

Treatment of Comminuted Fracture of the Inferior Pole of Patella Using Encirclage and Patellar Tendon Repair Using Transosseous Sutures” – A Prospective Study of 20 Cases

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Abstract

Objective: The objective of the study was to evaluate the functional outcome of comminuted extra-articular inferior pole fractures of patella treated with patellar encirclage and patellar tendon repair by transosseous sutures.

Materials and Methods: In this prospective study between November 2018 and January 2020, we treated 20 patients with this method for inferior pole patella fractures, 14 were male and 6 were female. Postoperatively, the knee was immobilized in a knee brace with quadriceps strengthening advised. Flexion is restricted in the first 2 weeks; then, every week, the knee flexion was increased in 20–30°/week till 6 weeks postoperatively. Later, after 6 weeks, knee flexion is increased furthermore.

Results: Results at final follow-up were assessed using Bostman scoring system. Average Bostman score was 25.6. Excellent results were seen in 65% of cases. Two patients had an episode of superficial infection. There were no reports of other complications and almost all patients returned to their pre-injury activity level.

Conclusion: Patellar encirclage and patellar tendon repair using transosseous sutures are a very effective method in the management of comminuted extra-articular inferior pole patella fractures which are not normally amenable to conventional fixation methods. It is simple and easy to perform with reproducible excellent results with no hardware-related complications. Further studies are required to validate this technique with a larger sample size and controls.

Keywords: Inferior pole patella; Comminuted; Transosseous; Patellar tendon repair.

Introduction

The patella forms an important constituent of the extensor mechanism of the knee by increasing its lever arm [1]. It is the largest sesamoid bone [2] and its fracture accounts for approximately 1% of all fractures in adults [3]. It can be fractured by either a direct or indirect mechanism that leads to the fractures of the patella. Increased level of distraction forces along the patella bone longitudinal axis makes it a surgical challenge thus extensor mechanism, articular congruity should be restored for an early and better outcome [4]. Lower pole patella fracture

comprises 9–22% of total cases of patella fractures [5]. Lower pole fractures of the patella are more commonly avulsion injury due to unexpected sudden flexion of knee joint against a violent contraction of the quadriceps muscle. These are not grouped under the regular anatomical classification of patella fractures. In the AO-ASIF system of classification, they are classified as 34-A1 [6].

They are more often comminuted and treatment becomes difficult during reduction and fixation, and ideal treatment has not yet been identified [7]. Many methods have been advocated for the management of these fractures ranging from excision of the lower pole with patellar tendon repair to various forms of internal fixation [8]. The main goal of the treatment of any modality is to restore the normal extensor mechanism and early mobilization. The

study aims to show our experience of operating 20 cases of comminuted lower pole avulsion fractures with the traditional method of patellar tendon repair by transosseous sutures and encirclage as a newer method of fixation of these kinds of fractures without excising the inferior pole.

Materials and Methods

This prospective study was conducted in our institute between November 2018 and January 2020. Twenty patients were operated during this period and considered for the study who met the inclusion criteria. Fourteen were male and six were female. Most of them were indirect injuries, four were due to direct injury due to fall. Inclusion criteria were comminuted lower pole avulsion patella fractures, age 20-55 years, closed injuries. Exclusion criteria were open injuries,

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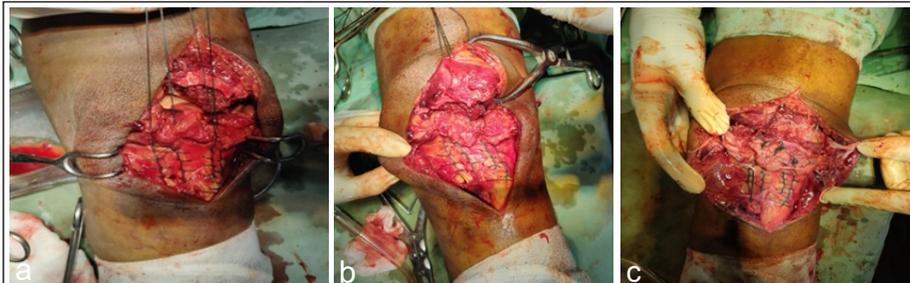


Figure 1: (a) Ethibond no. 5 (non-absorbable) tied to patellar tendon in Krakow fashion. (b) Transosseous suture passed through proximal fragment of patella. (c) All sutures tied together getting good apposition of tendon with bone without any gap.

quadriceps, or patellar tendon mid-substance ruptures ipsilateral lower limb other bone fractures. All were operated with the same technique of patellar encircage with patellar tendon repair by transosseous sutures without excision at our institute.

