

Original Research Article

A prospective study of 50 cases of patella fractures treated with different modalities

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ABSTRACT

Background: Fractures of patella account for 1% of all skeletal injuries. There is no universal accepted treatment for patellar fractures. After a fracture of the patella, the best results are obtained by accurate reduction and stable internal fixation. Partial or total patellectomy is generally indicated when the patella is so severely comminuted that an accurate reduction and reconstruction of the retropatellar joint surface cannot be achieved.

Methods: The prospective study of 50 cases of patellar fractures was carried out at the department of orthopaedics for the period from May 2015 to December 2017. The maximum period of follow up was 18 months with a minimum period of follow up of 5 months (average 11.68 months). Operative treatment was done in patella fractures for more than 2 mm of articular displacement or 3 mm of fragment separation. Surgical options includes internal fixation with tension band wiring with k wire and partial patellectomy with extensor mechanism repair.

Results: We have studied 50 patients where 7 cases were treated conservatively. In the present series 22 patients were treated with internal fixation out of which 13 patients had excellent results. 6 patients had good results. 21 patients were treated with partial patellectomy where 6 patients had excellent results, 11 patients had good and 4 patients had fair results.

Conclusions: Patella should be preserved and Osteosynthesis whenever possible has better chance for excellent results. A good surgical technique, optimal operation room environment and judicious use of antibiotics will reduce the possibility of infection.

Keywords: Patella fracture, Internal fixation, Partial patellectomy, Tension band wiring

INTRODUCTION

Patellar injuries are usually caused while a person stumbles or falls on a flexed knee when the forces from the extensor mechanism exceed the intrinsic strength of patella. As the bony failure precedes, it coincide or pursue injury to medial and lateral expansions of quadriceps mechanism by the pull of the muscles.¹ Inability of the patient to extend the affected knee actively usually indicates a disruption of the extensor mechanism and a torn retinaculum, which require surgical treatment.

There is a huge and paradigm of changes in treatment of fractures of patella. it has been taken place from ancient medicine to currently evolving surgical techniques.²⁻⁵ Degenerative changes on the femoral articular surface were described by Cohn and Kelly et al after patellectomy in a rabbit model.⁶⁻⁷

After a fracture of the patella, the best results are obtained by accurate reduction and stable fixation, probably by tension band wiring.⁸ A combination of circlage wiring and screw fixation are the most accepted techniques for stabilisation of transverse and less comminuted as well as

marginal patella fractures. Partial or total patellectomy is generally indicated when the patella is so severely comminuted that an accurate reduction and reconstruction of the retropatellar joint surface cannot be achieved.⁹

The conservative treatment can be opted if the extensor mechanism is functioning as some non-displaced fractures, fractures in which the articular gaps are lesser than 2 mm and fractures in which deviated fragments are lesser than 3 mm. When these conditions cannot be satisfied, the surgical treatment should be recommended.¹⁰

METHODS

The prospective study of 50 cases of patellar fractures was carried out at the Department of Orthopaedics at NHL Municipal Medical College, Ahmedabad for the period from May 2015 to December 2017. The maximum period of follow up was 18 months with a minimum period of follow up of 5 months with average period of follow up 11.68 months.

Inclusion criteria

In our study inclusion criteria were isolated patella fracture; adult patient (skeletally mature).

Exclusion criteria

Exclusion criteria were associated periarticular tibial or femoral condyle fractures; skeletally immature patient; old malunion/nonunion of patella.

All patients were treated as indoor patients and clinically examined thoroughly. The continuity of the quadriceps mechanism was evaluated. Whether patient could do active extension of the knee was judged. Radiographs of the injured knee were taken in anteroposterior and lateral projection after x rays a posterior plaster slab was given.

Routine lab investigations were done. Rontegenograms were evaluated for fracture pattern, displacements and comminution. All fractures were classified according to the fractures morphology and skin condition. Open fractures were treated as emergency. All patients were operated as the earliest, when fit for anaesthesia.

