



A Prospective Clinical Study of Patellar Fractures Treated by Modified Tension Band Wiring

Authors

Dr L.G. Vishali¹, Dr Venkat Lakavath², Dr S. Lakshminarayana³

¹Post graduate student, Dept of Orthopaedics, MGM Hospital, Kakatiya Medical College, Warangal, Telangana State

²Associate Professor, Dept of Orthopaedics, Government Medical College, Nizamabad, Telangana state,

³Professor, Dept of Orthopaedics, MGM Hospital, Kakatiya Medical College, Warangal, Telangana state, India

Corresponding Author

L.G. Vishali

Email: lgvishali@gmail.com, 9885550890

Abstract

Background: Patellar fractures constitutes about 1% of all skeletal injuries resulting from either direct or indirect trauma. Patella is of importance for the extension of knee joint, which increases the force of quadriceps apparatus by improving the leverage, in addition it protects the anterior surface of distal femur against external violence but may be easily injured due to unprotected position. Any compromise of the joint surface is likely to lead to degenerative joint disease. It is therefore, highly desirable, in patellar fractures to strive for anatomical reduction of the joint surface and stable fixation.

Objectives: To determine the demographic profile (age and sex distribution) of our patients with fracture patella.

To study the functional outcome by early mobilization.

To study the complications of tension band wiring.

To clinically evaluate the tension band wiring technique for fracture patella.

To assess knee joint motion and stability after the procedure.

To study the mode of injury for fracture patella.

Methods: This prospective study is consists of 40 selected cases of fractured patella treated by modified tension band wiring at the Kakatiya Medical College, MGMH, Warangal from July 2015 to October 2017.

Results: 40 cases of fracture patella treated by tension band wiring technique at Kakatiya Medical College, MGM Hospital, Warangal. have been presented. Maximum number of cases 11 (27.5%) were in the age group of 41-50. There was male sex predomination, 29(62.5%) were males and 11(27.5%) were females. Right side fractures were common with 25(62.5%) cases. 31(77.5%) cases are due to an indirect trauma to the knee joint, direct injury resulted fracture patella in 9(22.5%) cases. 26(65%) cases are transverse fractures and 14 (35%) cases had comminuted fractures. Subjective complaints like mild pain was observed in 6(15%) patients and moderate pain was observed in 2(5%) patients.

8(20%) patients had flexion limitation, quadriceps wasting was observed in 8(20%) patients a quadriceps power of grade-4 was observed in 8 (20%) patients. Extensor lag of 5 to 10 degrees was seen in 2 cases(5%), 32 (80%) cases had excellent result, 6 (15%) cases had good results and 2(5%) cases had poor results based on WEST'S CRITERIA following modified tension band wiring procedure.

Keywords: Patella, Fractures, Treatment, Tension band Wiring.

Modified Tension Band Wiring

Modified tension band wiring was first described by Muller which involves the use of two parallel 2mm Kirschner wires combined with an 18 gauge wire looped over the Kirschner wires and over the anterior aspect of the patella to act as a tension band. This anterior tension band neutralizes the large distraction force that occurs across the anterior surface with contraction of the quadriceps and also with flexion of the knee. This method of fixation of fractured patella is a simple, effective means of immobilizing the fracture, has very sound biomechanical background theory, and allows early mobilization of the knee joint.

Methodology

The present study consists of 40 selected cases of fractured patella treated by tension band wiring at the Kakatiya Medical College, MGMH, Warangal from July 2015 to October 2017.

Inclusion criteria

- Patella fractures in both males and females with age >20yrs
- Simple and compound (Grade I and II) patella fractures
- Transverse, upper pole, lower pole, stellate and comminuted fractures

Exclusion criteria

- Patients having associated tibia and femur fractures.
- Patients having associated nerve injuries
- Patient aged less than 20years
- Pre-existing fixed flexion deformity
- Patients with neurological and medical comorbidities
- Pathological fractures

Method of Collecting Data

Once the patient was admitted to the hospital, the details of the case regarding the name, age, sex, occupation, and address are recorded. All the Patients enquired for mode of injury and duration is recorded, thorough general and clinical examination will be carried out and radiographs

are taken. The patients were selected according to the protocol and Routine laboratory investigations were carried out. The limb was immobilized by an above knee plaster of Paris posterior slab and operation was done at a later date, mean while patient is prepared for surgery.

