ORIGINAL RESEARCH PAPER
Volume - 13 | Issue - 02 | February - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

EVALUATION OF THE RESULTS OF TENSION BAND WIRING IN TRANSVERSE FRACTURES OF PATELLA IN ADULTS

Orthopaedics

Dr Avisek Majumder Orthopaedic surgeon, Dept of Orthopaedics ,Agartala Government Medical College & Govinda Ballav Panth Hospital, Agartala, Tripura.

Dr Tapan Kumar Das Associate Professor, Dept of Orthopaedics, Government Medical College & Govinda Ballav Panth Hospital, Agartala, Tripura.

Shashi Ranjan Senior Resident, MS orthopedics, Agartala Government Medical College, Tripura, India.

ABSTRACT

Aim: To assess the functional outcome of tension band wiring in transverse fracture of patella postoperatively in local population in adults. **Materials and Methods** This is a prospective descriptive study. 29 patients with transverse fractures of patella treated by tension band wiring were instructed to follow the rehabilitation protocol of early mobilization. For the evaluation, the modified knee pain score and Goodfellow grading were used. **Results** Total of 29 patients were enrolled in this study. 27 were male and 2 female; age ranged from 21 years to 65 years . Right knee was involved in 15 cases while the left knee was involved in 14.There was gradual increase in the knee pain score and Goodfellow grading in each follow up. Most of the patients had the maximum scores (50) at 6th month of follow up. And more than 50% of the patients had a Goodfellow grading at 2nd month of follow up. But in the same evaluation, the female patients had a delayed functional outcome as compared to the male patients. Regarding the range of motion, 19 of the patients had a range of motion of more than 90 degree at the end of 2nd month which can be regarded as an acceptable function of the knee. **Conclusion:** Properly following the rehabilitation protocol post operatively after tension band wiring in transverse fractures of patella, the better function can be achieved earlier.

KEYWORDS

Tension band wiring, Fracture patella, Good fellow grading.

INTRODUCTION-

Patella is the largest sesamoid bone in the human body situated in the front of the knee with thethickness between 1.5cm and 2cm[1] .

Patellar fracture is a common injury caused by excessive tension through the extensor mechanism or a direct blow. Anatomic reduction and fixation with a tension-band technique is associated with the best outcomes; however, symptomatic hardware is a frequent complication.[2]

Patella fractures comprise 1% of all fractures encountered in the emergency department, and about 30% of them require surgical intervention.[3]

The patella is susceptible to injury from a direct blow as a result of its anterior location and thin overlying soft tissue covering. Fractures of the patella may result from direct, indirect, or combined injury pattern.[4]

Fracture of the patella can occur either by direct or by indirectforce[5]. The direct force often results in comminuted or displaced fractures, whereas the indirect force such as sudden violent contraction of quadriceps muscles with knee flexion causes transverse fracture of patella .Fracture pattern has not changed much since past but different modality of treatment has been tried. But depending of the socioeconomic and geographic condition all recent modalities cannot be tried in every cases. Same form of treatment is not universally accepted and the popularity of treatment methods waxes and wanes. But there is one principle that will always stand out as a clear guide "We are here not to replace nature's method of repair, but only to use the intelligence to assist that repair, and prevent some of the disabilities which can result if nature is left to its own resources[6]

Fixation of patellar fractures is very crucial as it allows early mobilisation of the knee without detrimental displacement at the fracture site .[7]

This general philosophy has been taken on overall management of fracture patella. All surgical procedures has to be designed to assist this natural repair. In many cases function cannot be restored without the help of surgeons.There are various surgical ways to treat the fracture of patella .Currently there are four forms of operative treatment. They are –ORIF with screws, various forms of internal fixation with an anterior tensionband, partial patellectomy and total patellectomy. Tension band wiring techniques appear to offer the best clinical results for the stabilization of patella fractures. By proper placement of the wires, the distracting or shear forces tending to separate the fragments are converted into compressive forces across the fracture site, resulting in early union and this method also allows immediate motion and exercise of the knee. Hence, for displaced transverse fracture of patella, tension band wiring technique has proven to be the ideal method oftreatment[8]

Tension band wiring (TBW) of patella is one of the most common and popular methods of fixation, specially for simple mid-pole patella fractures .[9]

Displacement of more than 2 mm in 22% of the fractures after early mobilisation using TBW technique popularised by the Arbeitsgemeinschaft für Osteosynthesefragen (AO group) has been reported.[10]

METHODOLOGY

Aim of the study

The present study was planned to assess the functional outcome of tension band wiring in transverse fracture of patella post operatively in local people.

