

A Prospective Study of Functional Outcome of Surgical Management in Cases of Fracture Patella in A Tertiary Care Hospital

Y. Panduranga Rao¹, K.N. Sandeep²

¹Assistant Professor, Department of Orthopedics, Santhiram Medical College, Nandyal, India

²Assistant Professor, Department of Orthopaedics, Santhiram Medical College, Nandyal, India

³Assistant Professor, General Surgery, Great Eastern Medical School & Hospital, Srikakulam, India

⁴Professor & HOD, General Surgery, Great Eastern Medical School & Hospital, Srikakulam, India

⁵PG Resident, General Surgery, Great Eastern Medical School & Hospital, Srikakulam, India

Received: 09-10-2021 / Revised: 19-11-2021 / Accepted: 28-12-2021

Abstract

Introduction: Fracture of the patella constitutes almost 1% of all skeletal injury and fracture of the lower pole of the patella is a commonly encountered type of fracture patella. The fracture patella occurs as a result of direct or indirect force. It is twice as common in men as women. Fracture of the lower pole is commonly an avulsion injury as a result of violent contraction of the quadriceps muscle or as a result of subluxation or dislocation of patella especially as a sports injury occurring in young individuals. Hence there is more likelihood of extensive retinacular tear. This retinacular tear precludes conservative treatment and operative treatment is the mainstay of lower pole patellar fractures. **Materials and Methods:** A longitudinal study was conducted from the Department of Orthopedics, Santhiram Medical College and Nandyal for one year in August 2020 and July 2021. All the adult patients admitted with the diagnosis of patellar fracture were included in the study. A total of 60 patients were included in the study. History is related to socio-demography, nature of trauma, whether due to direct or indirect violence was noted. The inquiry was made to note pain, swelling, its rate of increase, and if the patient was able to bear weight on the affected limb and was able to do active movements of the affected joint. A complete local examination was conducted and an X-ray of AP and the lateral view was taken for all the patients. Following operative procedures were performed based on their fracture pattern, the activity of the patient, and the functional expectations. All the patients after discharge were followed up regularly on 2nd week, 6th week, 3rd month, and 6th month postoperatively. The functional outcome was assessed using the West criteria grading system as excellent, good, or poor. **Results:** Transverse patella fracture is being the most common fracture and forth at modified tension band wiring (TBW) was the most common procedure performed and for comminuted fracture partial patellectomy was the most common procedure and for 1 patient total patellectomy was performed. **Conclusion:** The study shows that the treatment of patella fractures with modified tension band wiring is a definitive treatment with minimal complications and excellent functional outcomes.

Keywords: Patella, tension band wiring, subluxation, dislocation, fracture patella.

This is an Open Access article that uses a fund-ing model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Fracture of the patella constitutes almost 1% of all skeletal injury and fracture of the lower pole of the patella is a commonly encountered type of fracture patella. The fracture patella occurs as a result of direct or indirect force[1]. It is twice as common in men as women. Fracture of the lower pole is commonly an avulsion injury as a result of violent contraction of the quadriceps muscle or as a result of subluxation or dislocation of patella especially as a sports injury occurring in young individuals. Hence there is more likelihood of extensive retinacular tear. This retinacular tear precludes conservative treatment and operative treatment is the mainstay of lower pole patellar fractures[2]. The most common fracture pattern is a simple 2-part diversion caused by a direct blow (i.e., dashboard injury). As a result of the bony lesion, the extensor mechanism of the knee joint can become insufficient[3]. The degree of the insufficiency depends among other

factors on accompanying damage to the reserve extensor mechanisms. Additional injuries to the adjacent bones are rare but can affect the articular surface of the distal femur. The most frequent indirect mechanism is a fall on the feet with eccentric contraction of the quadriceps muscle. Depending on the velocity of the fall and the resistance of the extensor mechanism, either the patella or the adjacent tendons fail. Closed fractures of the patella represent the vast majority of this injury[4]. However, up to 7% of the cases result in open fractures. The underlying mechanisms of open fractures are mostly high-velocity accidents[5]. These can result in devastating soft tissue conditions with comminuted fractures as well as additional ruptures of the reserve extensor mechanism. Of note, approximately 80% of open patellar fractures are associated with multiple accompanying injuries, namely fractures of the femur or acetabulum, traumatic dislocation of the hip joint, or disruption of knee ligaments.⁶ The most frequent causes are traffic accidents in 78.3%, followed by work-related accidents in 13.7% and domestic accidents in 11.4%. Sports-related fractures of the patella are relatively seldom.

