

Patellar Fractures Treated by Modified Tension Band Wiring: A Clinical Study in a Teaching Hospitals.

Gangadhara Reddy Kota¹, Vamshi D²

¹Assistant Professor, Department of Orthopedics, Medicity Institute of Medical Sciences, Ghanpur, India.

²Assistant Professor, Department of Orthopedics, MNR Medical College, Sangareddy, India.

ABSTRACT

Background: Patellar fractures are more common in country like India due to the activity of daily life and constitute 1% of all skeletal injuries by direct or indirect mechanism. Direct injuries due to the subcutaneous location of patella and indirect injuries because of forceful contraction of quadriceps with knee in flexed position are common. Thus, improper operative procedure can lead to disability in the patient. Therefore, this study was conducted to assess of advantages and complications associated with fixation technique so as to manage the fracture of patella. **Methods:** The study was conducted on 60 cases of transverse patellar fracture treated by Modified tension band wiring. All patients who had closed and open type I displaced transverse patellar fractures, acute fractures and who were medically fit for operative procedures were included in the study. **Results:** The most common age group in our study was 41-50 years. Male patients were 46 (76.7%) and female patients were 14(23.3%). Fracture due to direct injury was seen in 12(20%) patients and 48(80%) cases were with indirect trauma. Right side injury was seen in 26(43.3%) patients while 34 (56.7%) patients had injuries on the left side. The outcome of our study was excellent in 90% of cases, 8.3% was good and only 1.7% was poor. **Conclusion:** According to our study modified tension band wiring showed better outcome for the early mobilization and management of displaced transverse patellar fracture.

Keywords: Displaced transverse type patellar fracture, Modified tension band wiring, Patellar fracture.

INTRODUCTION

Patella is the largest sesamoid bone, located subcutaneously and has an important role in knee extension mechanism.^[1] Depending on this position, the function of patella and patella-femoral joint is subjected to high-tension forces. Quadriceps is also weaker without patella.^[2] Patellar fracture occur due to direct, indirect or combined forces and accounts for 1% of all skeletal fractures. Subcutaneous location of patella makes it more vulnerable to injury from direct force, which leads to comminute fracture. Indirect injuries occur because of heavy forces from contracted quadriceps with knee in flexed position. Therefore, fracture not only depends on injury mechanism but also various other factors such as patient age, bone quality and degree of knee flexion.^[1,3,4]

Concomitant injuries commonly associated with patellar fractures, consist mainly (80%) of open patellar fracture.^[5,6] Patellar fractures are classified as displaced and non-displaced fractures for the clinical diagnosis. These types can be further classified depending upon the geometric configuration, like transverse or horizontal, comminute, apical, vertical or longitudinal, and osteochondral.^[7]

Name & Address of Corresponding Author

Dr. Gangadhara Reddy Kota,
Assistant Professor,
Department of Orthopedics,
Medicity Institute of Medical Sciences,
Ghanpur, India.
E.mail: theganges2006@gmail.com

Approximately, of transverse type of fractures, 52% are reported to be of the displaced patellar fractures^[8-11] while 35% are of non-displaced type.^[11,12] Non-displaced comminute type of patellar fractures account

for 65% while vertical type of non-displaced fracture accounts for 12-22%.^[13-15]

Osteochondral fractures are associated with comminute fractures or with patellar dislocation.^[16] The extensor mechanism has important role in active knee extension to maintain an erect position.^[17]

The treatment of patellar fracture is dependent on the fracture classification, physical examination and extensor mechanism. Patellar fracture can be treated by operative or non-operative procedures. Most common treatment options are non-operative management, open reduction and internal fixation with cannulated screw tension band or tension band wiring and partial or complete patellectomy.^[1]

