

A Comparative Study Of Modified Tension Band Wiring And Cannulated Cancellous Screw Fixation In Management Of Transverse Fractures Of Patella

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Abstracts: Background This study compares the results of two commonly used methods of internal fixation for transverse fracture of patella namely modified tension band wiring (TBW) and cannulated cancellous screw fixation. Methodology: The study consists of 20 cases treated at BRIMS hospital, Bidar with modified tension band wiring with K-wires and cannulated cancellous screws with a follow up of 1 year. Out of 20 cases, Group A consists of 10 patients treated for tension band wiring and Group B of 10 cases treated for cannulated cancellous screws. Results: Union was achieved in all 20 cases. Group A treated 9 out of 10 had excellent to good results with knee flexion more than 120° and Group B, had 8 out of 10 with excellent to good results with knee flexion more than 120°. In all the 20 cases Quadriceps wasting was severe but less in Group A. Discussion: Although the modified tension band technique (eg. tension band supplemented by longitudinal Kirschner wires) has long been the mainstay for fixation of transverse fractures of patella. It has shortcomings, such as bad reduction, loosening of implants, and skin irritation. It was found that modified tension band wiring showed better results than cannulated cancellous screws as stability of implants is better in transverse fracture patella and post operative rehabilitation is faster. Conclusion The modified tension band wiring is better than that of Cannulated cancellous screw transverse fractures of patella probably because of good stability of implant and easier postoperative rehabilitation. [Jabshetty A NJIRM 2015; 6(4):1-5]

Key Words: Fractures, Patella, Injuries, cannulated cancellous screw, Quadriceps.

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Introduction: The principle of using a modified tension band technique for treatment of patellar fractures was first proposed and then subsequently recommended as the primary treatment method for patellar fractures.¹ The principle of the tension band technique is to convert the tension forces acting on the anterior surface into compression forces at the articular surface. This technique can substantially improve results because of its reliable fixation and allowance of early joint motion. However, this technique still has some shortcomings. First, the tension band is supplemented by longitudinal smooth Kirschner wires (K-wires) that bear the risk of loosening and migration. Second, direct interfracture compression cannot be achieved with the K-wire, and additionally, there is the potential of skin irritation. We have adopted what we perceive to be an improved technique, cannulated screw tension band construct, to remedy the shortcomings of the modified K-wire tension band in treating patellar fractures. We compared cannulated screw tension band technique with the modified tension band technique to see whether the new technique could achieve better reduction and direct inter fragmentary compression force; shorten fracture healing time decrease

complications, such as loosening of implants and skin irritations; and achieve better knee function. Radiographic evaluation : It includes standard views like antero-posterior and lateral, specialized views like axial or skyline, CT scan, bone scintigraphy, Magnetic Resonance Imaging. Standard views Antero-posterior view: In patellar fractures, AP view is taken with patient supine and X-ray plate underneath knee. X-ray should include lower half of the thigh and upper half of the tibia. Evaluation of the AP view should be carefully done. A bipartite patella may be confused for a marginal fracture of the patella. The X-ray of the opposite knee may be taken to rule out a bipartite patella, as it is usually bilateral. Lateral view: A transverse fracture is well seen in a lateral view. The articular congruity can be assessed in a well-positioned lateral view. With the knee flexed to 90°, the proximal patellar pole normally lies posterior to the anterior surface of the femur. With a ruptured patellar tendon, the proximal patellar pole rests anterior to the anterior surface of femoral shaft. The most reliable method of assessment of the patellar height is Insall's index.² This technique employs the ratio of the greatest diagonal patellar length and the patellar tendon length. In normal individuals the ratio is 1. A ratio less than 1