Operative Procedure

The fracture site will be exposed through transverse incision/ midline longitudinal incision in front of the knee; the fragments will be reduced and held in position with the help of patellar clamp or towel clips. Two Kirschner wires of 1.6 mm thickness are passed parallel to each other from above down wards starting at its superior border till lower pole of patella is reached. 18 G stainless steel wire is taken and passed deep to ligamentum patellae inferiorly and behind the quadriceps tendon superiorly making a figure of '8' in front of the patella sufficient tension is given. Tear in the quadriceps expansion is sutured with vicryl and wound closed in layers. Above Knee slab or pressure bandage is given as a temporary immobilization. Check X-Rays are done post operatively.

Post Operative Management

The operated knee was immobilized in extension in an above knee posterior slab, and advised to do straight leg raising test and weight bearing started from third post operative day. Sutures were removed from 12th to 14th day, later on knee flexion was started with quadriceps board and with continuous passive motion (CPM) machine. They were advised to do dynamic quadriceps exercises (isometric) which they could do themselves at home regularly and patients were discharged 14th to 20th post operative day.

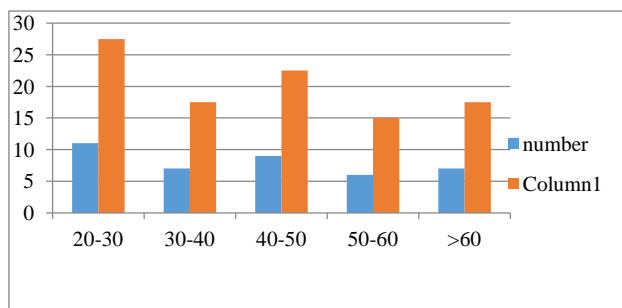
Follow Up

The discharged patients were advised to report for follow up on every month, during each follow up the patients were examined for both subjective symptoms and objective signs which was recorded. The patients were questioned about

subjective complaints like pain, difficulty in walking, squatting, climbing and getting down stairs and ability to perform routine work. The patient’s objective assessment was done for Extensor lag, Range of knee movement, circumference of thigh (wasting) and Efficacy of quadriceps (power).

Table 1. Age distribution

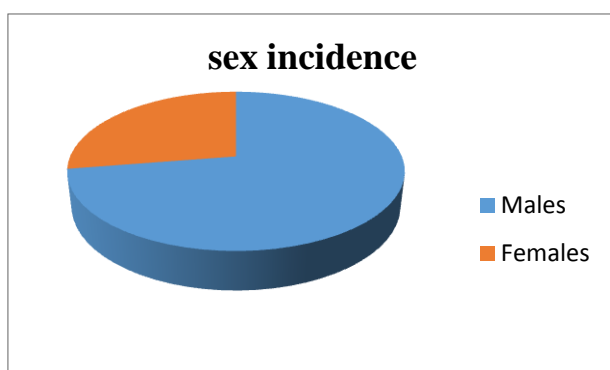
Age group years)	Number of cases	Percentage
21 to 30	9	22.5
31 to 40	7	17.5
41 to 50	11	27.5
51 to 60	6	15
>60	7	17.5



Out of 40 patients, 11 (27.5%) cases were patients between 41-50 years and 7 cases (17.5%) were elderly patients.

Table 2 - Sex Distribution

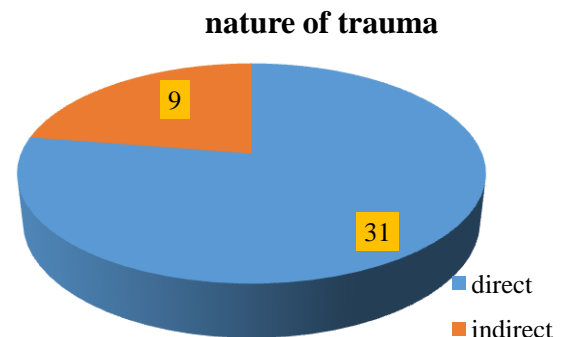
Sex	Number of cases	Percentage
Males	29	72.5
Females	11	27.5



