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A prospective clinical study of patellar fractures treated by modified tension band wiring

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Abstract

Background and objectives: Patellar fractures are common and it constitutes about 1% of all skeletal injuries resulting from either direct or indirect trauma. The subcutaneous location of the patella makes it vulnerable to direct trauma Any improper and inadequate treatment would inevitably lead to a great deal of disability which would be most perceptibly felt in a country like India, where squatting is important activity in daily life. Objectives: The objectives of the study are: 1. The advantage of this method of fixation in patellar fractures; 2. The complications associated with this method of fixation. Methods: This prospective study is done in Department of Orthopaedics at Mamata General Hospital, Mamata Medical College, Khammam –AndhraPradesh, during the period from April 2011 to Aug2012. This study consists of 30 cases of *displaced transverse* fracture patella treated by modified tension band wiring. Results: In our series the range of age was between 14-72 years, the mean age was 42.05 years and the incidence was high in the age group of 41-50 years. 22 fractures were in men and 8 fractures were in females. 20 fractures were as a result of indirect mechanism and 10 cases were due to direct trauma to the patella as in Road traffic accident. 17 patients had fracture on the right side and 13 patients had fracture on the left side. Based on WEST'S Criteria our results were graded as excellent in 26 cases (86.6%), good in 3 cases (10%) and poor in 1 case (3.3%).Conclusion: Our study shows that modified tension band wiring is a definitive procedure in management of *displaced transverse* patellar fracture with least complications. This surgery of modified tension band wiring helps for early mobilization post-operatively which plays an important role in final out come.

Keywords

Patella, Fractures, Treatment, Wiring

1. Modified Tension Band Wiring

Modified tension band wiring was first described by Muller8 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. As tension is resisted by this wire, compressive forces are generated at the posterior aspect of the fracture gap, improving stability at the articular surface failures are often directly attributable to errors in operative technique.

The Modified tension band technique is currently the most widely accepted and several studies have shown a high percentage of good results.19. The application of AO tension band principles in the operative management of patella fracture has gained great popularity and in many trauma or Orthopaedic centres this method is the treatment of choice. The AO tension band method of fixation of fractured patella has given excellent results of internal fixation because it is a simple, effective means of immobilizing the fracture, has very sound biomechanical background theory, and allows early mobilization of the knee joint.

2. Methodology

This prospective study is done in Department of Orthopaedics at mamata general Hospital and mamata Medical college, khammam during the period from april 2011 to aug 2012. This study consists of 30 cases of *displaced transverse* fracture patella treated by modified tension band wiring. The cases were selected based on inclusion and exclusion criteria.

2.1. Inclusion Criteria

1. All closed and type I open displaced transverse patellar fractures.
2. Acute fractures.
3. Transverse fracture with displacement of more than 2 to 3 mm and articular step of more than 2mm.
4. Patients who are medically fit for surgery.

2.2. Exclusion Criteria

1. Type II and type III compound fractures.
2. Grossly comminuted, vertical or marginal fractures.
3. Old fractures (more than 2-3 weeks).
4. Undisplaced transverse fractures.
5. Patients who are not medically fit for the surgery.

2.3. 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 are personally interviewed 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.

2.4. 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 2 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.

2.5. 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.

2.6. 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).

3. Results

In our study, 30 cases of displaced transverse fractured patella were treated by modified tension band wiring, the findings and the end results of our study were analyzed in the following discussion.

Table 1. *Age distribution.*

Age in years	No. of cases	Percentage
0-10	0	0%
11-20	4	13.3%
21-30	2	6.6%
31-40	5	16.6%
41-50	12	40.0%
51-60	5	16.6%
61-70	1	3.3%
71-80	1	3.3%

Fracture of patella occurs in any age, but it occurs very rarely below 30 years, in our series the range of age was between 14-72 years, the mean age was 42.05 years and the incidence was high in the age group of 41-50 years.

Table 2. *Sex distribution: In a total of 30 cases, 22 fractures were in men and 8 fractures were in females.*

Sex	No. of patients	Percentage
Male	21	70%
Female	09	30%
Mode of injury	No. of cases	Percentage
Indirect	20	66%
Direct	10	34%

In our study of 30 cases, 20 fractures were as a result of indirect mechanism (forceful flexion of the knee against a contracted quadriceps as in fall from height) and 10 cases were due to direct trauma to the patella as in RTA.

Table 3. *Side of fracture.*

Side of fracture	No. of cases	Percentage
Right	17	56%
Left	13	44%

In our study of 30 cases 17 patients had fracture on the right side and 13 patients had fracture on the left side. There were no cases of bilateral fracture patella seen in our study.

3.1. Associated Injuries

Two patients of patellar fractures had other associated injuries. Both had ipsilateral fracture shaft femur that were treated with intramedullary fixation.

3.2. Hospital Stay

Average duration between injuries to hospital admission was about 1.16 days. The average duration between the day of admission to the day of surgery is about 2.93 days and the average duration of stay in hospital is about 13.2 days (ranging from 11 to 22 days). 22 days in a patient due to superficial infection of the wound and this was healed by 3rd week under antibiotic cover and sterile dressings.

3.3. Post Operative Immobilization

As all the cases of patellar fractures in our study were associated with tear of the extensor retinaculum which was repaired during surgery, all the patients were immobilized in an above knee POP slab for 2 weeks. After which patients were thought quadriceps exercises and knee bending exercises.

In patients with ipsilateral femoral shaft fractures that were treated with intramedullary fixation, quadriceps exercises and knee bending exercises were started after 2 weeks, and non-weight bearing crutch walking was advised for 8 weeks.