Study design

The study was an open prospective, descriptive, clinical trial, and was conducted at the Departmentof Orthopaedic Surgery, Agartala Government Medical College &Govinda Ballav Panth Hospital, Agartala, as per the guidelines of Ethical Committee, AGMC. 29 patients, who had unilateral transverse fracture of patella, are enrolled in this study.

Risks and benefits of study were explained in easily understandable language to the patients. Consent was taken from each patient and assured that the entire information and records will be kept confidential.

MATERIALS AND METHODS

Inclusion criteria

- All closed displaced transverse fracture of patella with intra articular incongruity of more than 2 mm and displacement of morethan 3 mm.
- Fracture less than 10 days old
- Age > 18 years .
- Sex: Both male and female

Exclusion criteria

- Comminuted fractures
- Any established knee deformities prior tofracture

- Fracture associated with other ligamentous andbony injuries in the knee region.
- Compound fractures.

Statistical analysis

The collected data were analyzed by student t test for continuous variables and with the chi-square test for categorical variables. The minimum level of significance was fixed at 95% confidence limit and a p-value of <0.05 was considered significant.

Study procedure

To produce uniformity in the study, a general guide linewas made from the time of sending patients to the surgical procedure. Before sending a patient for the surgery, history was taken in detail, all preliminary general, local and radiographic evaluations were done. Each patient was counselled to follow strictly the post operative rehabilitation protocol. Patients were prepared in a conventional way in the OperationTheatre. Longitudinal midline incision over the mid portion of the patella was preferred. Fracture fragments were reduced anatomically by using large towel clips, patellar clamps or appropriate boneholding forceps and then a 18-gauge wire was passed in figure of eight fashion and tightened at the upper end. Proper reduction of the patella was checked by palpating the under surface of the patella with the knee extended. Retinacular tears were repaired withmultiple interrupted sutures by vicryl 2-0. Skin wasclosed by Ethilon 2-0 .

Bandaging wasdone with Robert Jones bandage. plaster was applied as a form of cylinder slab. Teaching session of Rehabilitation Protocol wasstarted on 3rd days. Quadriceps strengthening exercise, progressive straight leg raising (SLR) with weight, range of motion (ROM) exercise and partial weight bearing, toe touch walking with crutches were taught. Patients were asked to do gradual full weight bearing on 2nd follow up (4th week).

Although in this study we used stainless steel wire, the improvements in principle may be used, even when nonmetallic sutures are used. Nonmetallic sutures are in vogue with some surgeons for their obvious advantages of preventing metallic implant-related problems like skin irritation which might necessitate implant removal.[11,12]

Follow up evaluation

The patients were followed in 2nd week, 4th week,2nd month, 3rd month & 6th month. In each follow up, knee pain score was recorded, range of motion and extension lag were recorded, Good fellow's gradingof range of motion was done, thigh circumference was measured & check x-ray was taken to assess fracture union. Maximum score of knee pain score is 50.

Knee Pain Score

Pain Points

- None 50
- Mild or occasional 45
- Stairs only 40
- Walking & stairs 30
- Moderate
- Occasional 20
- Continual 10
- Severe 0

Goodfellow's grading of Range of motion

Grading	Range of motion
Excellent	Painless full movement and able to squat
Good	Full flexion and extension but painful squat
Fair	Painless movement with 10-20 degree limitation of flexion
Satisfactory	Painless movement with limitation of 20-40 degree of flexion
Poor	Limitation of > 40 degree flexion

Tables-

Table 1 thigh circumference in each follow up

THIGH CIRCUMFERENCE DIFFERENCE IN EACH FOLLOW UP	1st	2nd	3rd	4th	5th
-2	10	8	4	3	2
-1	15	13	10	10	10
0	4	8	14	15	16
1			1	1	1
total	29	29	29	29	29

Table 2 ROM in each follow up

THIGH CIRCUMFERENCE DIFFERENCE IN EACH FOLLOW UP	1st	2nd	3rd	4th	5th
-2	10	8	4	3	2
-1	15	13	10	10	10
0	4	8	14	15	16
1			1	1	1
total	29	29	29	29	29

Table 3 knee pain score in each follow up

Knee pain score	1st	2nd	3rd	4th	5th
20	8				
30	21	14	5	2	
40		15	12	9	3
45			12	13	6
50				5	20
total	29	29	29	29	29

Table 4 Goodfellow grading in each follow up

Goodfellow grading	1st	2nd	3rd	4th	5th
Excellent				7	20
Good			1	6	3
Fair	1	6	16	9	3
Satisfactory	1	14	8	5	1
poor	27	9	4	2	2
Total	29	29	29	29	29

RESULTS-

The total number of patients included in this studywas 29 who had completed all the follow up of the study.The interval between the occurrence of the injury and the surgical intervention ranged from 0 to 10 days with a mean of 7.2 days and a standard deviation of 2.6. There was no statistically significant difference in the outcome attributable to the time of surgical intervention after injury. The complication noted was superficial infectionin one case during 1st follow up at 2 weeks. This was treated with oral antibiotics and local dressing. Implant breakage was seen in two cases and symptomatic hardware was seen in two cases.