Operative Technique (Fig. 1)

All patients were operated under spinal anesthesia with Esmarch tourniquet applied to mid-thigh. A standard midline longitudinal incision from the superior pole of the patella to tibial tuberosity was given. After rising flaps, fracture ends are exposed. The torn patellar retinaculum if present and patellar tendon were exposed. Saline irrigation was done to clear hematoma and clots. Loose and small pieces of bone of the lower pole were removed. Any small chunk of bones

attached to the patellar tendon were preserved for better healing of tendon-bone repair due intact blood supply and only free lying fragments are removed. Using non-absorbable suture (Ethibond No. 5) tied to the patellar tendon in Krakow fashion in its central, medial, and lateral ends, three pairs of these sutures were raised. Needles of the respective suture are removed from the proximal aspect of the distal fragment.

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 hole was made just anterior to the articular surface of the proximal fragment and parallel proximally directed. This pin acted as both drill bit and a suture passer, and these pairs of sutures were taken through bone to the upper pole. All were

tied together with knots with the knee in hyperextension so that the tendon margin along with attached fractured fragments was opposed to the bone. Encircled with SS wire. Any torn retinaculum was repaired with absorbable sutures to prevent future instability. On the table, knee flexion was checked and to see if there was any gaping of the repair. The wound was closed in layers in a standard manner and a long knee brace was applied.

Postoperatively, the 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 a brace applied to the operated knee. Sutures were removed in 2 weeks. Knee bending was avoided till the 2nd week. Thereafter, every week, the knee flexion was increased in the increments of 20–30°. At the end of 6 weeks, with 90° flexion, the brace was removed and resistance quadriceps strengthening exercises were encouraged. Extensor lag if any was noted and quadriceps strengthening was advised. Post-operative rehabilitation was done under the guidance of a physiotherapist.

Patients were followed up for at least 6 months at the 1st, 3rd, and 6th months with a radiograph and clinically assessed (Fig. 2) for improvement. Demographic history, injury, time to surgery, range of movement, extensor lag, thigh circumference, radiographs, and any complications were recorded. Functional outcome of the patients was assessed using Bostman criteria (Table 1) [9] and depending on the total score at outcome was categorized into excellent, good, and unsatisfactory (Table 2 and Fig. 3).

Results

Twenty patients were operated on during the study period, 14 were male and 6 were female and age range from 20 to 55 years. The right-sided patella was

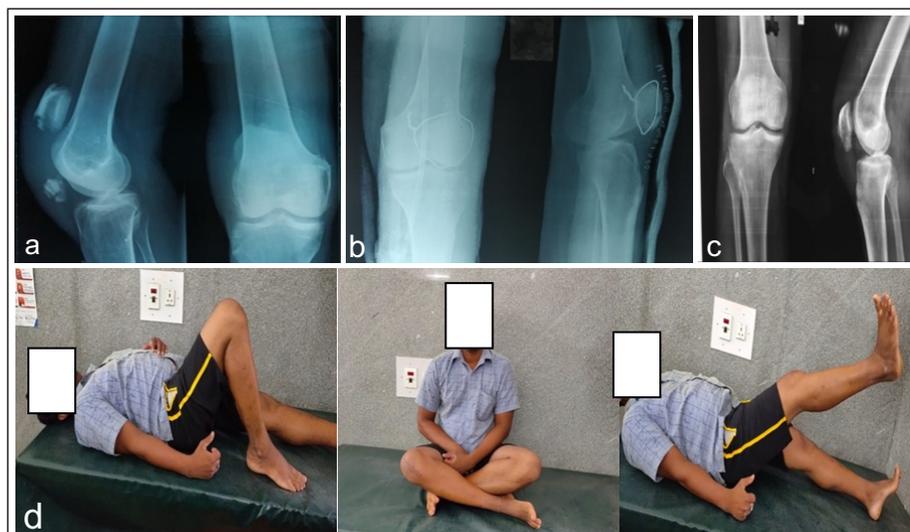


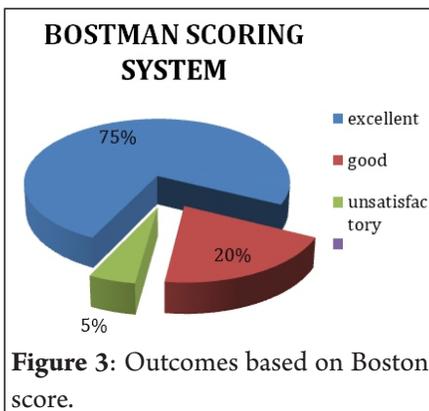
Figure 2: (a) Pre-operative X-ray. (b) Immediate post-operative X-ray. (c) Six months post-operative X-ray after SS wire removal. (d) Six months post-operative range of motion.