Materials and Methods

A longitudinal study was conducted from the Department of Orthopedics, Santhiram Medical College, Nandyal for one year in August 2020 and July 2021. All the adult patients admitted with the diagnosis of patellar fracture were included in the study. A total of 60

*Correspondence

Dr. K.N. Sandeep

Assistant Professor, Department of Orthopaedics, Santhiram Medical College, Nandyal

E-mail: kn.sandy@gmail.com

patients were included in the study. History is related to socio-demography, nature of trauma, whether due to direct or indirect violence was noted. The inquiry was made to note pain, swelling, its rate of increase, and if the patient was able to bear weight on the affected limb and was able to do active movements of the affected joint. A complete local examination was conducted and an X-ray of AP and the lateral view was taken for all the patients. Following operative procedures were performed based on their fracture pattern, the activity of the patient, and the functional expectations. All the patients after discharge were followed up regularly on 2 nd week, 6 th week, 3 rd month, and 6 th month postoperatively. The functional outcome was assessed using the West criteria grading system as excellent, good, or poor.

Inclusion criteria: All the adult patients admitted with the diagnosis of patella fracture were included in the study. All transverse fracture patella can be treated with either cerclage wiring, tension band wiring, or modified tension band wiring. All comminuted fracture patella can be treated with either cerclage wiring, modified tension band wiring, partial patellectomy, or total patellectomy. The polar fractured patella can be treated either with K wire fixation and tension band wiring or partial patellectomy.

Exclusion criteria: Compound fracture patella. Fracture patella associated with femoral condylar fracture. Fracture patella is associated with intra-articular and tibial plateau fractures were excluded from the study.

Study procedure: The study was started after getting clearance from the institutional ethical committee. Informed consent was obtained from all the patients involved in the study. Sociodemographic profile related to name, age sex, occupation, address, family history, and history was obtained from the patients. History related to the nature of trauma, whether due to direct or indirect violence was noted. Whether trauma due to road traffic accidents, assault, fall in the same plane, or fall from a height were specifically asked. An enquiry was made to note pain, swelling its rate of increase, and if the patient was able to bear weight on the affected limb and was able to do active movements of the affected joint.

Local examination

Inspection: Size, shape, and extent of the swelling, condition of the skin over the swelling, and presence of any contusion, abrasion, or laceration. Whether any sulcus present in the middle of the swelling.

Palpation: the local rise of temperature, tenderness over the bone, a palpable transverse sulcus, crepitus, fluctuation, and broadening of the patella. Active extension movements of the affected knee were noted compared with the normal side. It was also noted whether the patient was able to stand on his injured limb. The circumference of both the thighs was measured to note any reduction in the bulk of the quadriceps. The other knee joint was examined for comparison and to note any anatomical variation.

Investigations: Routine examination of blood and urine were done for hemoglobin percentage, total and differential WBC count, bleeding and clotting time, and presence of albumin and sugar in urine and HbsAg, HIV tests.

X-ray examination: X-rays in lateral and anteroposterior views were taken for confirmation of diagnosis. X-rays in skyline views were taken in cases suspected to have longitudinal and marginal fractures. After a proper anesthetic workup, the patients were taken up for surgery. The following were the procedures performed based on their fracture pattern, the activity of the patient, and the functional expectations. 1) K-wire fixation and tension band wiring. 2) Lag screw fixation and tension band wiring. 3) Transverse lag screw with cerclage wiring. 4) Partial patellectomy. 5) Total patellectomy. Immediate post-op period complications were noted and addressed as per the requirements of the patients. All the patients after discharge were followed up regularly on 2 nd week, 6 th week, 3 rd month, and 6 th month postoperatively. The functional outcome was assessed using West's criteria which is graded.

Statistical analysis: All the data were entered and analyzed using SPSS version 22. Mean and standard deviation was derived for all the parametric variables and the percentage was derived for frequency variables. Chi-square test and Man-Whitney U test are the non-parametric tests used for deriving the statistical inference.