Non-operative treatment for minimally displaced fractures have better clinical outcomes which consist of extension splinting or branching for 4 to 6 weeks. Operative procedure are carried out by internal fixation techniques such as circled wiring for patellar fracture fixation^[18], screw fixation for longitudinal and transverse fractures^[19-21], modified tension band wiring with Kirschner wire (K-wires), circumferential circled wiring etc. Modified tension band wiring consists of two parallel 2mm K-wires with an 18 gauge wire looped over the K-wires and over the anterior part of the patella to act as tension band. This tension band solubilize the bigger distraction force on the anterior part of patella due to flexion of knee and contraction of quadriceps. This modified tension band wiring has shown better results in various studies and currently, is a widely used technique for the management of patellar fracture.^[22] In many orthopedic clinics, this method is the treatment of choice for the fixation of fractured patella and for the fast mobilization of the knee joint.^[23] Therefore, the aim of this present study is to assess the advantages and complications associated

with this fixation technique used for the management of patellar fracture.

MATERIALS AND METHODS

This prospective study was conducted in Department of Orthopaedic at MNR Medical College & Hospital and Archana Hospital, Hyderabad during the period of 2 years March 2013 to May 2015. In this study, 60 cases of transverse patellar fracture were treated by modified tension band wiring. Inclusion and Exclusion criteria-Patients with closed and open type I displaced transverse patellar fractures, acute fractures were included in the study. All the patients were medical fit for operative treatment. Patient with comminute, vertical fractures, type II and type III compound fractures, non-displaced transverse fracture and patients not medically fit for surgery were excluded from the study.

Method of data collection: Institutional ethical committee approval was taken before the commencement of the study and informed consent form was collected from the patients during admission for surgery. The demographic details of the patient such as name, age, sex, socio-economic status, mode and duration of injury were collected. Clinical examination and radiographs with routine laboratory investigations data were recorded for each and every case.

Operative procedure: The patient was kept in supine position on a radiolucent table. The fracture site was exposed through transverse or longitudinal midline incision in front of the knee. After exposure of the fracture site all debris and clots were cleared. The degree of injury was assessed before fixation. Two 2 mm K-wires were placed perpendicularly across the fracture line from above downwards. 18 gauge stainless steel wire was passed deep through inferiorly ligamentum patellae and superiorly behind the quadriceps tendon as look like figure of ‘8’ in front of the patella. Quadriceps expansion was sutured with vicryl. For the temporary immobilization above knee plaster was applied.

Post-operative procedures: Post-operative X ray report was collected. The patient was examined for straight leg raising test, and weight-bearing test which was started from 3rd post-operative day. On the 14th day, sutures were removed and knee flexion was started by the quadriceps board and continuous passive motion machine (CPM). Patients were discharged from the hospital between 14th to 20th post-operative days. They were taught to do dynamic quadriceps exercise at home regularly.

Follow-up: Patients were advised to visit hospital every month, when the follow-up was done. In every follow-up, the patients were examined for signs and symptoms. They were asked about any complaints like pain, walking difficulty or any kind of problem to carry on the daily work, climbing and getting down from stairs. The patients were also examined for knee

movement, power of quadriceps, and circumference of thigh.

RESULTS

In the present study, modified tension band wiring was used to treat 60 cases of displaced transverse patellar fracture. Patellar fracture happen in any age group, though the most common age group in our study was 41-50 years (51.7%) [Table 1]. 46 (76.7%) of the patellar fractures were seen in males and 14 (23.3%) in females [Figure 1]. 48 fractures (80%) were due to forceful flexion of the knee (indirect) and 12 patellar fractures (20%) due to road accident (direct) [Figure 2]. Right side patellar fracture were seen in 26 (43.3%) patients while left side fracture was seen in 34 (56.7%) patients [Figure 3]. All the patients were immobilized in an above knee posterior slab for almost 14 days. After that patients were advised on knee flexion and quadriceps exercise. There were no cases with intra operative complications. All patients were discharged after they were educated on the necessary exercise and the cases were followed up every month up to 5 months for better recovery. During follow-up all patients were questioned about complications (subjective and objective symptoms) and data were recoded properly. All the follow-up cases were graded depending on the WEST’s CRITERIA. We found 54 cases (90%) to be excellent during followed up study, 5 cases (8.3%) were good and only one case (1.7%) showed poor result [Table 2].

