months. Demographic history, injury, time to surgery, range of movement, extensor lag, thigh circumference, radiographs, and any complications were recorded. Functional outcome of the patients were assessed using Bostman criteria

(Table 1),<sup>[9]</sup> and depending on the total score at final outcome were categorized into excellent, good, and unsatisfactory.

**RESULTS**

12 patients were operated during the study period, 10 were male and 2 were female and age range from 20 to 55 years. Right side patella was predominantly more injured than the left side. In majority of the cases, injury was fall. Average time to surgery was 2.17 days (Table 2). Average Bostman score was 26.5. 67%



**Figure 4:** Transosseous suture passed through proximal fragment



**Figure 5:** Three pairs of transosseous sutures



**Figure 6:** All sutures tied together getting good apposition of tendon with bone without any gap

**Table 1:** Bostman score<sup>[9]</sup>

Variable	n=74 (%)
<b>ROM</b>	
Full extension and the ROM>120° or within 10° of the normal side	<6
Full extension, movement 90°-120°	3
<b>Pain</b>	
None or minimal on exertion	6
Moderate on exertion	3
In daily activity	0
<b>Work</b>	
Original job	4
Different job	2
Cannot work	0
<b>Atrophy, difference of circumference of thigh 10 cm proximal to the patella</b>	
<12 mm	4
12-25 mm	2
>25 mm	0
<b>Assistance in walking</b>	
None	4
Cane part of the time	2
Cane all the time	0
<b>Effusion</b>	
None	2
Reported to be present	1
Present	0
<b>Giving way</b>	
None	2
Sometimes	1
In daily life	0
<b>Stair-climbing</b>	
Normal	2
Disturbing	1
Disabling	0
<b>Total score</b>	
Excellent	30-28
Good	27-20
Unsatisfactory	<20

ROM: Range of movement

**Table 2:** Patient details

Case No.	Sex	Age (years)	Side	Injury	Time to surgery (days)	Complication	Bostman score at final follow-up	Final outcome
1	M	33	R	Fall	2		28	Excellent
2	M	20	R	Sports	1		30	Excellent
3	M	30	L	Fall	3		26	Good
4	M	29	R	Fall	2		29	Excellent
5	F	55	R	Fall	2	Extensor lag 20 degree	20	Good
6	M	21	R	Fall	4		29	Excellent
7	M	47	L	RTA	2		30	Excellent
8	M	33	R	Fall	1		28	Excellent
9	M	37	L	Fall	2	Infection	17	Unsatisfactory
10	M	40	L	Fall	2		28	Excellent
11	F	53	R	Fall	2		23	Good
12	M	23	L	Sports	3		30	Excellent

**Table 3:** Outcome based on Bostman score

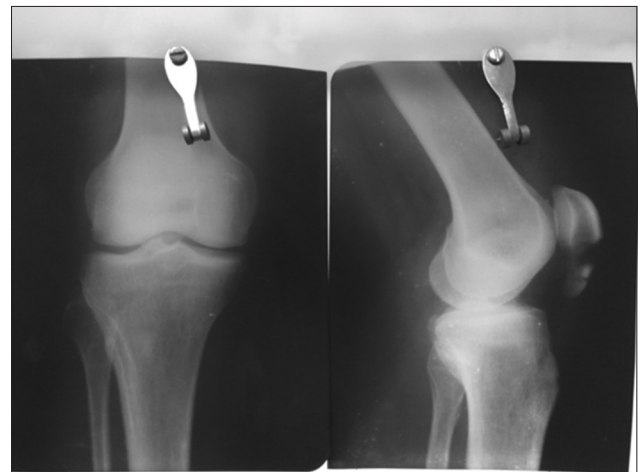
Outcome based on Bostman score	Number of cases (%)
Excellent	9 (67)
Good	2 (25)
Unsatisfactory	1 (8)

had excellent, 25% had good and 8% had unsatisfactory results (Table 3). One patient had an extensor lag of 20 degree. One patient had an episode of superficial infection with subsequent exposure of non-absorbable suture material which was trimmed off and later infection settled down. There were no reports of rerupture or suture pull out or patella baja during the entire study period. All patients returned to their pre-injury activity level and satisfied with procedure done (Figures 7-10).

**DISCUSSION**

Extensor mechanism of knee joint is very much crucial for standing erect and unassisted gait and for this patella plays an important role as lever arm and efficiently augmenting the quadriceps muscle.<sup>[2,10]</sup> Patella fractures if displaced needs surgical fixation to restore this extensor mechanism, to avoid patella femoral incongruity and for early rehabilitation.