Out of 40 cases 29 (72.5 %) were male patients and 11 (27.5%) were female patients

Table 3 -Mode of Injury

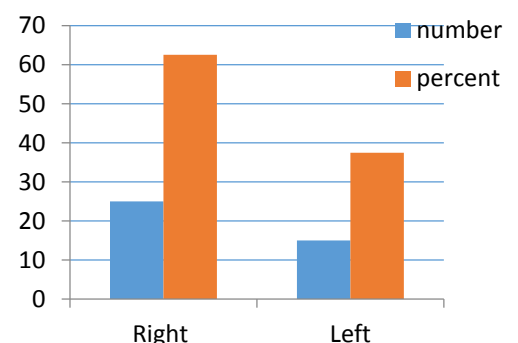
Nature of trauma	Number of cases	Percentage
Indirect	31	77.5
Direct	9	22.5



Out of 40 cases 31 fractures (77.5%) were due to indirect trauma and 9 cases (22.5%) were due to direct trauma.

Table 4 Side of Injury

Side of injury	Number of cases	Percentage
Right	25	62.5
Left	15	37.5



Out of 40 cases 25 fractures (62.5 %) were on right side and 15 fractures (37.5 %) were on left side

Table 5 -Type of Fracture

Type of fracture	Number of cases	Percentage
Transverse fracture	26	65
Comminuted fracture	14	35

Two types of fractures, in the present series 35% were communitted and 65% were transverse fracture.

Graph showing type of fracture

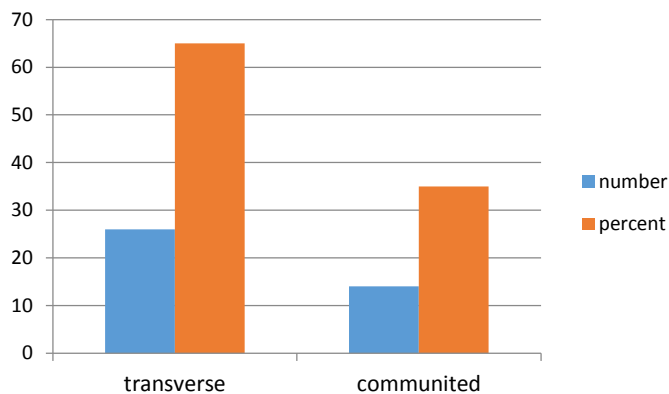
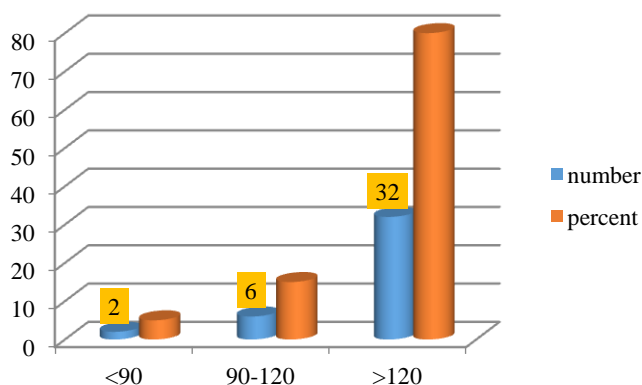


Table 6 : Complications

Complications	Cases	Percentage
Hardware impingement	2	5%
Superficial wound infection	1	2.5%
Extension lag	8	20%
Loss of flexion <30 degrees	6	15%
Loss of flexion >30 degrees	2	5%
Mal union	0	0
Non union	0	0
No Complications	32	80%
Total	40	100%