Table 1: Age wise distribution of patients

Age (years)	No. of cases	Percentage (%)
0-10	0	0
11-20	6	10
21-30	5	8.3
31-40	10	16.7
41-50	31	51.7
51-60	5	8.3
61-70	2	3.3
71-80	1	1.7

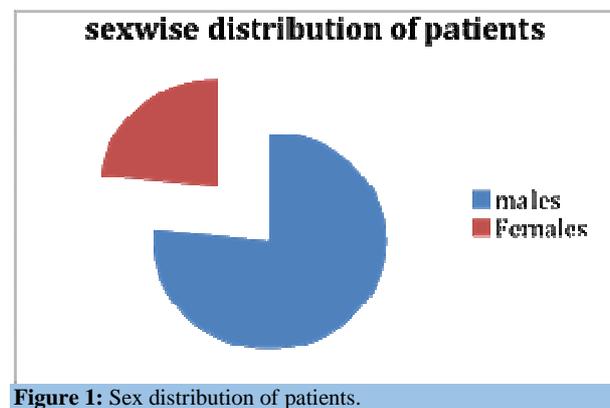


Figure 1: Sex distribution of patients.

DISCUSSION

Patellar fractures are common injuries resulting in loss of knee function due to direct or indirect trauma. This type of fracture constitute about 1% of all skeletal injuries. The subcutaneous location of patella makes it more prone to direct injuries and indirect fractures of patella due to forceful contraction of the quadriceps. Majority of the displaced transverse patellar fractures thus need reduction and internal fixation. For fixation of this type of fracture it is important to address biomechanics of the construct. Thus proper and adequate treatment is required to prevent disability due to patellar fracture. Recently modified tension band wiring is widely used technique in many orthopedic clinic for such fracture fixation.

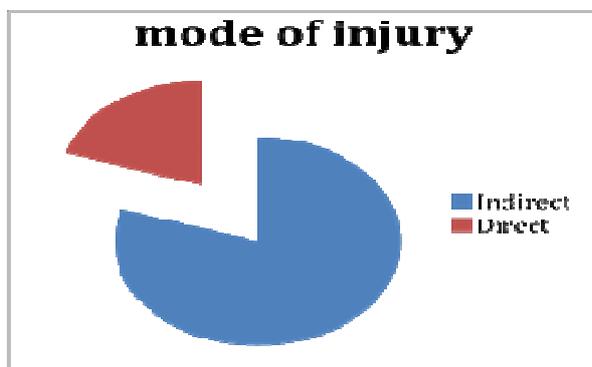


Figure 2: Mode of injury

In this prospective study, 60 patellar fracture cases were treated with modified tension band wiring and the results were recorded after such treatment. Most of the patellar fracture were in age group of 41-50 years (51.7%). In a similar study by Siddaram N Patil^[23], it was shown that 40% of patients were in the age group of 41-50 years and 69.8% in the 20-49 age group was recorded by Sudheendra P.R.^[24]

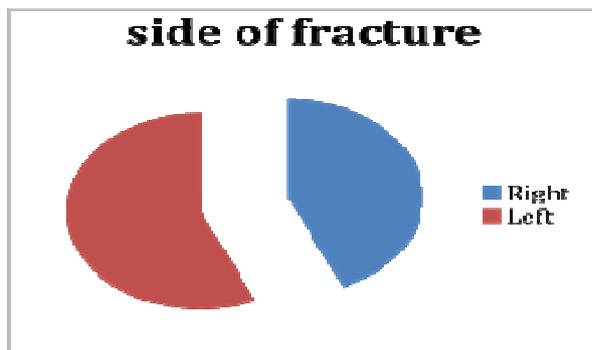


Figure 3: Site of fracture

A predominance of male patients were seen, accounting for 46 (76.7%) and female patients were 14 (23.3%). Sudheendra et al. recorded 69.8% male and 30.2% female patients while Siddaram N Patil study showed a prevalence of 70% male and 30% female patients.^[23,24] Similar findings reported by Nummi et al.^[13] Fall from height (indirect) were the most

common mode of injury which accounted for 48 cases (80%) followed by road traffic accidents 12 cases (20%). Siddaram N Patil showed that 66% fractures due to indirect mechanisms and 34% resulting from direct trauma. Similarly Sudheendra et al. showed more number of cases due to indirect mechanism (58.1%) and 39.5% road traffic accidents. The mode of injury recorded by Aglietti and Buzzi was in concordance to our findings.