Figure 1 implant breakage -1

Figure 2 implant breakage 2

The age of the patients ranged from 21 to 65 yearswith a mean age of 39.75 years. The maximumincidence of the injury was observed during 3rd and4th decade of life.

27(93.11%)patients were male and 02(6.89%) patients were female. Right knee was involved in 15(51.72%) cases while the left knee was involved in 14(48.28%) and there were no cases of bilateral knee involvements.

Most of the patients came to the OPD and emergency department. The mode ofinjury was mainly fall (20 out of 29). In themajority, the complaints used tobe pain and swelling of the affected knee.

Quadriceps wasting was noted in most of the casesin spite of intensive physiotherapy programs. Outof 29 patients, 21 patients had a quadriceps wastingduring the 2nd week of follow up. Most of thepatients (14 out 29) regained their muscle girth at 2nd month of follow up but 12 patients didn't regain thefull pre injury muscle girth status even at 6 months.In comparison between male and female, female patients had a delay in recovery of wasted muscles.Out of 2 female patients, both (100%) had no recovery of the wasted muscles at the end of 6months.

Figure 3 thigh wasting

Regarding the achievement of flexion, there was statistically significant difference between each follow up period . At the end of 2nd week, most of the patients (28 out of 29) had ROMof< 90 degree. There was significant increase in ROM at the end of 2nd month, in which period 24 patients had >90 degree ROM (82.75). 25 patients (86.21%) regained ROM of >120 degree at theend of 6 months.

For the subjective evaluation, the modified knee pain score was used. At 2nd weeks follow up, all patients had a subjective score of 30 or less which indicates that the patients had mild or moderate knee pain during that period. At 4 weeks follow up, 51.52% patients had knee pain score of 40 and 48.28 % patients had 30. Hence all the patients during this follow uphad mild knee pain. 20 patients (68.97%) had knee pain score of 50 at 6th month follow up and 9 had more then>40 knee pain score during this period. There was statistically significant difference between 1st with 2nd ,3rd ,4th and 5th follow up.

The clinical results were categorized according to theGoodfellow grading mentioned in the methodology.Most of the patients (29 out of 29 patients) had poorresult at 2nd week follow up. This result graduallyimproved in successive follow up. At 2nd monthsfollow up, more than 55.17% patients had good result. At 6 months follow up 27 patients had good, satisfactory or excellentresult.

DISCUSSION

29 patients were included in the study. Patients' age ranged from 21 to 65 years. Majority of the injuries were in the 3rd and 4th decade of life, which means working individuals who were more outgoing suffered the most. The male dominance (27out of 29) in the injuries also verified the similar interpretation. The most common mode of injury was fall . Other common mode of injury was road traffic accident. In majority of cases, right knee was involved (15 out of 29) but there were no cases of bilateral knee involvement. There were no intra-operative and immediate postoperative complications. One patient encountered superficial infection at 2nd wks follow up. This was treated with oral antibiotics and local dressings. Complications like implant breakage were seen in two no of cases and symptomatic hard ware was seen in two cases.

All fractures were treated operatively by tension band wiring technique. In tension band technique, all the tensile forces are absorbed and the bone comes under compressive force. One can then confidently begin early mobilization and results into primary healing.

In this present study, all patients were instructed to do the early mobilization of the knee post operatively. Most of the patients gained the ROM of > 90 degree at 8thweeks which is said to have a clinical union of fracture patella.

The common sequel of transverse patellar fractures tear in medial and lateral retinacular expansions by pull of contracting quadriceps muscles resulting into loss of continuity of extensor mechanism and extension lag if untreated .Thus goal of treatment will be to restore the continuity of extensor mechanism to restore normal knee function. Earlier in the study by Weber et al, the efficacy of various forms fixation of transverse fracture of patella, showed that if early motion is to be instituted tension band wiring should be used with repair of Retinaculam. In tension band wiring, there was no separation of fragment through 0-90 degree of motion, which was attributed to the stability of the interface between the wire loop and bone.