Table 7 Flexion Assessment

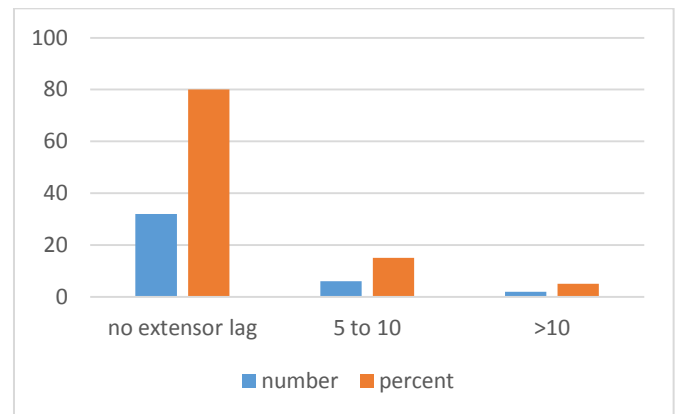
Knee flexion (in degrees)	Cases	Percent
<90	2	5%
90 -120	6	15%
>120	32	80%
Total	40	100%



In this series of 40 cases, 2 cases(5%) showed loss of flexion >30 degrees,6 cases(15%) had loss of flexion less than 30%

Table 8: Extension Assessment

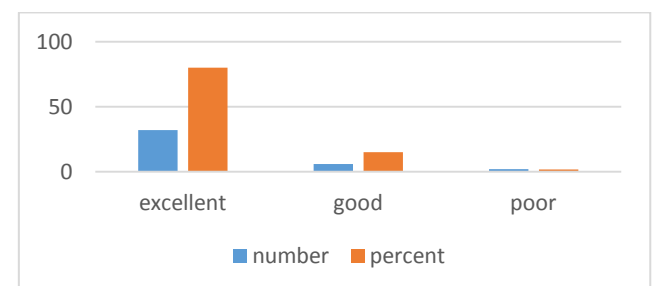
Extensor lag (in degrees)	cases	percent
No extensor lag	32	32%
5 - 10	4	15%
>10	2	5%
TOTAL	40	100%



In this series out of 40 cases, 4 cases (15%) had extensor lag of 0 to 5 degrees, and 2 cases (5%) had extensor lag of 5-10 degrees.

Table 9 : Results Assessment

Result	Cases	percentage
Excellent	32	20%
Good	6	15%
Poor	2	5%
Total	40	100%



Based on WEST'S CRITERIA, In the present study 32 cases (80%) had excellent result, 6 cases (15%) had good results and 2 cases (5%) had poor results. All the cases were assessed based on WEST'S CRITERIA. which is graded as:

Excellent

Patient do not have any limitation of activities
 No loss of flexion.
 No extensor lag.
 No subjective complaints
 No quadriceps wasting or subsequent reduction in power.

Good (1 or >1 criteria)

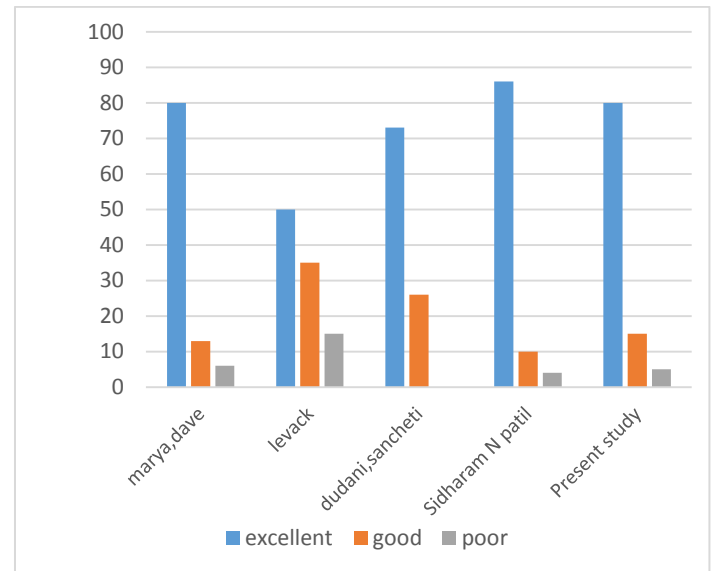
Moderate limitation of activity
 Extensor lag of 5-10 degrees.
 Minimal wasting of quadriceps and power of Grade 4.
 Some subjective symptoms
 Flexion loss not >30 degrees.