The present study showed 43.3% right side involvement and 56.7% on left side, while similar studies by Siddaram and Sudheendra recorded right side involvement 56% and 60.5% more than left side 44% and 39.5% respectively. Nummi showed no predominance of either side. A transverse type of patellar fracture was the most frequent type of fracture in our study. Similar type was reported by Siddaram, Sudheendra and Nummi, where also the transverse fracture was found to be the most common.

In the present study, associated injury was noted only 4 (6.7%) out of 60 cases. Siddaram reported 2 (6.7%) out of 30 cases had associated injuries and Sudheendra showed 3 (7%) out of 43 cases. But this type of injuries did not affect the end result of the follow-up.

Modified tension band wiring was the most commonly used technique of internal fixation. Similar results were reported by other authors.^[13,23,24] Modified tension band wiring showed better result in knees mobilization in earlier stages, compared to other techniques in operative treatment of patellar fractures.^[24]

Table 2: Grading of results based on WEST'S CRITERIA

sResults	No. of cases	Percentage (%)
Excellent	54	90
Good	5	8.3
Poor	1	1.7

In our study time taken for radiological evidence of fracture after fixation was 14 weeks. In a similar study, Berg, reported 13 weeks.^[25,26] The post-operative loss of fixation of more than 2mm was reported in 1 (1.7%) patient. Sudheendra, Smith and Nummi reported 11.6% and 13.7%, 11% cases of postoperative loss of fixation by modified tension band wiring.^[27] In our study follow up was 5 months similarly as Siddaram study. In contrast with this study done by Dudani et al. and Einolas et al. follow up was 12 to 18 months.^[28,29] Thus 6 months or more time required for complete assessment of result for the late complications. In all the cases fractures were decreased anatomically and internally. We had three cases with complications after fixation, one of the cases had wound gapping and it was mobilized by secondary suturing and 2nd case was superficial skin infection controlled by 3.5-week post operatively and 3rd case was flexion restriction. The outcome of our study shows 90% of the outcome to be excellent, 8.3% good and 1.7% poor result. Sudheendra showed 58% excellent, 16% good and 4.7% poor. Another study by Siddaram found 86.6% excellent,

10% good and 3.3% poor outcome. Leung et al. reported 100% excellent and no good and poor result.^[30]

CONCLUSION

In this prospective study, the treatment of patellar fracture by modified tension band wiring during the period of 2 years from March 2013 to May 2015 in the Orthopaedic Department for 60 cases of displaced transverse type. All the cases were clinically and radiological studied before operative procedure. Physiotherapy plays important role in decreasing the complications like knee stiffness. End results of our study were not affected by associated injuries. To overcome the late complications like osteoarthritis long term follow up is recommended.