Conservative treatment

Undisplaced fractures with intact extensor mechanism with fragment separation of less than 3 mm and articular step off less than 2 mm were managed non-operatively. If haemarthrosis was painful and tense, it was aspirated under total aseptic conditions followed by application of posterior plaster of paris slab or cast from just above the ankle joint to the upper third thigh for 3-4 weeks. Static quadriceps exercise was started. Weight bearing was started as patients tolerated with knee in extension. Patients were discharged with in two days.

Operative treatment

Operative treatment was done in patella fractures for more than 2 mm of articular displacement or 3 mm of fragment separation. Operative treatment was done in transverse two part fractures with displacement, comminuted fractures with disruption of the articular surface. An informed written consent was taken before surgery. All the patients were operated in supine position under anaesthesia. All patients were operated by straight midline incision under tourniquet.

Surgical options include the following:

1. Internal fixation [tension band wiring with k wire].
2. Partial patellectomy with extensor mechanism repair

Internal fixation [tension band wiring with k wire]

Tension band wiring was done for patella fracture which has two part transverse or multiple fragment fractures with large fragments which would be converted to two part by screw fixation and minimal comminution with more than 2 mm of articular step off and more than 3 mm of articular separation.

- With the drill two-2 mm Kirschner wires were drilled from inferior to superior fragment.
- The wires were placed 5 mm deep to the anterior surface of the patella along the lines dividing the patella into medial, central and lateral thirds.
- The wires were inserted as parallel as possible.
- After accurate reduction of the fracture wires were driven into the distal fragment.
- The reduction was checked under image intensifier intraoperatively and also clinically by palpating the articular surface of the patella.
- A SS 18 gauge wire was passed transversely through the quadriceps tendon attachment as close to the bone as possible, deep to the protruding wires then over the anterior surface of the reduced patella, transversely through the patellar tendon attachment on the inferior fragment and deep to the protruding wires, then back over the anterior patellar surface, then was tightened into a figure of 8 fashion with knot made at proximal pole of the patella and the knot was buried in the soft tissue to prevent irritation and to prevent bursa formation.
- Wires ends were bent acutely and were cut short. Torn retinaculum were repaired.
- Hemostasis was obtained and wound was closed in layers over negative suction drain. A compression dressing and posterior plaster splint from just above the ankle was applied.

Partial patellectomy

Partial patellectomy and repair of extensor mechanism was done in a fractures that included severe comminution of one pole that were not amenable to internal fixation

(16,29,35,48,49,50,53). All attempts were made to retain all large fragments and the articular surface when possible. When comminution exists at either pole or in a transverse fracture that was not amenable to fixation, a partial patellectomy was done and fragment was retained.

In cases of several inferior pole of comminution, resection of the fragment with patellar tendon reattachment was performed.

- The comminuted fragments were excised. Small flecks of bone were left within the patellar tendon to make anchorage easier.
- The articular edges of the proximal fragment were trimmed and made smooth.
- Beginning at the fracture surface of the proximal fragment, just anterior to the articular cartilage by using a 2 mm kirschner wire 3 parallel holes in the proximal direction were made.
- One hole in the centre and one each in the medial and 1 lateral thirds. By using two heavy nonabsorbable braided sutures and weave through the patellar tendon, one through the medial and one through the lateral half of the tendon.
- With the help of straight needle or a suture passer, free proximal ends of the sutures were passed through the holes in the patella. One suture through the each medial and lateral holes and two through the central hole were passed.
- With the knee slightly hyperextended, sutures tied over the superior pole of the patella.
- In cases where the proximal pole of the patella was comminuted, the comminuted fragments were excised and the single distal fragment consisting of half or more of the bone was preserved by applying the principles outlined above.
- To protect the repaired extensor mechanism SS wire of 18 gauge was passed in the remnant of the quadriceps tendon and it was passed transversely in figure of 8 fashion over the repaired area to the tibial tuberosity. This technique was applied in all cases which were treated with partial patellectomy. Haemostasis was obtained and wound was closed in layers over a negative suction drain. A compression dressing and posterior plaster splint from just above the ankle was applied.