Poor (1 or >1 criteria)

Marked limitation of activities with significant
 Complaints of pain and weakness
 Marked quadriceps wasting and power <3.
 Extensor lag >10 degrees
 Flexion loss >30 degrees.

Table 10 : Results Comparison

Study	No of cases	excellent	Good	Poor
Marya, Bhan, Dave ¹⁴	30	24(80%)	4(13%)	2(6.66%)
Levack, Flannagan Hobbs ³⁰	14	7(50%)	5(35.7%)	2(14.28%)
Dudani, Sancheti ¹²	15	11(73%)	4(26.6%)	0
Siddharam N Patil	30	26(86%)	3(10%)	1(4%)
Present study	40	32(80%)	6(15%)	2(5%)



In the present study 32 (80%) had excellent result, 6 (15%) had good results and 2(5%) had poor results.

Dudani, Sancheti¹² in their study also found similar results 11(73.33%) had excellent result and 4(26.66%) had good result.

Marya, Bhan, Dave¹⁴ found 24(80%) had excellent result, 4(13.33%) had good result and 2(6.66%) had poor result.

But Levack, Flannagan, Hobbs³⁰ found 7(50%) had excellent result, 5(35.71%) had good result and 2(14.28%) had poor result.

Siddharam N Patil observed excellent result in about 86.6% and good in about 10% and poor in 3.3% of cases.

Conclusion

Fractures of the patella are common though rare below the age of 20 years.

Fall in the same plane is the most common cause of fractures of the patella. Vertical incision is more helpful to mobilize the patient early. Anatomical reduction and stable fixation in patellar fracture is necessary for the normal integrity and stability of the joint. Early mobilization of the knee restores quadriceps power and range of knee motion within a short period. Excellent range of movement was achieved in 80% of cases.

The results of our study were comparable with other studies in the literature. Physiotherapy is a

very essential tool of success in the management of these fractures, which helps in reducing complication like stiffness of knee and in providing good functional. Early and continuous physiotherapy following the modified tension band wiring technique is of paramount importance in determining the end results. Long-term follow up is necessary to assess late complications like osteoarthritis and late functional outcome. Tension band wiring is therefore a good choice for the treatment of fracture patella with least complications.

Summary

40 cases of fracture patella treated by tension band wiring technique at Kakatiya Medical College, MGM Hospital, Warangal. have been presented. Maximum number of cases 11 (27.5%) were in the age group of 41-50. There was male sex predomination, 29(62.5%) were males and 11(27.5%) were females.

Right side fractures were common with 25 (62.5%) cases. 31 (77.5%) cases are due to an indirect trauma to the knee joint, direct injury resulted fracture patella in 9(22.5%) cases. 26 (65%) cases are transverse fractures and 14 (35%) cases had comminuted fractures.

Subjective complaints like mild pain was observed in 6(15%) patients and moderate pain was observed in 2(5%) patients. 8 (20%) patients had flexion limitation, quadriceps wasting was observed in 8(20%) patients a quadriceps power of grade-4 was observed in 8 (20%) patients. Extensor lag of 5 to 10 degrees was seen in 2 cases(5%), 32 (80%) cases had excellent result, 6 (15%) cases had good results and 2(5%) cases had poor results based on WEST'S CRITERIA following tension band wiring procedure.