suggests a high riding patella (Patella Alta). Up to 20% variance is acceptable. In Blumensatt's line, knee is flexed to 30°, the line passing through the intercondylar notch should just touch the lower pole of patella. Skyline view or Axial view or Merchant's view In vertical fractures, marginal fractures and osteochondral fractures, this view is very much helpful. Merchant et al.¹⁸ described a method of obtaining axial view of the patella. Patient is placed supine with the knee flexed to 45° on the end of the table; the knee is elevated slightly to keep the femur horizontal and parallel with the table surface. An X-ray beam is angled 30° from the horizontal. The cassette is then placed about 1 foot below the knee and perpendicular to the X-ray beam. Bone Scan or CT The main indication for CT and bone scan is the detection of occult fractures. Some authors recommend tomography over bone scan in these cases especially for stress fractures in the elderly with osteopenia and haemarthrosis. Magnetic Resonance Imaging MRI is mainly used for extensor mechanism injuries, ligament injuries and meniscal injuries. It is rarely indicated in patellar fractures. After patellectomy careful reconstruction of extensor mechanism should be performed. For open reduction and internal fixation, many methods can be used, but the commonly used methods are Modified tension band wiring, Cerclage wire, Combination of tension band wire and cerclage wire and Cancellous screw fixation.

Design: Retrospective analysis

Material and Methods: The study is permitted by IRB BRIMS Bidar. This retrospective study included 20 patients treated in BRIMS hospital ,Bidar .

Inclusion criteria: Study includes Closed displaced transverse fractures of patella and Compound grade-I transverse fractures of patella only. All selected cases were healthy and with active life. The mode of trauma was either RTA or fall on the knee. All the patients were admitted to the hospital, examined clinically. All injuries were enclosed and included slip and fall and car accident. The inclusion criteria were age >30 years. Out of 20 cases, A group of 10 cases experienced cannulated screw fixation and another group of 10 cases underwent the Modified tension band wiring method of treatment. The follow-up period was minimum of 1year. The criteria for comparison between the 2 groups of treatments were:

duration of healing, range of movement of knee joint, quadriceps atrophy and power, ability to walk without aid, ability to squat and staircase climbing, extensor lag and complications.

Exclusion criteria: The Communitated or stellate fractures of patella, Undisplaced fractures of patella, Fractures of patella in children, Fractures of patella associated with ipsilateral limb injuries in whom Postoperative rehabilitation not possible, Grade-II or III compound fractures of patella were excluded from the study.

The operations were performed via an anterior longitudinal incision. After sectioning the skin and subcutaneous tissue followed by fully exposing the patella and its sides, we confirmed the quadriceps femoris aponeurosis and the ligament patellae were adherent to the patellar surface. We examined the fracture and condition of the bilateral aponeuroses and joint capsule, removed fracture chips or any intraarticular hematoma, and rinsed the articular cavity. Operations were considered when the articular displacement was greater than 2 mm or fragment separation was greater than 3 mm on radiography. The time from fracture to the operation was 1 to 7 days (mean, 3 days). Patients were divided into either Gp A cannulated screw tension band group or a Gp B modified K-wire tension band group, according to their operation.

The longitudinal fracture was fixed by one lag screw inserted perpendicularly to the fracture line. With the knee in extension, the fragments were clamped to reduce the fracture with a large towel clamp. After observation the reduction of articular surface under intraoperative fluoroscopy, two K-wires (2.0-mm diameter) were drilled in parallel from the lower pole to the superior pole of the patella, with a 2-cm space and a 5- to 10-mm distance from the patellar articular surface. The K-wires penetrated the cortex of the superior patellar pole. The position of the K-wire was determined using intra operative fluoroscopy. In the modified tension band group, the upper end of the K-wire was bent into hooks and threaded a 1.2-mm steel wire through the upper hooks and lower end of the K-wire to form a figure-of-eight tension band. Tightened the steel wire using a wire cutter, hide the upper hooks of the K-wires in the patella, and re observed reduction of the articular surface

by intra operative fluoroscopy. If the reduction was satisfactory, tails of the K-wires and the steel wire were cut-off. In the cannulated screw tension band group, one K-wire was first removed and a cannulated screw guide pin was inserted along the pin tract. The guide wire was drilled along with a cannulated bit and, after measuring its depth, screwed a 4.0-mm cannulated compression screw along the guide wire. The screw head remained protruded of the patella cortex, and the proximal end of the screw should be close to, or embedded within, the patella. Then screwed the second cannulated screw and alternately tightened the screws. The guide wire was removed and threaded a 1.3-mm diameter through each of the cannulated screws, then tightened the screw anterior to the patella.

