

# To Evaluate the Clinical Outcome of Transverse Fractures of Patella Treated with Modified Tension Band Wiring. A Prospective Study.

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## ABSTRACT

**Background:** Patella is the largest sesamoid bone in the body situated in the quadriceps tendon<sup>1</sup>. The main function of patella is to improve the efficiency of quadriceps muscle by improving the mechanical leverage of the quadriceps muscle. Patellar fractures are common and it constitutes about 1% of all skeletal injuries resulting from either direct or indirect trauma<sup>2</sup>. The subcutaneous location of the patella makes it vulnerable to direct trauma. Aims of the study were to evaluate the clinical outcome of Transverse fractures of patella treated with modified tension band wiring. The objectives of the study are to study the advantages of modified tension band wiring fixation in patellar fracture, the complications associated with this method of fixation and to assess the role of early mobilization with this technique. **Methods:** This prospective study is done in Department of Orthopaedics at R L Jalappa Hospital and Research Center, attached to Sri DevarajUrs Medical College, Kolar during the period from December 2010 to June 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. After pre anaesthetic fitness patient, patient was operated (tension band wiring). Operated knee was immobilized in extension in an above knee posterior slab, and advised to do straight leg raising test. Weight bearing was started from 3rd post-operative day. Sutures were removed on 12th to 14th post operative day. The discharged patients were advised to report for follow up 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). **Results:** The range of age of fracture of patella in our series was between 19-70 years, the mean age was 42 years and the incidence was high in the age group of 31-40 years. In a total of 30 cases, 24 fractures were in men and 6 fractures were in females. 22 fractures were as a result of indirect mechanism and 8 cases were due to direct trauma to the patella as in RTA. 17 patients had fracture on the right side and 13 patients had fracture on the left side. Average duration between injuries to hospital admission was about 1.16 days. The average duration between the days 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). No intra operative complications like fragmentation at wiring, difficulty in closure were encountered. Results were excellent in 26 cases, good in 3 cases and bad in 1 case as per West's criteria. **Conclusion:** Thus we conclude that anatomical reduction and stable fixation in patellar fracture is necessary for the normal integrity and stability of the joint. Early post-operative physiotherapy plays an important role in final outcome, which helps in reducing complication like stiffness of knee and in providing good functional. Our outcome was not influenced by the associated injuries. Long-term follow up is necessary to assess late complications like osteoarthritis and late functional outcome.

**Keywords:** Patella, Transverse Fracture, Tension Band Wiring.

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## INTRODUCTION

Patella is the largest sesamoid bone in the body situated in the quadriceps tendon.<sup>[1]</sup> The main function of patella is to improve the efficiency of quadriceps muscle by improving the mechanical

leverage of the quadriceps muscle. Patellar fractures are common and it constitutes about 1% of all skeletal injuries resulting from either direct or indirect trauma.<sup>[2]</sup> The subcutaneous location of the patella makes it vulnerable to direct trauma as in dashboard injuries or a fall on the flexed knee. 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.<sup>[3]</sup> Any improper and inadequate treatment would inevitably lead to a 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. Aims of the study were to evaluate the clinical outcome of Transverse fractures of patella treated with modified tension band wiring. The objectives of the study are to study the advantages of modified tension band wiring fixation in patellar fracture, the complications associated with this method of fixation and to assess the role of early mobilization with this technique.

### MATERIALS AND METHODS

This prospective study is done in Department of Orthopaedics at R L Jalappa Hospital and Research Center, attached to Sri Devaraj Urs Medical College, Kolarduring the period from December 2010 to June 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. Inclusion criteria included all closed and type I open displaced transverse patellar fractures, transverse fracture with displacement of more than 2 to 3 mm and articular step of more than 2mm and comminuted fractures where reconstruction and fixation by modified tension band wiring are still possible. Exclusion criteria included type III compound fractures, grossly comminuted, vertical or marginal fractures and old fractures (more than 2-3 weeks).