Incompletely reduced articular surface results into posttraumatic arthritis and prolonged immobilization of knee causes stiffness. In order to prevent these complication, anatomical restoration of articular surface and rigid fixation of fracture should be done. This provides a regimen for physical therapy that includes both early mobilization of knee and quadriceps strengthening exercise.

Articular congruity and fracture union were observed by the mean of a series of x-ray taken is each followup. Most of the fractures were radiologically united at an average of 12 week. In the study of Berg, EE, radiological union of transverse fracture of patella were seen at a mean of 13 week7, which is statically significant to this study.

With the passage of time, treatment options for patellar fracture has been changed from patellectomy to modified tension band wiring technique, advised by AO, emphasizing on the guiding principle of open reduction, rigid anatomical fixation with compression, no cast immobilization and early return to full activity.

Lavack et al 9studied all fracture of patella with different modalities of fixation and best of the result of all were achieved by precise anatomical reduction of patella fracture and fixation with K wires and tension band wire (modified tension band wires). The described fixation technique with early mobilizations for transverse fracture of patella has clinical results equivalent to the results that are published in the different journal. Subjective and functional results using knee pain score and Goodfellow's grading are comparable to the previously published reports, with more than 97.13 % achieving an excellent or good outcome. Though the clinical union and functional outcome occurred at an average of 8 weeks, it doesn't fulfil the whole function of that knee in our context. In this area of world, people have to sit in squat position for their daily activities like toilet, cleaning the floor, etc. Hence the functional outcome of the knee in our context should be squatting position when the knee is around 130 degree and when the patients can do painless squatting, then only the functional outcome should be reported.

In this study, at 6th month, more than 68.97% of patients developed painless squatting with around 130 degree of flexion of the knee. So, the total functional gain for the local people with transverse fracture of patella with tension band wiring developed on around 6th post operative months if the proper rehabilitation protocols are followed.

CONCLUSION

This study shows that the clinical union of transverse fracture of patella with tension band wiring in local patients is comparable to the results that are found in the similar studies of the developed countries. But, most of the local people have to sit in squatting position for daily activities like going to toilet, cleaning floor, etc.

Hence, the full function of the knee in our context should correspond to the achievement of around 120-130 degree of knee flexion. Thus the proper comparison of this particular point with the results published in the western literatures not possible. Furthermore, the sample size is small and the period of follow up is shorter in this present study. So, further studies including a large sample and a longer period of follow up is desirable to further support the result of this study.

REFERENCES-

1. Mark R.Brinker; Extensor mechanism injuries of the knee;Peterw.Ross and Mark D.Miller;Review of Orthopaedic Trauma.
2. Melvin, Stuart J. MD; Mehta, Samir MD. Patellar Fractures in Adults. American Academy of Orthopaedic Surgeon 19(4):p 198-207, April 2011.
3. Scilaris T.A., Grantham J.L., Prayson M.J. Biomechanical comparison of fixation methods in transverse patella fractures. *J Orthop Trauma.* 1998;12:356–359. [PubMed] [Google Scholar]
4. Melvin J.S., Karunakar M.A. Patella fractures and extensor mechanism injuries. *AAOS Annu Meet.* 2015;54:2–3. [Google Scholar]
5. Whittle A.P.and Wood II G W.;Fractures of lower Extremity;Cambell's Operative Orthopaedisc;10th Edition.
6. Wilson JN;healing of injury.In:Watson –Jones.Fracture and Joint injuries,6th Edition.1982
7. Lotke P.A., Ecker M.L. Transverse fractures of the patella. *Clin Orthop Relat Res.* 1981;158:180–184. [PubMed] [Google Scholar]
8. Harris R.M.;Fractures of Patella.Rockwood and Green's fracture in adults;5th edition,volume-2
9. Egol K., Howard D., Monroy A. Patella fracture fixation with suture and wire: you reap what you sew. *Iowa Orthop J.* 2014;34:63–67. [PMC free article] [PubMed] [Google Scholar]
10. Smith S.T., Cramer K.E., Karges D.E. Early complications in the operative treatment of patella fractures. *J Orthop Trauma.* 1997;11:183–187. [PubMed] [Google Scholar]
11. 6a-Patel V.R., Parks B.G., Wang Y. Fixation of patella fractures with braided polyester suture: a biomechanical study. *Injury.* 2000;31:1–6. [PubMed] [Google Scholar]
12. 6b-Chen A., Hou C., Bao J. Comparison of biodegradable and metallic tension-band fixation for patella fractures. 38 patients followed for 2 years. *Acta Orthop Scand.* 1998;69:39–42. [PuabMed] [Google Scholar