Post-operative management

Static quadriceps exercise was started from first postoperative day. Check radiographs were taken. First postoperative dressing was done after 48 hours and drain was removed. Second dressing was done on fifth day. Patients was made to stand with the help of axillary crutches or walker. Gradually increasing weight bearing was allowed as tolerated with knee in extension and posterior plaster splint. Sutures were removed on twelfth day. Patient was discharged and was called for regular follow-up at 2 to 4 weeks interval. Knee bending and

range of motion exercises were started after 3 weeks. Patients continued to bear weight as tolerated with knee in extension and with posterior plaster splint. Depending upon quadriceps strength, pain and fracture union splint was removed at 6 to 8 weeks. All findings were noted. We have compared our observations with that in literature wherever possible.

We have evaluate the results based on criteria reported by Gaur and also followed by Shrinivas.^{11,12}

The evaluation of results was based on the following clinical grading scale (Table 1).

RESULTS

In the present study, we have studied 50 patients with unilateral fracture of patella, 7 cases were treated conservatively, 21 cases were treated with partial patellectomy, 22 cases were treated with internal fixation (Tension band wiring). There were 3 (6%) open injuries and 47 (94%) closed injuries.

In the present series, youngest patient was 18 years and oldest patient was 67 years with mean age of 42.5 years. Majority of patients in present study in age group of 31-50 years.

In the present study there were 74% male (37patients) and 26% female (13 patients). Number of fractures were identical on both sides in our study.

It is evident from the table that 26 patients had transverse fractures and 7 had comminuted fractures and 16 patients had inferior pole fractures. As evident from (Table 5 and 6) majority of patients achieved range of movement of knee joint greater than 110 degree in the present series.

Two patients had post operative infection in the present series. One patient had superficial infection and another had impingement and 10% of patients had wire breakage, and 12% of patients had effusion. In the present series 3 patients had delayed union which were lost in follow up.

The results of surgery were evaluated using the Gaur's criteria for the knee function evaluation which is based on the subjective and objective criteria such as quadriceps wasting, extensor lag, knee ROM, knee pain, quadriceps power and functional status.¹¹ Quadriceps wasting was measured by measuring the circumference of thigh 15 cm above the knee joint level on both sides and amount of wasting noted in cms by making the patient to actively extend the knee and noting the amount of loss of active extension extensor lag was calculated, knee pain and function evaluated based on subjective symptoms. Quadriceps power was checked by noting the contraction of muscle and graded according to that. (In Gaur's criteria quadriceps power measured by spring dynamometer).¹¹

In the present series 22 patients were treated with TBW with SS wire and K wires. Out of 22, 13 patients had excellent results. 6 patients had good results. Twenty one

patients were treated with partial patellectomy. Out of 21, 6 patients had excellent results, 11 patients had good results and 4 patients had fair results.

Table 1: Grading clinical scale score by Gaur et al and Srinivas et al.^{11,12}

Score	Result			
25-32	Excellent			
19-24	Good			
11-18	Fair			
<10	Poor			
Parameters	Result			
	Excellent	Good	Fair	Poor
Quadriceps wasting	Nil	<1.5 cm	Upto 2.5 cm	>2.5 cm
Extensor lag	No	No	<10	>10
Knee rom	Full	0-110	Upto 90	>90
Knee pain	No	Mild	Moderate	Severe
Quadriceps power	Grade 5	Grade 4	-	-
Function	Normal	Normal	Restricted	Incapacitated

Table 2: Pattern of fracture.

Type of fracture	Conservative	Partial patellectomy	Internal fixation with TBW	Total	Percentage (%)	K-Shrinivas series
Transverse two part	4	0	22	26	52	Majority of patients in this series had inferior pole comminuted or severely comminuted fractures
Comminuted	0	7	0	7	14	
Inferior pole	3	13	0	16	32	
Superior pole	0	1	0	1	2	

Table 3: Shows range of movement of the knee joint.