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. After pre anaesthetic fitness patient, patient was operated (tension band wiring). Operated knee was immobilized in extension in an above knee posterior slab, and advised to do straight leg raising test. Weight

bearing was started from 3rd post-operative day. Sutures were removed on 12th to 14th post operative 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. The discharged patients were advised to report for follow up 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).

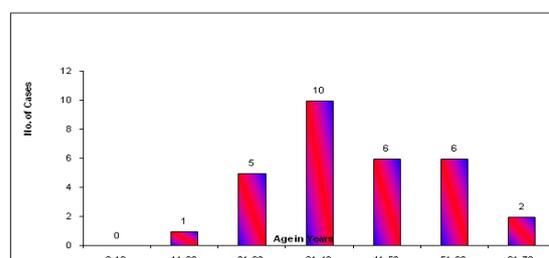
### RESULTS

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 analysed in the following discussion.

**Table 1: Age distribution.**

Age in years	No. of cases	Percentage
0-10	0	0%
11-20	1	3.33%
21-30	5	16.67%
31-40	10	33.33%
41-50	6	20%
51-60	6	20%
61-70	2	6.67%

Fracture of patella occurs in any age, but it occurs rarely below 30 years, in our series the range of age was between 19-70 years, the mean age was 42 years and the incidence was high in the age group of 31-40 years. [Table 1 & Chart 1]



**Chart 1: Age distribution**

**Table 2: Sex distribution**

Sex	No. of patients	Percentage
Male	24	80%
Female	6	20%

In a total of 30 cases, 24 fractures were in men and 6 fractures were in females. [Table 2 & Chart 2]

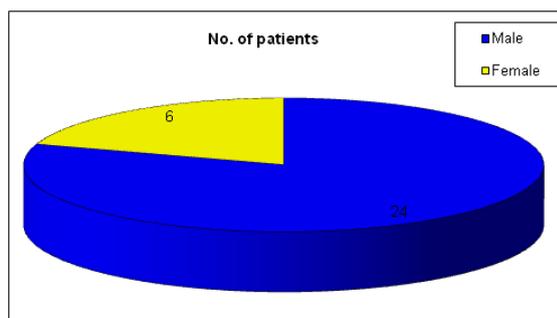


Chart 2: Sex distribution.

Table 3: Mode of Injury

Mode of Injury	No. of cases	Percentage
Indirect	22	73.33%
Direct	8	26.67%

In our study of 30 cases, 22 fractures were as a result of indirect mechanism (forceful flexion of the knee against a contracted quadriceps as in fall from height) and 8 cases were due to direct trauma to the patella as in RTA. [Table 3 & Chart 3]

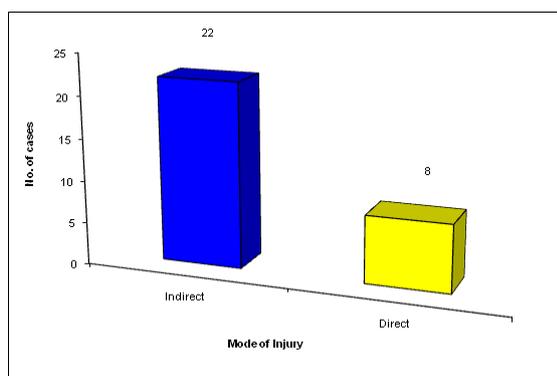


Chart No.3: Mode of Injury

Table 4: 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. [Table 4 & Chart 4]

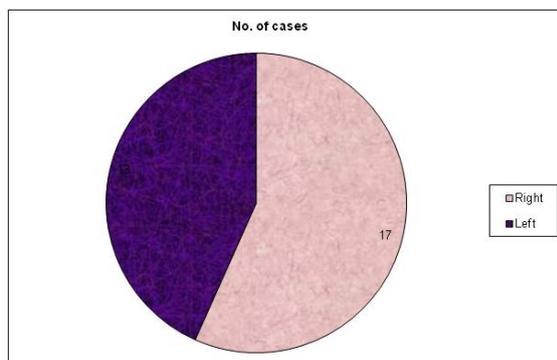


Chart 4: Side of fracture.

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

Average duration between injuries to hospital admission was about 1.16 days. The average duration between the days 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 stay in hospital was due to superficial infection of the wound and this was healed by 3rd week under antibiotic cover and sterile dressings.