3.4. Post Operative Complications

No intra operative complications like fragmentation at wiring, difficulty in closure were encountered. In the immediate post operative period we had a case of wound gaping after suture removal and a case of superficial infection of the wound.

As for the delayed complications all the fractures were united at an average of 13.6 weeks, so we had no cases of delayed or malunited fractures. But we had a case of migration of pin through the skin after 11 weeks for which implant was removed and another case of limitation of flexion by 25 degrees.

3.5. Follow Up

All our patients were discharged after teaching them quadriceps exercises, and they were followed up every month for 20 weeks (5 months). During the follow up patients were asked about the subjective symptoms, and the objective signs were elicited and recorded. 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 4. *Based on WEST'S CRITERIA our results were graded as:*

Results	No. of cases	Percentage
Excellent	26	86.6%
Good	3	10.0%
Poor	1	3.3%

Table 5. *Results Compared with other Studies:*

S. No	Series	Cases	Excellent	Good	Poor
1	Our study	30 (100%)	26 (86.6%)	03 (10.0%)	01 (3.3%)
2	Dudani11	15 (100%)	11 (73.33%)	04 (26.66%)	00 (0%)
3	Liang12	27 (100%)	24 (88.88%)	02 (7.40%)	01 (3.7%)
4	Leung26	05 (100%)	05 (100%)	00 (0%)	00 (0%)
5	Levack30	14 (100%)	07 (50%)	05 (35.71%)	02 (14.28%)
6	Marya13	30 (100%)	24 (80%)	04 (13.33%)	02 (6.66%)

4. Discussion

Patellar fractures are common and it constitutes about 1% of all skeletal injuries resulting from either direct or indirect trauma. The subcutaneous location of the patella makes it vulnerable to direct trauma as in dashboard injuries or a fall on the flexed knee. Where as violent contraction of the quadriceps results in indirect fractures of patella. These fractures are usually transverse and are associated with tears of medial or lateral retinacular expansions. Any improper andn inadequate treatment would inevitably lead to a great deal of disability which would be most perceptibly felt in a country like India, where squatting is important activity in daily life.

Controversy exists regarding treatment of patellar

fracture since the earliest times. There were two school of thoughts, one school of thought, lead by Brooke (1936) and supported by Watson Jones (1945) favour patellectomy. And another school of thought lead by Haxton (1945) believed in complete, accurate and anatomical reduction of patella fracture. Thomson (1942) advocated excision of the smaller fragment and reattachment of the larger fragment to the ligamentum patellae.

In this study a series of 30 cases of fracture patellae have been studied where the results were obtained after treating with Modified Tension Band Wiring. Age of the patients was ranging from 14 years of minimum to 76 years of maximum with an average age of 42.05 years.

In the present study there were 21 males (70%) and 9 females (30%). In study done by Einolas et al, there were 71% males and 29% females. Their study also showed involvement of 63% cases on right side.

The present study showed the involvement of right side in 17 cases (56%) and 13 cases on (44%) left side.

In the present study 20 fractures (66%) were as a result of indirect mechanism as in forceful flexion of the knee against the contracted quadriceps, and 10 cases (34%) were due to direct trauma (RTA) to the patella.

In the present study we have included only transverse pattern of patellar fractures which were displaced. And this type of fracture pattern showed excellent results with modified tension band wiring irrespective of the age of the subject.

In the present study 2 out of 30 cases had associated injuries and this was attributed to the road traffic accidents. These associated injuries did not influence the end result of the treatment.

In this study the average follow up was five months, where as in Einolas et al 7 study and Dudani et al 11 study the average follow up was 12 to 18 months.

Thus for complete assessment of outcome and for seeing the late complications like patello femoral arthritis we need an extended follow up of 6 months to one year.

In all the cases, fractures were anatomically reduced and were internally fixed. We had four cases with complications, among which one case had wound gaping for which secondary suturing was done, another with superficial skin infection which was controlled by 3rd week post operatively. The 3rd case had terminal 250 of flexion restriction. And in the fourth case there was migration of the pin through the skin, for which implant removal was done and the limb was immobilized in a cylindrical cast for 4 weeks.

The results of the present study are similar to that in the literature. This study showed 86.6% excellent, 10% good and 3.3 % poor results. Dudani et al 11 showed 74% excellent and 26% good results in his study.

5. Summary

We have done a prospective study for the management of patellar fractures treated by modified tension band wiring in 30 patients over a period o from april 2011 to aug 2012 in the Department of Orthopaedics, All the fractures were transverse type, which were displaced.

All the patients were preoperatively assessed both clinically and radiologically and operated by modified tension band wiring. Follow up of the patients was done clinically and radiologically at 4th, 8th, 12th, 16 week.

In our study we observed good to excellent result in about 86.6% and good in about 10% and poor in 3.3% of cases. 4 Out of 30 cases had complications.

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. Our out come was not influenced by the associated injuries. Long-term follow up is necessary to assess late complications like osteoarthritis and late functional outcome.

6. Conclusion

Thus we conclude that

1. Anatomical reduction and stable fixation in patellar fracture is necessary for the normal integrity and stability of the joint.
2. Our study shows that modified tension band wiring is a definitive procedure in management of *displaced transverse* patellar fracture with least complications.
3. Since most cases of patellar fractures are associated with extensor retinacular tear, repair of the tear is necessary for early mobilization.
4. This surgery of modified tension band wiring helps for early mobilization post-operatively.
5. Early post-operative physiotherapy plays an important role in final out come

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