

Original research article**Tension band wiring versus circumferential wiring in the management of patellar fractures: Radiological union****¹Dr. Syed Natiq Hussain, ²Dr. Ambreen Fatima, ³Dr. Vishal Huggi, ⁴Dr. Subbukannu Balaravindran**¹Assistant Professor, Department of Orthopedics, GIMS, Gulbarga, Karnataka, India²Assistant Professor, Department of Orthopedics, KBNU FOMS, Gulbarga, Karnataka, India³Senior Registrar, Department of Orthopedics, GIMS, Gulbarga, Karnataka, India⁴Junior Consultant, MIOT Hospital, Madurai, Tamilnadu, India**Corresponding Author:**

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Abstract

It can be a direct injury to the patella as in a blow to the patella which happens commonly in the injury to the knee because of the more superficial location and the meager soft tissue cover over the patella. Direct injuries can be low or high energy depending upon the mechanism involved. After obtaining institutional ethics committee clearance and written informed consent, patients attending the OPD of Orthopaedics department, satisfying the inclusion/ exclusion criteria, were enrolled in the study. As soon as the patient was admitted, a detailed history was taken and a meticulous examination of the patient was done. The required information was recorded and proforma was prepared. Radiographs were taken in approximate views and diagnosis was established by clinical and radiological means. Study reveals that 24 (60.0%) of patients had radiological union by 8 weeks, 6 (15%) patients by 9 weeks, 7 patients (17.5%) by 10 weeks and 03 (7.5%) patients by 12 weeks. And there was no statistical significant difference of duration radiological union in weeks between the groups A and B.

Keywords: Tension Band Wiring, Circumferential Wiring, Patellar Fractures**Introduction**

Patella fractures account for 1% of all skeletal fractures and are seen at the age of 20 to 50 years. Incidence in men is almost twice that in women. Patella fractures result from direct or indirect forces. Majority occurs from direct injuries such as blow to the patella from a fall, motor vehicle crash. Indirect injuries occur from a near fall, fall from a height or combination ^[1].

This type of injury occurs when the forces from the extensor mechanism exceeds the intrinsic strength of patella. Once bony failure occurs, the injury may continue through the medial and lateral expansions of quadriceps by the pull of the muscle. This injury usually results in a transverse fracture with some inferior pole comminution and fragment displacement is dependent on the amount of damage to the quadriceps retinaculum. Transverse fractures result from excessive longitudinal forces. Stellate fractures are caused by high-energy direct blow to the patella ^[2].

It can be a direct injury to the patella as in a blow to the patella which happens commonly in the injury to the knee because of the more superficial location and the meagre soft tissue cover over the patella. Direct injuries can be low or high energy depending upon the mechanism involved. Fall from a sitting or standing height are the examples of low energy injury. Impact on the dashboard produces high energy injuries. These high energy direct injuries usually produce comminuted fractures ^[3].

High energy mechanism injuries are almost always associated with other fractures in the ipsilateral limb which should always be looked out for. Indirect forces are the forces generated across the extensor mechanism, typically resulting from forceful contraction of the quadriceps with the knee in a flexed position. The high quadriceps contracture forces across the patella results in the dissipation of forces across the adjacent retinaculum and hence producing a higher degree of retinacular disruption. Active knee extension is most often affected. The degree of displacement of fragments is directly proportional to the occult damage to the adjacent soft tissues ^[4].

Most of the transverse fractures are a result of indirect mechanism of injury. Other factors influencing the fracture pattern are the patient age, bone quality and degree of knee flexion. Usually the mechanism of injury is a combination of all the mechanisms ^[5]. Majority of the patella fractures happen as a result of excessive tensile forces across the extensor mechanism. When a partially flexed knee is subjected to a substantial direct force it produces a vertical fracture. If the retinaculum is intact and if the extensor mechanism is not disrupted, the fragments are usually non-displaced. When a direct force onto the knee produces an impaction of the patella onto the femoral condyles, it produces a typical comminuted and stellate fracture patterns ^[6].

Methodology

Study Design: Prospective interventional study.

Place of Study: The study was conducted in the Department of Orthopaedics.

Sample Size: 40 Patients (divided into two groups of 20 cases each)

Patients with patella fractures were divided into two groups of 20 each. Group A was treated using Tension band wiring and the Group B was treated using Circumferential wiring.

Inclusion Criteria

1. Age above 18 years
2. Fresh and old fractures of Patella.
3. Either sex

Exclusion Criteria

1. Infected fractures.
2. Age below 18 years.

After obtaining institutional ethics committee clearance and written informed consent, patients attending the OPD of Orthopaedics department, satisfying the inclusion/ exclusion criteria, were enrolled in the study.