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.

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.

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 [Table 5 & Chart 5] based on WEST'S CRITERIA<sup>12</sup> which is graded as:

**Excellent -**

- Patient does 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
- Extensors 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) -**

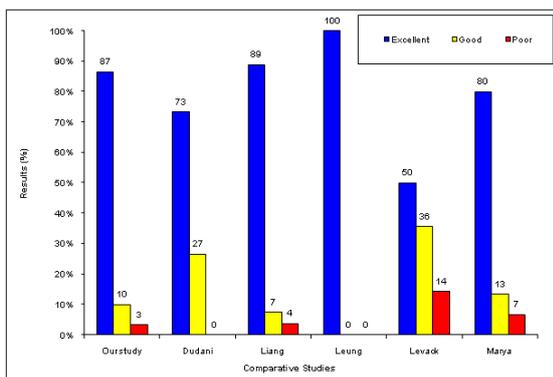
- Marked limitation of activities with significant complaints of pain and weakness
- Marked quadriceps wasting and power <3
- Extensor lag >10 degrees
- Flexion loss >30 degrees
- Based on WEST'S CRITERIA our results were graded as:

**Table 5: table showing results in our study based on West's criteria**

Results	No. of cases	Percentage
Excellent	26	86.6%
Good	3	10%
Bad	1	3.3%

**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	Dudani 4	15 (100%)	11 (73.33%)	04 (26.66%)	00 (0%)
3	Liang 5	27 (100%)	24 (88.88%)	02 (7.40%)	01 (3.7%)
4	Leung 6	05 (100%)	05 (100%)	00 (0%)	00 (0%)
5	Levack 7	14 (100%)	07 (50%)	05 (35.71%)	02 (14.28%)
6	Marya 8	30 (100%)	24 (80%)	04 (13.33%)	02 (6.66%)



**Chart 5: Chart showing results in our study based on West's criteria.**

**Clinical Photograph Of Operated Patients**



Preoperative X-Ray

Post Operative X-Ray



Case 1:



CLINICAL PHOTOGRAPH CASE.2

**DISCUSSION**

Patellar fractures are common and it constitutes about 1% of all skeletal injuries resulting from either direct or indirect trauma.<sup>[2]</sup> The subcutaneous location of the patella makes it vulnerable to direct trauma as in dashboard injuries or a fall on the flexed knee<sup>3</sup>. 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 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.

Controversy exists regarding treatment of patellar fracture since the earliest times. There were two schools of thoughts, one school of thought, led by Brooke (1936) and supported by Watson Jones (1945) favour patellectomy.<sup>[3]</sup> And another school of thought led by Haxton (1945) believed in complete,<sup>[9]</sup> 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.<sup>[2]</sup> 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 19 years of minimum to 70 years of maximum with an average age of 42 years. In the present study there were 26 males (80%) and 6 females (20%). 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.<sup>[10]</sup>

The present study showed the involvement of right side in 17 cases (56%) and 13 cases on (44%) left side. In the present study 22 fractures (73%) were as a result of indirect mechanism as in forceful flexion of the knee against the contracted quadriceps, and 8 cases (27%) 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 study and Dudani et al study the average follow up was 12 to 18 months.<sup>[10,11]</sup>

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<sup>[11]</sup> showed 74% excellent and 26% good results in his study.<sup>[11]</sup>

## CONCLUSION

Thus we conclude that anatomical reduction and stable fixation in patellar fracture is necessary for the normal integrity and stability of the joint. Our study shows that modified tension band wiring is a definitive procedure in management of displaced transverse patellar fracture with least complications. Since most cases of patellar fractures are associated with extensor retinacular tear, repair of the tear is necessary for early mobilization. This surgery of modified tension band wiring helps for early mobilization post-operatively. Early post-operative physiotherapy plays an important role in final outcome, which helps in reducing complication like stiffness of knee and in providing good functional. Our outcome was not influenced by the associated injuries. Long-term follow up is necessary to assess late complications like osteoarthritis and late functional outcome.

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