Results: Twenty cases of fracture patella were included in this study. Out of these 10 were treated with modified tension band wire and 10 with cannulated cancellous screw fixation. Age distribution of the cases Thirty five percent of cases were between 30-40 age group, 20 % of them were between 41-50 age group, 25 % were between 51-60 age group, 15 % of them were 61-70 age group and 5 % of the cases were above 70 age group.. Maximum numbers of cases were in the age group of 30-40 i.e., 7 (35%). Out of 20 cases, 15 were male and 5 were female. There was a male preponderance with a male-female ratio of 3:1. Right patella was involved in 65% cases, which is commonest side. Left side was involved in 35% of cases. Sixty percent of the cases consisted of fall injuries and rest were of RTA. Interval between Trauma and Surgery was 0-10 days. Sixty five percent of surgeries were done with transverse incision, 20 % of surgeries were done with Midline longitudinal incision and rest were done with Para patellar incision. Range of movements of knee was seen full in 5 cases and more than 120° in 4 cases and less than 120° in 1 case i.e., 90% shown to have good range of movements of more than 120° flexion (Table 1). Quadriceps power was near normal in 15 cases ie., 75% but 5 cases had quadriceps power of grade-IV. Extensor lag was seen in 3 cases (Table 2). One case was treated with modified tension band wire and 2 cases of cannulated cancellous screw. No case was shown instability but 3 cases had the giving way sensation on walking.

Table 1: Range of knee movements

Range of movement (degree)	Modified tension band wiring		Cannulated cancellous screw	
	No. of cases	%	No. of cases	%
Full	5	50	4	40
More than 120	4	40	4	40
Less than 120	1	10	2	20

Table 2: Quadriceps power

Quadriceps power	Modified tension band wiring		Cannulated cancellous screw	
	No. of cases	%	No. of cases	%
Grade -V	8	80	7	70
Grade-IV	2	20	3	30

Discussion: In this present study, 20 cases of transverse fractures of patella has been studied. Out of this 10 were treated by modified tension band wiring using 2 parallel K-wires and anterior figure of 8 stainless steel wire and the other 10 cases treated with cannulated cancellous screw. In our present study 10 cases were treated with modified tension band wiring of Pauwel. This is the most widely accepted treatment worldwide. Studies have shown high percentage of results in cases treated with modified tension band wiring.³ We have 5 cases with excellent results i.e., 50%. 4 cases shown good results i.e., 40% and only 1 case had poor results i.e., 10%. The overall results of 20 cases were comparable to most of the series. In our study group, 4 cases has excellent results i.e., 40% and 40% (4 cases) has good results and only 20% (2 cases) had poor results. Early mobilization of joint after surgery appears to have greatly helped to gain good range of motions, which is prime requisite for squatting. Majority of our patients were satisfied with range of motion gained particularly necessary for the oriental habits of squatting and sitting cross-legged. Our results are comparable to Dudani and Sancheti,⁴ where 15 cases were treated with modified tension band wiring and also comparable with that of Srinivaslu et al.⁵ which consists of 55 patients, among them 15 were treated with cannulated cancellous screw fixation.

In the present study, right side was more common i.e., 13 cases (65%) and 35% were left sided. In Dudani and Sancheti series, right side was affected

in 60% and left in 40% of cases. In our study, postoperative suction drainage was used in all the cases, but it was not reported in other series. In the present study, in patients treated with modified tension band were immobilized for two weeks and knee mobilization exercises were started after that and in patients treated with cannulated cancellous screw, the mobilization exercises were started after 4 weeks. In the series of Srinivaslu et al,⁵ the mobilization exercises were stated as soon as patient could tolerate it. In the series of Dudani and Sancheti⁴ the mobilization exercises were started on 11th and 14th day.