Table 1: Boston score [9].

Table 1: Boston score ⁽⁹⁾	
Variable	n=74 (%)
ROM	
Full extension and the ROM >120° or within 10° of the normal side	<6
Full extension, movement 90°-120°	3
Pain	
None or minimal on exertion	6
Moderate on exertion	3
In daily activity	0
Work	
Original job	4
Different job	2
Cannot work	0
Atrophy, difference of circumference of thigh 10 cm proximal to the patella	
<12 mm	4
12-25 mm	2
>25 mm	0
Assistance in walking	
None	4
Some part of the time	2
Some all the time	0
Effusion	
None	2
Reported to be present	1
Present	0
Giving way	
None	2
Sometimes	1
In daily life	0
Stair-climbing	
Normal	2
Disturbing	1
Disabling	0
Total score	
Excellent	30-28
Good	27-20
Unsatisfactory	<20

Table 2: Outcome based on Bostman score.

Outcome based on Bostman score	Number of cases (%)
Excellent	15 (75)
Good	4 (20)
Unsatisfactory	1 (5)



predominantly more injured than the left side in our study. In the majority of the cases, the injury was a fall. Average time to surgery was 3–5 days. Average Bostman score was 26.5. About 75% had excellent, 20% had good, and 5% had unsatisfactory results (Table 2). One patient had an extensor lag of 20°. 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. Only one case of Ethibond suture material in the tendon causing pain in the knee and foreign body sensation was noted, which was later excised at 6 months follow-up and the patient got relieved of that pain. All patients returned to their pre-injury activity level and were satisfied with the procedure done.

Discussion

Extensor mechanism of the knee joint is very much important for standing straight and unassisted gait and for this, patella plays an important role as a lever arm and efficiently augmenting the quadriceps muscle [2, 10]. Patella fractures if displaced need surgical fixation to restore this extensor mechanism, to avoid patella femoral incongruity and for early rehabilitation. About 9–22% of operated cases of patella fractures are of the lower pole [5]. Lower pole fractures of the patella are extra-articular, 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 an ideal method. There is a failure rate of 30–40% when inferior pole fractures are fixed with K-wires and SS wires [11].

Even wiring and screw fixation do not offer any rigid fixation due to the inherent weakness of cancellous bone of comminuted inferior pole patella, which cannot be held rigidly by a screw or wire, we have chosen this technique for comminuted inferior pole patella fractures. Besides reported by Chang et al., fixation usually fails and various metal implants are not able to hold before failure [12]. Saltzman et al. advocated for partial patellectomy by excision of loose fragments and reattachment of the patellar tendon with transosseous sutures in comminuted lower pole fractures [13]. In partial patellectomy, the large proximal fragment with the whole of articular

cartilage is preserved without disturbing much of the extensor mechanism in comparison to total patellectomy [1]. In the present study, we used the traditional method to treat the extra-articular comminuted inferior pole fractures with cerclage of the patella and patellar tendon repair using transosseous 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 inefficiency of extensor mechanism after partial patellectomy, but in our study, we did not find these complications [14].

We have used three pairs of braided non-absorbable ethibond number 5 suture for transosseous 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 [5]. Iqbal et al. [15] in their comparative study found that reattachment of patellar 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 [16] 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 an 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 patella tibial wire has been advocated by a few authors to protect the patellar tendon reattachment procedure but frequently breaks can decrease the length of the patellar tendon and also require an additional procedure to remove once it serves its purpose [17].

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 [18]. We chose to attach the patellar tendon closer to the articular surface as there is better healing rate in cartilage to tendon complex as reported by Lu et al. in their study [19].

In our study, we also retained any bone piece attached to the tendon while reattaching for better incorporation and it did as shown in the follow-up radiographs. In our study, 95% of the patients operated had a good-to-excellent outcome. Key to this was two

pair strong suture transosseous 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 the use of minimal hardware; hence, no complications related to it. Limitations of the study were relatively small sample size and absence of controls.

Conclusion

Patella encircage and patellar tendon repair using transosseous sutures are a very effective method in the management of comminuted extra-articular 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 very less hardware-related complications. Further studies are required to validate this technique with a larger sample size and controls.

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