Range of motion	Conservative	Partial patellectomy	Internal fixation with TBW	Total	Percentage (%)	K-Shrinivas series
Full	5	6	13	24	51.06	Majority of patients in this series had greater than 110 degree of knee range of motion
0-110 Degree	2	11	6	19	40.42	
Upto 90 Degree	0	4	0	4	8.51	
Less than 90 Degree	0	0	0	0	0	

Table 4: Complications.

Complication	Conservative	Partial Patellectomy	Internal fixation with TBW	Total	Percentage (%)	K-Shrinivas series
Infection	0	2	0	2	4	In K. Shrinivas series two cases had impingement from implant.
Impingement	0	5	14	19	38	
Effusion	0	5	1	6	12	
Wire breakage	0	3	2	5	10	
Delayed union	0	--	3	3	10.34	
Non union	0	--	0	0	0	

Table 5: Comparison of overall result with Shrinivas series.¹¹

Final results	TBW patella		Partial patellectomy		Total patellectomy	
	Shrinivas ¹¹ series (%)	Present series (%)	Shrinivas ¹¹ series (%)	Present series (%)	Shrinivas ¹¹ series (%)	Present series
Poor	2 (20)	0	1 (8.3)	0	2 (20)	0
Fair	0	0	2 (16.7)	4 (19)	2 (20)	0
Good	4 (40)	6 (31.57)	7 (58.3)	11 (52.38)	4 (40)	0
Excellent	4 (40)	13 (68.42)	2 (16.7)	6 (28.57)	2 (20)	0

Table 6: Comparison of overall results with Mittal series.¹⁴

Result	Number of patients			Percentage (%)		
	Shrinivas series	Present series	Mittal series	Shrinivas series	Present series	Mittal series
Excellent	8	24	6	25	51.06	33.33
Good	15	19	9	46.87	40.42	50
Fair	4	4	3	12.5	8.51	16.66
Poor	5	0	0	15.62	0	0



Figure 1: Pictures showing pre-op and post op x ray (patient treated with partial patellectomy and wiring), clinical photos showing rom at final follow up.



Figure 2: Preop and post op x-rays with clinical photos of rom at final follow up.

DISCUSSION

The average age of the patients in the present series was 42.5 years of age.

While in K-Srinivas series age range was 12-65 years with mean range of 39.9 years.¹² While in study reported by Kareem and Rehman mean age of the patients was 38.08±1.68 years with 3rd and 4th decade preponderance and Mittal series average age of patient was 47 years.^{13,14} In series of Singh average age was 35 years.¹⁵

In the present series majority of the patients were males. In the series of Shrinivas male female ratio was 9:1.¹² In the series of Mittal majority of patients were females.¹⁴

In the present series the number of patients who sustained fracture of right or left side patella was identical. In the series reported by Mittal more number of patients sustained fracture of left patella.¹⁴ While Shrinivas has not mentioned about this.¹² It is a matter of chance which limb gets an injury.

In the present series the number of patients with closed fractures of patella is more compared to number of patients having open fractures of patella. In Shrinivas, Mittal and Singh series all fractures were closed.^{12,14,15}

In the present series most of the patients had direct mode of injury. In series reported by Kareem and Rehman and the series reported by Singh also majority of patients had direct mode of injury.^{13,15}

In series reported by Shrinivas majority of patients had comminuted or inferior pole fractures.¹² In the series reported by Kareem and Rehman majority of patients had transverse fractures. Our observation is similar to that in literature.¹³

In our study patients who were treated with internal fixation as well as partial patellectomy were mobilised after 3 weeks. In the series reported by Shrinivas majority of operated patients were mobilised after 4-5 weeks and in series reported by Mittal majority of patients were mobilised after 5-6 weeks.^{12,14}

With the advances in the technique of internal fixation and improvement in quality of metals, the current trend is more towards internal fixation. One must attempt to preserve the patella as far as possible. In the present series 22 cases were treated with internal fixation. 21 cases were treated with partial patellectomy and 7 cases were treated conservatively. In Shrinivas out of 32 cases 10 cases were treated with internal fixation, 12 cases were treated with partial patellectomy and 10 cases were treated with total excision.¹²

The rate of postoperative infection for patella fractures is low in most clinical series. Infection is a constant risk following any open surgery. Good skin condition in

operative area, optimal operation room condition, meticulous surgical technique, good adequate debridement (in open wounds) and judicious use of antibiotics are important factors to minimize the chances of infection. Two patients had post operative infection. Out of two, one patient had superficial and another had deep infection. Both patients responded to debridement, culture specific antibiotics and secondary wound closure.