As soon as the patient was admitted, a detailed history was taken and a meticulous examination of the patient was done. The required information was recorded and proforma was prepared. Radiographs were taken in approximate views and diagnosis was established by clinical and radiological means.

Then splinting of fractures was done with the above knee POP slab for patellar fractures. All patients were taken for elective surgery as soon as possible after necessary blood, urine and radiographic preoperative work-up. Patient’s attenders were explained the nature of injury and its possible complications and the need for surgery.

Written and informed consent was obtained. Preoperative intravenous cephalosporin antibiotics were given and continued at 12 hourly intervals postoperatively for five days and then switched to oral form till suture removal.

Then the patients were allocated into two groups by simple random sampling technique, i.e. group A & group B. Group A was treated using Tension band wiring and the Group B was treated using Circumferential wiring.

Results

Table 1: Diagnosis wise distribution of patients

Diagnosis	Group A		Group B		Total	
	No.	%	No.	%	No.	%
Transverse fracture	12	60.0	12	70.0	24	60.0
Oblique Fracture	3	15.0	5	25.0	8	20.0
Comminuted fracture	5	25.0	3	15.0	8	20.0
Total	20	100.0	20	100.0	40	100.0
X2-test value P-value	X2 = 0.439		P = 0.643		NS	

NS= not significant, S=significant, HS=highly significant, VHS=very highly significant

Present study observes that, Transverse fracture of patella cases were more 24 (60.0%), Comminuted fracture and Oblique fracture patella patients were 8 (20%) and 8 (20%) respectively. And there was no statistical significant difference of diagnosis between the groups A and B

Table 2: Distribution of patients according to radiological union in weeks

Duration in weeks	Group A		Group B		Total	
	No.	%	No.	%	No.	%
8	12	60.0	12	60.0	24	60.0
9	3	15.0	03	15.0	06	15.0
10	3	15.0	04	20.0	07	17.5
11	0	00.0	0	00.0	0	0.00
12	2	10.0	01	05.0	03	7.5
Total	20	100.0	20	100.0	40	100.0
Mean ± SD	8.85±0.78		8.75±0.63		8.8±0.705	
t-test value P-value	t = 1.237 P = 0.224 NS					

NS= not significant, S=significant, HS=highly significant, VHS=very highly significant.

Study reveals that 24 (60.0%) of patients had radiological union by 8 weeks, 6(15%) patients by 9 weeks, 7 patients (17.5%) by 10 weeks and 03(7.5%) patients by 12 weeks. And there was no statistical significant difference of durationradiological union in weeks between the groups A and B.

Table 3: Interval between injury and surgery wise distribution of patients

Duration	Group A		Group B		Total	
	No.	%	No.	%	No.	%
Within 48 hours	14	70.0	16	80.0	30	75
2-10 days	4	20.0	3	15.0	7	17.5
>10 days	2	10.0	1	5.0	3	7.5
Total	20		20		40	100
X2-test valu P-value	X2 = 0.106		P = 0.912		NS	

NS= not significant, S=significant, HS=highly significant, VHS=very highly significant

Study observes that, the interval between injury and surgery was within 48 hours in 30(75%) patients, from 2-10 days (17.5%) patients and after more than 10 days in 3 patients. But there was no statistical significant difference of interval between injury and surgery, between the groups A and B.

Table 4: Distribution of patients according to post-operative pain

Duration	Group A		Group B		Total	
	No.	%	No.	%	No.	%
4 weeks	15	75.0	14	70.0	29	72.5
8 weeks	3	15.0	4	20.0	7	17.5
12 weeks	2	10.0	2	10.0	4	10.0
Total	20		20		40	100
X2-test valu P-value	X2 = 0.106		P = 0.912		NS	

NS= not significant, S=significant, HS=highly significant, VHS=very highly significant

Study observes that, maximum number of patients 29 (72.5%) had postoperative pain at 4 weeks, while 7 (17.5) had persistent pain at 8 weeks and only 4 (10%) had persistent pain at 12 weeks. But there was no statistical significant difference of interval between injury and surgery, between the groups A and B.

Discussion

Hoshino CM, Tran W (2013) evaluated the complications following tension band fixation of patellar fractures with cannulated screws compared with k wires and concluded that symptomatic implants was the most common complication observed, were twice as frequent in patients treated with K-wires [7].

Della Rocca GJ (2013), concluded that displaced patella fractures often result in disruption of the extensor mechanism of the knee. An intact extensor mechanism is a requirement for unassisted gait. Therefore, operative treatment of the displaced patella fracture is generally recommended. The evaluation of the patella fracture patient includes examination of extensor mechanism integrity. Operative management of patella fractures normally includes open reduction with internal fixation, although partial patellectomy is occasionally performed, with advancement of quadriceps tendon or patellar ligament to the fracture bed [8].