In our series, in cases treated with modified tension band wiring, the movements of knee were started after two weeks compared to 4 weeks in cases of cannulated cancellous screw. The range of movements of knee were faster in cases of modified tension band wiring. By the end of 6 weeks, 7 (70%) cases had flexion of greater than 90°. In the present series, 17 patients i.e., 85% have gained knee movements of more than 120°. In Dudani and Sancheti⁴ 73% of cases had more than 120° of flexion: whereas in Srinivas et al⁵ series, all (100%) cases had full range of movements. In the present study, 3 patients (15%) had extensor lag, whereas there was no case of extensor lag in both the series compared. In our present study, 80% of patients had normal quadriceps power and 20% had grade-IV power of quadriceps in cases treated with modified TBW. Whereas, in cases treated cannulated cancellous screw 70% had normal power. In Srinivaslu et al⁵ series, normal power was in 93% of patients. In the study of Jakobsen et al.⁶ and Edwards et al.⁷ reduction in quadriceps strength was seen in 33% and 44% cases respectively. In 60% of our cases, the mechanism of injury was fall on the knee and in other 40% cases it was RTA. In the study of Shobhat and Mann,⁸ fall accounted for 82% of cases.

Comparison between modified tension band wiring and Cannulated cancellous screw fixation:

Present study group consists of 20 cases, 10 cases each from both groups. Union was seen in all the 20 cases, but the union was faster in cases of TBW. The average period of union was 10-12 weeks in cases treated with modified tension band wire. In cases of, Cannulated cancellous screw the average time of union was 12-14 weeks. The results of cases treated with tension band wiring are

excellent in 50% of cases, good in 40% of cases and poor in 10% of cases. In cases of, Cannulated cancellous screw excellent results were found in 40% of cases, good in 40% and poor in 20% of cases. Quadriceps wasting was seen in all the cases. In modified tension band wiring, 1-10 mm in 50%, 11-20 mm in 40% of cases and 21-30 mm in 10% cases. In Cannulated cancellous screw 1-10 mm in 20% cases, 11-20 mm in 80% cases and no case showed quadriceps wasting of more than 20 mm. Quadriceps power was reduced to grade-IV in 20% of cases in modified TBW group and 30% in Cannulated cancellous screw group. Rest of cases had near normal quadriceps power. In modified tension band wiring, 50% of cases showed full range of movement, 40% showed more than 120° of flexion and 10% showed flexion between 90-120°. In, Cannulated cancellous screw 40% of cases showed full movement, 40% above 120° flexion and 20% showed flexion between 90-120°. Gaining range of movements was faster in cases treated with tension band wiring because of better fixation and start of knee mobilization after 2 weeks compared to 4 weeks in cases of Cannulated cancellous screw Quadriceps atrophy may also have occurred because of this longer period of immobilization in Cannulated cancellous screw. Extensor lag was seen in 20% of cases treated with Cannulated cancellous screw and 10% of cases treated with modified tension band wiring. The overall results show that modified tension band wiring is better than of Cannulated cancellous screw.

Conclusion: Patella is essential for effective function of quadriceps and for proper biomechanics of knee joint so it should be preserved wherever possible. Careful selection of cases and good surgical technique is essential for a good functional outcome in fractures of patella. Operative treatment is essential to carry out repair of the torn expansion of quadriceps and gives good results.

Patellectomy leads to quadriceps atrophy, loss of power and extensor lag. Post operative immobilization and physiotherapy plays a vital role. Open grade-I compound transverse fracture should be treated with internal fixation and the disability period should be lessened so that patient could return to work earlier. The modified tension band wiring is better than that of Cannulated cancellous

screw transverse fractures of patella probably because of good stability of implant and easier postoperative rehabilitation. Study should be conducted in larger group and more long-term follow-up is needed.