References

1. Matthew I. Rudloff "Campbell's operative orthopaedics". Chapter 54. 12th edition, Edt. S. Terry Canale, James

- H.Beaty, Elsevier Mosby, Vol. 3, 2013: 2681-2688pp.
2. Haxton H.A. "The functions of the patella and the effects of its excision". Surg Gynaec Obst, 1945; 80: 389pp.
3. Kaufer H. "Mechanical function of the patella". JBJS, 1971; 53 (A): 1551.
4. Cameron HC. "Transverse fracture of the patella". Glasgow Med J, 1878; 10: 289-294pp.
5. Douglas CD., Netto. "Fractures of the Patella". PGMJ, 1963; 39: 83.
6. Muller ME, Aiigower M, Willinegger H. "Technique recommended by the AO group. In: Manual of internal fixation". New York: Sphringer-Verlag, 1979; 249-250pp.
7. Weber M.J., Janecki C.J., McLeod P. et al. "Efficacy of various forms of fixation of transverse fractures of the patella". JBJS, Am, March 1980; 62 (2):
8. Dudani B, Sancheti K.M. "Management of fracture patella by tension band wiring". Ind. J of Ortho. 1981; 15-1: 43-48pp.
9. Benjamin J, Bried J, Dohmm et al. "Biomechanical evaluation of various forms of fixation of transverse patellar fracture". J Ortho Trauma, 1987; 1: 219pp.
10. Curtis M.J. "Internal fixation for fractures of the patella. A comparison of two methods". JBJS Br, March 1990; 72 (2):
11. Carpenter JE, Kasman RA, Patel N. et al. "Biomechanical evaluation of current patella fracture fixation techniques". J Orthop Trauma, 1997; 11: 351- 356.
12. Gray's Anatomy, 40th edition, Churchill Livingstone, 2008, ch 82: 1393-1410pp.
13. Cunningham's manual of practical anatomy, 15th edition, ELBS, Oxford University Press, Vol. 1, 1984: 215-221 pp.

14. Scapinelli R. "Blood supply of the human patella". JBJS, 1967; 49 (B): 563- 570pp.
15. Fredrick J. Liee. "Quadriceps mechanism of the knee" JBJS, 1966; Vol. 48 (6):51-54.
16. Grooves E.W. Hey. "A note on the extension apparatus of the knee joint". Br.J Surg, 1937; 24: 747-748pp.
17. Asheesh Bedi & Madhav.A.Karunakar. "Rockwood and Green's Fractures in adults", Charles A. Rockwood, Robert W. Bucholz (edt) ,Chapter 52, 7th edition, Philadelphia, Lippincott Williams& Wilkins, Vol. 2, 2010: 1752- 1779pp.
18. Desai N.N. "A study of different types of treatment in fractures of the patella". Ind J Surg, 1972; 34: 54.
19. Bostrom A. "Fractures of the patella: A study of 422 patellar fractures". Acta ortho Scand. 1972; 143:1-80pp.
20. Logan Clark. "Conservative treatment for comminuted fracture of the patella". JBJS, 1969; 51 (B): 776pp.
21. Levack B, Flannagan J.P., Hobbs S. "Results of surgical treatment of patellar fractures". JBJS, 1985; 67-B: 416-419pp.
22. Timothy J Bray et al. chapter 46 in Michael W Chapmans Operative Orthopaedics, 2nd edition, Philadelphia, JB Lippincott Company, Vol. 1, 1993: 663-670pp.
23. Gardner, Michael J, Griffith, Matthew H, Lawrence, Brandon D, Lorch, DeanG. Complete exposure of articular surface for fixation of patellar fractures. J orthop trauma 2005 feb;19(2):118-123.
24. Szyskowitz R. Muller ME et al. chapter 13 in manual of internal fixation. Technique recommended by the AO group, 3rd edition, New York, Springer Verlag, 1992, 226-227, 564-569pp.
25. Chrioff B.T. "A new technique for the treatment of comminuted transverse fractures of the patella". Surg. Gynaec Obst, 1977:145pp.
26. DePalm A.F Flynn JJ "Joint changes following partial and total patellectomy" JBJS, 1958; 40a: 395.
27. Basu Ray S.K. and Ghosh M.S. "Functional end results of patellectomy in fracture of the patella". Ind J Orthop, Vol. 8; 1974.
28. Bostman O, Kivilvoto O, Nirhamo J, "Comminuted displaced fracture of patella". Injury, 1982; 13: 196-202pp.
29. Siddaram N. Patil, Sankar Rao P. A Prospective Clinical Study of Patellar Fractures Treated by Modified Tension Band Wiring. Open Science Journal of Clinical Medicine. Vol. 2, No. 2, 2014, pp. 54-58.
30. Sudheendra P. R, Krishnaprasad S. "Functional Outcome of Patellar Fractures Treated by Internal Fixation: A Retrospective Study". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 29
31. Anand Jabshetty B. A comparative study of modified tension band wiring and cerclage wiring in management of transverse fractures of patella. Indian Journal of Science and Technology. 2011; 4:0974-6846.