9-22% of operated cases of patella fractures are of lower pole.<sup>[5]</sup> Lower pole fractures of patella are extraarticular, avulsion type and often comminuted which are not normally amenable to surgical fixation. With various methods described for treating such fractures none has yet been advocated as ideal method. There is a reoperation rate between 20% and 50% when inferior pole fractures are fixed with K-wires.<sup>[11]</sup> Even wiring and screw fixation do not offer any rigid fixation due to inherent weakness of bone and loose fragments when it is comminuted as in our study. In addition reported by Chang *et al.*, fixation usually fails and various metal implants are not able to hold before failure.<sup>[12]</sup>

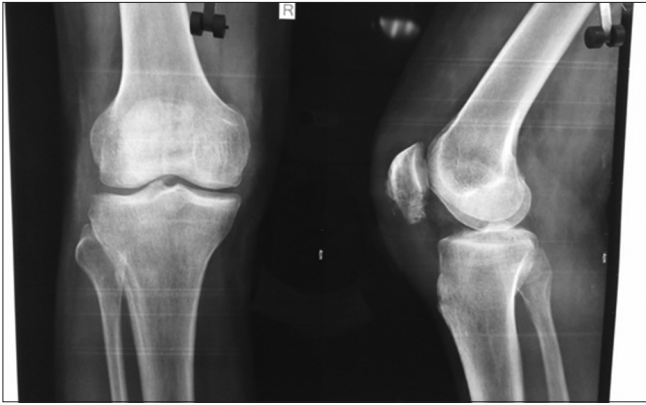


**Figure 7:** Pre-operative radiograph showing comminuted lower pole patella fracture



**Figure 8:** Immediate post-operative radiograph showing repair with intact bone fragment left untouched with tendon

Saltzman *et al.* advocated for partial patellectomy by excision of loose fragments and reattachment of patellar tendon with transosseus sutures in comminuted lower pole fractures.<sup>[13]</sup> In



**Figure 9:** At final follow-up radiograph, showing incorporation



**Figure 10:** At final follow-up showing full extension

partial patellectomy, the large proximal fragment with whole of articular cartilage is preserved without disturbing much of extensor mechanism in comparison to total patellectomy.<sup>[1]</sup> In the present study, we used the traditional method to treat the extraarticular comminuted inferior pole fractures with partial patellectomy with patellar tendon repair using transosseus sutures without risking for the loss of fixation with the use of hardware. There are reports of complications such as patella baja and reduction of patellar height leading to in efficiency of extensor mechanism after partial patellectomy but in our study, we did not find these complications.<sup>[14]</sup> We have used three pairs of braided non-absorbable polyester suture for transosseus fixation and on table full flexion achieved without any gaping, relying on this we have mobilized earlier unlike studies done by Kastelec *et al.* where average immobilization was 6.5 weeks postoperatively.<sup>[5]</sup>

Iqbal *et al.*<sup>[15]</sup> in their comparative study found that reattachment of patella tendon to patella showed better clinical results than open reduction and fixation with tension band wiring and our study results were at par with theirs. Veselko and Kastelec<sup>[16]</sup> in their study found that basket plate fixation gave better outcome compared to partial patellectomy in the management of comminuted inferior pole patella fractures by retaining inferior pole and earlier mobilization. Basket plate

is still not in regular use, not available in India and not an economical option for a country of low socioeconomic status.

A protective patello tibial wire has been advocated by few authors to protect the patellar tendon reattachment procedure but frequently breaks, can decrease the length of patellar tendon, and also requires additional procedure to remove once it serves its purpose.<sup>[17]</sup> Based on this, we did not use this protective wiring and thus avoided possible complications. The site of attaching patellar tendon to the proximal remnant bone is also controversial some are advocating to attach near articular cartilage and some near to anterior cortex.<sup>[18]</sup> We chose to attach the patellar tendon closer to articular surface as there is better healing rate in cartilage to tendon complex as reported by Lu *et al.* in their study.<sup>[19]</sup> In our study, we also retained any bone piece attached to tendon while reattaching for better incorporation and it did as shown in the follow-up radiographs.

In our study, 92% of the patients operated had good-to-excellent outcome. Key to this were 3 pair strong suture transosseus fixation, preservation of any bone piece attached to the avulsed ligament, early mobilization; hence, restoring extensor mechanism more efficiently. The technique is very easy and there is no use of any hardware; hence, no complications related to it. Limitations of the study were relatively small sample size, absence of controls.

## CONCLUSION

Partial patellectomy and patellar tendon repair using transosseus sutures is very effective method in the management of comminuted extraarticular inferior pole patella fractures which are not normally amenable to conventional fixation methods. It is simple and easier to perform with producible excellent results with no hardware-related complications. Further studies are required to validate this technique with larger sample size and controls.

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