REFERENCES

1. Ashesh B, Madhav A, Karunakar. Patellar fracture and extensor mechanism injuries in: Rockwood and green's fractures in adults 7th ed Volume 2, Lippincott 2010: 1756-67.
2. Huberti HH, Hayes WC, Stone JL, Shybut GT. Force ratios in the quadriceps tendon and ligamentum patellae. *J Orthop Res* 1984;2:49-54
3. Whittle PA. Fractures of the lower extremity in: S. terry canale, James H. Beaty; campbell's operative orthopaedics 11th ed. Mosby: Philadelphia; 2008: 3161-6165.
4. Barano, Manisali M, Cecen B. Anatomical and biomechanical evaluation of the tension band technique in patellar fractures. *IntOrthopEpub*. 2009;33(4).22.
5. Nummi J. Fracture of the patella: a clinical study of 707 patellar fractures. *Ann. Chir Gynaecol. Fenn.* 1971;60(Suppl):179-87.
6. Anand S, Hahnel JCR, Giannoudis PV. Open patellar fractures: High energy injuries with a poor outcome? *Injury*. 2008;39:480-4.
7. Catalano J, Iannacone W, Marczyk S. Open fractures of the patella: Long-term functional outcome. *J Orthop Trauma* 1995;39:439-44.
8. Lotke PA, Ecker ML. Transverse fractures of the patella. *Clin Orthop Relat Res*1981;158:180-4.
9. Böstman O, Kiviluoto O, Nirhamo J. Comminuted displaced fractures of the patella. *Injury*1981;13:196-202.
10. Böstman O, Kiviluoto O, Santavirta S. Fractures of the patella treated by operation. *Arch Orthop Trauma Surg* 1983;102:78-81.
11. Boström A. Fracture of the patella. A study of 422 patellar fractures. *Acta Orthop Scand*1972;143(suppl):1-80.
12. Andrews JR, Hughston JC. Treatment of patellar fractures by partial patellectomy. *South Med J*,1977;70:809-13.
13. Nummi J. Operative treatment of patellar fractures. *Acta Orthop Scand*,1971;42:437-8.
14. Black JK, Connors JJ. Vertical fractures of the patella. *South Med J*. 1969;62:76-7.
15. Dowd GS. Marginal Fractures of the Patella. *Injury* 1982;14:287-91.
16. Yu JS, Petersilge C, Sartoris DJ. MR imaging of injuries of the extensor mechanism of the knee. *Radiographics*,1994;14:541-51.
17. Kaufer H. Mechanical function of the patella. *J Bone Joint Surg Am.* 1971;53:1551-60.
18. Anderson LD. Campbell's Operative Orthopaedics. 5th ed. St. Louis, MO: Mosby; 1971.
19. DePalma A, Flynn J. Joint changes following experimental partial and total patellectomy. *J Bone Joint Surg Am.* 1958;40-A:395-413.
20. Weber M, Janecki C, McLeod P. Efficacy of various forms of fixation of transverse fractures of the patella. *J Bone Joint Surg Am.* 1980;62-A:215-20.
21. Miskew DBW, Pearson RL, Pankovich AM. Mersilene strip suture in repair of disruptions of the quadriceps and patellar tendons. *J Trauma.* 1980;20:867-72.
22. Iame's E Carpenter. "Fracture of patella. *JBJS* 1993;75 A:1550-61.
23. Siddaram N. Patil, SankarRao P. Aprospective clinical study of Patellar Fractures Treated by Modified Tension Band Wiring. *Open Science Journal of Clinical Medicine* 2014;2(2):54-8.
24. Sudheendra PR, Krishnaprasad S. Functional Outcome of Patellar Fractures Treated by Internal Fixation: A Retrospective Study. *Journal of Evolution and Dental Sciences* 2014; (29):8126-41.
25. Lieb FJ, Perry J. Quadriceps function: an anatomical and mechanical study using amputated limbs. *J Bone Joint Sgr* 1968;50:1535.
26. Berg EE. Open reduction internal fixation of displaced transverse patella fractures with figure eight wiring through parallel cannulated compression screws. *J Orthop Trauma* 1997;11(8);573-6.
27. Smith ST, Cramer KE, Karges DE, Watson JT, Moed RR. Early complications in the operative treatment of patella fractures. *J Orthop Trauma* 1997;11(3);183-7.
28. Dudani. B, Sancheti KM. "Management of fracture patellae by tension band wiring" *Ind.Jortho* 1981;15(1)43-8.
29. Einola S, Aho AJ, Kallio P. Patellectomy after fracture: long-term follow-up results with special reference to functional disability. *Acta Orthop Scand* 1976;47:441-7.
30. Leung PC, Lee SY. "Percutaneous tension band wiring" A new method of internal fixation for mildly displaced patellar fracture. *J.Ortho Trauma* 1983;23:62-4.

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