Tension band technique can be used in many patellar fracture patterns. One major disadvantage of this technique is impingement of hardware. This problem is common and is related to irritation of the capsule and tendons from the implants. In the present series, 38% of the patients had impingement of the implants. Wire breakage occurred in 10% of patients in our series and 12% of patients had knee effusion.

Results of final outcome following patellar fractures vary from one series to another. There is no generally accepted outcome assessment system for patellar fractures. Most authors base outcome on subjective complaints of pain, limitations in activities of daily living, change in job status and ambulation. The lack of uniform assessment scale allows only broad generalizations to be made about results of these injuries. We have used the criteria based on Gaur's series knee function evaluation score which included subjective as well as objective points such as quadriceps wasting, knee ROM, knee pain, extensor lag, quadriceps power and function and Shrinivas series also used criteria based on Gaur's series knee function evaluation.^{11,12}

In the present and most other series, majority of the patients were pain free during activities of daily living.

In Shrinivas series 8 out of 10 patients who underwent internal fixation with TBW of the patella had minimal or no quadriceps wasting, knee pain or quadriceps power loss and extensor lag; Knee range of motion was greater than 110 degree in 9 out of 10 patients and two cases had implant impingement.¹² In partial patellectomy group of 8 out of 12 patients had minimal or no quadriceps wasting and knee pain with knee range of movement greater than 110 degree. In present series majority of patients had knee range of movement greater than 110 degree with minimal or no quadriceps wasting with quadriceps power grade 5. In present series we had 3 patients with extension lag. Our observation is similar to that series.

We observed better results after internal fixation (TBW with K wire). In the present series 22 cases treated with internal fixation with TBW in which all had obtained good to excellent results while 21 cases treated with partial patellectomy with extensor mechanism repair in which 6 cases had excellent results, 11 cases had good results and 4 cases had fair results. The operating surgeon should avoid tilting of retained fragment during repair. We had no patients with total patellectomy.

While 7 patients who were treated with conservative method, all of them had excellent to good results. Nonoperative treatment is a reasonable option for displaced fractures of the patella, particularly in selected patients.¹⁶

In the present series overall more than 80% had excellent to good results. Overall data is comparable with other series. In Shrinivas series 72% patients had good to excellent result.¹² Where in case of Karim and Rehman 88% patients had excellent to good result.¹³ In the present series results of partial patellectomy were satisfactory in 90%. Results of open reduction, internal fixation are definitely better as compared to patellectomy. This suggests that one should opt for open reduction internal fixation for preserving the patella as far as possible. Patellectomy should be reserved for those patients where reconstruction and osteosynthesis is not possible. Patello-femoral pain or osteoarthritic symptoms may develop as a late sequelae of patella fracture. In the present series, length of follow up was too short to draw any conclusion regarding patello-femoral arthritis.

CONCLUSION

As far as possible one should preserve patella and Osteosynthesis whenever possible has better chance for excellent results. Surgeon should avoid tilting of retained patellar fragment during repair. A good surgical technique, optimal operation room environment and judicious use of antibiotics will reduce the possibility of infection.

Early partial weight bearing as tolerated with posterior plaster splint is beneficial. Range of movement exercise should be started after 3 weeks when soft tissue healing is complete. Physiotherapy protocol plays an important role to improve final results. Implant impingement and wire breakage are common. Patients should be explained for the same. Conservative management for undisplaced patella fractures still stand a good outcome in our series.

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