Open reduction with internal fixation has historically been performed utilizing anterior tension band wiring, although comminution of the fracture occasionally makes this fixation construct inadequate. Supplementation or replacement of the tension band wire construct with interfragmentary screws, cerclage wire or suture, and/or plate-and-screw constructs may add to the stability of the fixation construct. Arthrosis of the patellofemoral joint is very common after healing of patella fractures, and substantial functional deficits may persist long after fracture healing has occurred [9].

Sharma N *et al* (2014), conducted a study on 19 patients with transverse fracture of patella who were treated in their institute, using percutaneous tension band wiring. All patients had successful functional outcomes evaluated in terms of range of knee motion, power of knee extensors, rate of union, VAS score, Lysholm score and Knee society clinical rating scale. All patients achieved successful union with an average time for union 10.1, 1.9 weeks. Excellent Lysholm and KSCRS scores were achieved at 18 months. Complications were noted only in two patients which was knee irritation. In their study, they concluded that percutaneous tension band wiring of patella is associated with a satisfactory union rate as well as good functional outcome requiring less surgical time. Closed method can be used for displaced fractures of patella, however whether this technique can be used for comminuted fractures needs further evaluation [10].

Comparison to TBW with the cable pin system in patella fracture, a randomized prospective study by Tan Qx, Haiy, RuXR (2015) concluded that cable pin system is a viable options for transverse Fracture of patella with shorter healing time and fewer complications and better function than TBW [11].

Padmanaban K *et al* (2016), did a prospective study that analyzed the clinical and radiological outcome of transverse patellar fractures in 20 patients treated with percutaneous tension band wiring. Operative time and blood loss in percutaneous tension band wiring is much less compared with open tension band wiring. This technique both clinically and radiologically showed rapid bony union. Lysholm knee score that was used in their study is more with percutaneous tension band wiring ^[12].

In present study, pain persisted in 10% of cases postoperatively after 12 weeks. Pain could be due to periarticular adhesions, superficial necrosis, and bursitis over protruding K wires.

Conclusion

Study reveals that 24 (60.0%) of patients had radiological union by 8 weeks, 6 (15%) patients by 9 weeks, 7 patients (17.5%) by 10 weeks and 03 (7.5%) patients by 12 weeks. And there was no statistical significant difference of duration radiological union in weeks between the groups A and B.

References

1. Bushnell BD, Byram IR, Weinhold PS. The use of suture anchors in repair of the ruptured patellar tendon: A biomechanical study. *Am J Sports Med.* 2006;34:1492-99.
2. Arendt EA, Fithian DC, Cohen E. Current concepts of lateral patella dislocation. *Clin Sports Med.* 2002;21:499-519.
3. Nomura E, Inoue M, Osada N. Anatomical analysis of the medial patellofemoral ligament of the knee, especially the femoral attachment. *Knee Surg Sports Traumatol Arthrosc.* 2005;13:510-15.
4. Nomura E, Inoue M, Osada N. Anatomical analysis of the medial patellofemoral ligament of the knee, especially the femoral attachment. *Knee Surg Sports Traumatol Arthrosc.* 2005;13:510-15.
5. Kaufer H. Mechanical function of the patella. *J Bone Joint Surg Am.* 1971;53:1551-60.
6. Huberti HH, Hayes WC, Stone JL. Force ratios in the quadriceps tendon and the ligamentum patellae. *J Orthop Res.* 1984;2:49-54.
7. Rathi A, Swamy MK, Prasantha I, Consul A, Bansal A, Bahl V, *et al.* Percutaneous tension band wiring for patellar fractures. *J Orthop Surg.* 2012;20(2):166-169.
8. Hoshino CM, Tran W, Tiberi JV, Black MH, Li BH, Gold SM, *et al.* Complications following tension band fixation of patellar fractures with cannulated screws compared with k wires. *JBJS.* 2013;95(7):653-9.
9. Dowd GS. Marginal Fractures of the Patella. *Injury.* 1982;14:287-91.
10. Sharma N, Chaturvedi H, Singh SP, Rakesh AA. Minimally invasive tension band wiring fixation for patella fractures: A study of 19 cases. *Int. J Res Health Sci.* 2014 Jul 31;2(3):761-6.
11. Della Rocca GJ. Displaced patella fractures. *J Knee Surg.* 2013 Oct;26(5):293-300.
12. Padmanaban K, Palanisamy B, Ramasamy V, Subramaniyan VKA. Analysis of percutaneous tension band wiring for patellar fractures. *IJOS.* 2017;3(1):729-734.