Results

Age wise distribution of the study subjects. It is seen from the table that the majority of the study subjects were in the age group between 40 and 50 years with a mean age of 44.1 years. Gender wise distribution of the study subjects. It is seen from the table majority of the patients were males with a male : female ratio of 1.7:1.

Table 1: Age wise distribution of the study subjects

Age group (year)	Frequency	Percentage (%)
20-30	8	13.3
31-40	12	20
41-50	20	33.3
51-60	16	26.6
>60	4	6.6
Total	60	100

Table 2: Distribution of the study subjects based on the side of the knee involvement

Side of Knee	Frequency	Percentage (%)
Right knee	36	60
Left knee	24	40
Total	60	100

Table 2 shows the side of the knee involvement among the study subjects. It is seen from the table that right knee involvement was more common than the left knee.

Table 3: Distribution of the study subjects based on the nature of trauma

Nature of trauma	Frequency	Percentage (%)
Direct impact	40	66.6
Indirect impact	20	33.3
Total	60	100

Table 4: Distribution of the study subjects based on the type of accident

Type of accident	Frequency	Percentage (%)
Road traffic accident	32	53.3
Fall in the same plane	16	26.6
Assault	12	20
Total	60	100

Table 5: Distribution of the study subjects based on the type of patellar fracture

Type of patellar fracture	Frequency	Percentage (%)
Transverse fracture	18	46
Vertical fracture	12	20
Comminuted fracture	16	26.6
Stellate fracture	4	6.6
Total	60	100

Table 6: Distribution of the study subjects based on the operative procedure

Operative procedure	Frequency	Percentage (%)
Modified tension band wiring	24	40
Cancellous screw fixation with TBW	8	13.3
TBW with cerclage wiring	8	13.3
Partial patellectomy	8	13.3
Cerclage wiring	4	6.6
Cancellous screw fixation with cerclage wiring	4	6.6
Cancellous screw fixation	2	3.3
Total patellectomy	2	3.3
Total	60	100

Table 7: Types of patellar fractures and the various modalities of operative techniques

Type of fracture	Operative Procedure							Total patellectomy	Partial patellectomy	Total
	CS fixation with TBW	ORIF with CS	ORIF with CS and cerclage wiring	ORIF with TBW and cerclage wiring	ORIF with cerclage wiring	ORIF with modified TBW				
Comminuted fracture of patella	0	0	0	06	0	0	2	8	16	
Stellate fracture	0	0	0	0	4	0	0	0	4	
Transverse fracture	4	0	2	2	0	20	0	0	28	
Vertical fracture of patella Lt knee	4	2	2	0	0	4	0	0	12	
Total	8	2	4	8	4	24	2	8	60	

Table 8: Distribution of the study subjects based on the grading of west criteria.

West criteria	Frequency	Percentage
Excellent	46	76.6
Good	12	20
Poor	2	3.3
Total	60	100

Table 9: Comparison of various operative procedure for fracture patella and their functional outcome measured by using West criteria grading system

Operative Procedure	West criteria grading			Total	P Value
	Excellent	Good	Poor		
Modified tension band wiring	24	0	0	24	0.0218
Cancellous screw fixation with TBW	8	0	0	8	
TBW with cerclage wiring	8	0	0	8	
Partial patellectomy	0	8	0	8	
Cerclage wiring	4	0	0	4	
Cancellous screw fixation with cerclage wiring	2	2	0	4	
Cancellous screw fixation	0	2	0	2	
Total patellectomy	0	0	2	2	
Total	46	12	2	30	

Table 9 shows, p value derived by using the Chi-square test along with Fischer's exact test as most of the columns had numbers less than. Table 9 shows the comparison of various operative procedures for fracture patella and their functional outcome measured by using the West criteria grading system. It is inferred from the table that poor functional outcome was only reported in total patellectomy patients and a good outcome was reported among patients who underwent cancellous screw fixation and the excellent outcome was seen in patients who had undergone patellar repair with modified tension band wiring and a statistically significant association was seen between the type of procedure and the functional outcome ($p < 0.05$).