References:

1. Gosal HS, Singh P, Field RE. Clinical experience of patellar fracture fixation using metal wire or non-absorbable polyester: a study of 37 cases. *Injury*. 2001;32:129–135.
2. Berg EE. Open reduction internal fixation of displaced transverse patella fractures with figure-eight wiring through parallel cannulated compression screws. *J Orthop Trauma*. 1997;11:573–576.
3. Levack B, Flanagan JP and Hobbs S, Results of surgical treatment of patellar fractures. *J. Bone Joint Surg*. 1985; 67(3): 416-419.
4. Dudani B and Sancheti KH Management of fracture patella by tension band wiring. *Indian J. Orthopedics*. 1981; 15(1): 4348
5. Srinivaslu K, Sanjiv K, Marya S, Surya Bhan and Dave PK, Results of surgical treatment of patellar fractures. *Indian J.Orthop*. 1986; 20(2): 158-161.
6. Jakobsen J, Christensen KS and Rasmussen OS Patellar fracture treatment. *Orthop Scand.*, 1985; 56 : 430-432.
7. Edwards SB, Johnell O and Redlund-Johnell I Patella fractures– a 30 years follow-up. *Acta Orthop.Scand*. 1989 ; 60 : 712-714.
8. Shobat S, Mann G, Functional results after patellar fractures. *Arch. Gerontol. Geriater*. 2003; 37(1): 93-98.
9. Carpenter JE, Kasman R, Matthews LS. Fractures of the patella. *Instr Course Lect*. 1994;43:97–108
10. Carpenter JE, Kasman RA, Patel N, Lee ML, Goldstein SA., Biomechanical evaluation of current patella fracture fixation techniques. *J Orthop Trauma*. 1997;11:351–356.
11. Cramer KE, Moed BR. Patellar fractures: contemporary approach to treatment. *J Am Acad Orthop Surg*.1997;5:323–331.
12. Fortis AP, Milis Z, Kostopoulos V, Tsantzalos S, Kormas P, Tzinieris N, Boudouris T. Experimental investigation of the tension band in fractures of the patella. *Injury*. 2002;33:489–493.
13. Haxton HA, Functions of patella and effects of its excision. *Surgery Gynec. Obst*. 1945 ; 80: 389-395.
14. Heineck AP, The modern operative treatment of fractures of the patella – an analytical review of over 1100 cases treated by operative methods. *Surg. Gynaec. Obstet*. 1909; 9: 177-248.
15. Instructional Course Lectures, AAOS fractures of Patella. *J. Bone Joint Surg.*, 1993; 75A: 10-15.
16. Kaufer H, Mechanical functions of patella. *JBJS*. 1971; 53A : 1551-1552.
17. Kaufer H, Patella biomechanics. *Clin. Orthop.* ; 1979 : 144, 51-54.
18. Merchant AC, Mercer RL, Jacobsen RH and Cool CR, Roentgenographic analysis of patellofemoral congruence. *J. Bone Joint Surg*. 1974 ; 56 : 1391-1396.
19. Benjamin J, Bried J, Dohm M, McMurtry M. Biomechanical evaluation of various forms of fixation of transverse patellar fractures. *J Orthop Trauma*. 1987;1:219–222.
20. Park MS, Chung CY, Lee KM, Lee SH and Choi IH, Which is the best method to determine the patellar height in children and adolescents? *Clin. Orthopaedics & Related Res*. 2010; 468(5): 1344-1351.

Conflict of interest: None
Funding: None
Cite this Article as: Jabshetty. A, A Comparative Study Of Modified Tension Band Wiring And Cannulated Cancellous Screw Fixation In Management Of Transverse Fractures Of Patella. <i>Natl J Integr Res Med</i> 2015; 6(3): 1-5