Discussion

Patellar fractures are common injuries resulting in loss of knee function due to direct or indirect trauma. It constitutes about 1% of all skeletal injuries. The subcutaneous location of the patella makes it more prone to direct injuries and indirect fractures of the patella due to forceful contraction of the quadriceps. The majority of the displaced transverse patellar fractures thus need reduction and internal fixation. For the fixation of this type of fracture, it is important to address the biomechanics of the construct[7]. Thus, proper and adequate treatment is required to prevent disability due to patellar fracture. Many patellar fractures are not displaced and may be treated conservatively. Indications for surgical management include displacement > 2 mm, a step-off involving the articular surface, or the inability to extend the knee actively. As with any intra-articular fracture, the goals of surgical treatment are to obtain an anatomic reduction and restore normal joint function while achieving bony union[8].

Many surgeons maintain cast immobilization for three to six weeks. The previous result has demonstrated that patients with diminished range of motion had experienced prolonged cast immobilization. This can best be avoided by initiating early knee movement. Ideally, knee movement should be started in the immediate postoperative setting since motion aids in the prevention of intra and periarticular fibrosis and having salutary effects on healing articular cartilage. Internal fixation of patellar fracture is to achieve fixation that is strong enough to allow an immediate range of motion. Several techniques have been described for the internal fixation of a fracture of the patella. Satisfactory compression at a fracture site reduces the risk of failure of fixation, loss of reduction (inter-fragmentary gap > 2 mm), and subsequent risks of mal-union, delayed union, and ultimately non-union from exercise movement[9].

Recently modified tension band wiring is a widely used technique in many orthopedic clinics for such fracture fixation. In this prospective study, 30 patellar fracture cases were treated with different types of operative procedures, and the functional outcome was assessed at the end of 6 months using the West criteria grading system and the results were recorded. In the present series, most of the patients had a direct mode of injury. In the series reported by Koval and the series reported by Singh also the majority of patients had a direct mode of injury.¹⁰

Conflict of Interest: Nil

Source of support: Nil

In our study, we found road traffic accident as the most common cause for patella fracture followed by fall from height whereas a study stated that the commonest mode of injury was fall on the knee, which was seen in 12 cases i.e., 60% of cases and the rest 40% had a road traffic accident. The present study indicates that transverse patella fracture is the most common type of fracture occurring in the patella followed by comminuted fracture and a similar type of pattern was also observed. The duration between the time of injury and surgery was 2.91 days (range 1-8 days). It was noted in our study that the delay in 7 cases was due to patients reporting late to the hospital.

Conclusion

The study shows that the treatment of patella fractures with modified tension band wiring is a definitive treatment with minimal complications and excellent functional outcomes. Early partial weight-bearing as tolerated with a posterior plaster splint is beneficial. The 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. To overcome the late complications like osteoarthritis long term follow-up is recommended.

References

1. Lotke PA, Ecker ML. Transverse fractures of the patella. Clin Orthop Relat Res. 1981; 158:180-184.
2. Pengas IP, Assiotis A, Khan W, Spalding T. Adult native knee extensor mechanism ruptures. Injury. 2016; 47(10):2065-2070.
3. Jarraya M, Diaz LE, Arndt WF, Roemer FW, Guermazi A. Imaging of patellar fractures. Insights Imaging. 2017; 8(01):49-57.
4. Benli IT, Akalin S, Mumcu EF, Citak M, Kiliç M, Paşaoğlu E. The computed tomographic evaluation of patellofemoral joint in patellar fractures treated with open reduction and internal fixation. Kobe J Med Sci. 1992; 38(04):233-243.
5. Meinberg EG, Agel J, Roberts CS, Karam MD, Kellam JF. AO-Foundation. Fracture and dislocation classification compendium - 2018. J Orthop Trauma 2018; 32(01)(Suppl. 01):S1-S170.
6. Speck M, Regazzoni P. Classification of patellar fractures] Z Unfallchir Versicherungsmed. 1994; 87(01):27-30.
7. Buckley RE, Moran CG, Apivatthakakul T. AO Principles of Fracture Management; Vol. 1: Principles, Vol. 2: Specific Fractures. 3 ed. Thieme, 2017.
8. Labitzke R. [Proper and improper tension band fixation exemplified by patellar fracture]. Chirurg. 1997; 68(06):638-642.
9. Levack B, Flannagan JP, Hobbs S. Results of surgical treatment of patellar fractures. J Bone Joint Surg Br. 1985; 67(03):416-419.
10. Weber MJ, Janecki CJ, McLeod P, Nelson CL, Thompson JA. Efficacy of various forms of fixation of transverse fractures of the patella. J Bone Joint Surg Am. 1980; 62(02):215-220.