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## RESEARCH ARTICLE

# FUNCTIONAL OUTCOME OF TBW WITH CANNULATED CANCELLOUS SCREWS FIXATION IN TRANSVERSE PATELLA FRACTURE: A SINGLE CENTRE EXPERIENCE

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**ABSTRACT**

Patella fractures constitute about 1% of all skeletal injuries and are seen frequently in the age range of 20-50 years. The purpose of our study to evaluate the effectiveness and safety of anterior tension band wire technique with two cannulated cancellous screws in patients with transverse patella fractures. This is a prospective study of 18 patients with transverse fracture or transverse fracture with mild communation patella fractures were treated in VSS institute of medical sciences and research from November 2014 to November 2016. There were 12 male (66%) and 6 female (33.3%). The age group ranged from 20-50 years (mean 35 years). All the patients were treated with open reduction and internal fixation using two paraller cannulated cancellous screw and 18G stainless steel wire as per TBW principle. Mean time to radiological union 11 weeks (9-13 weeks). Mean range of movement at 3 month follow up was 100 and 1 year follow up 135 degree respectively. The clinical and functional outcome of these patients were evaluated by radiograph and IOWA scoring. This technique showed improved fractured reduction and better Iowa score. This should be considered as an alternative method of treatement of transverse patella fracture.

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## INTRODUCTION

Fracture of the patella (Arbeitsgemeinschaft für Osteosynthesefragen classification: 34-C1) (Nerlich, 2007 and AO Foundation Fracture Classifications, 2012) accounts for approximately 1% of all skeletal fractures and may results from direct, indirect, or combined injury pattern (Bostrom, 1972). The anterior subcutaneous location makes it vulnerable to direct trauma leading to comminuted or displaced fracture. Most fractures of indirect injury are transverse involving the middle third of the patella results from a forceful contraction of quadriceps with knee flexed. Non-comminuted, transverse fractures comprises approximately 52% of displaced patellar fractures (Lotke, 1981; Bostrom, 1974 and Bostman, 1981). Displaced patellar fractures are defined by separation of fracture fragments more than 3 mm or articular incongruity of more than 2 mm. The management of patellar fractures largely based on the fracture classification and extensor mechanism intactness and displacement of fragments, and articular integrity. Conservative treatment limited to mild displacement (<3mm) and articular incongruity (<2mm), intact extensor mechanism, gross osteopenia and medical comorbid condition by long leg cylindrical cast, extension splinting or bracing.

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Operative treatment includes ORIF with TBW OR CCS band construct, partial or total patellectomy. The objectives of surgical treatment include preservation of the knee cap to the greatest possible extent, precise anatomic reduction of the joint surface by stable fixation, and restoration of the knee-extensor mechanism, thus allowing early mobilization (Catalano, 1995 and Hung, 1985). In TBW or modififed TBW, The K-wires may migrate leading to soft tissue irritation, thus hindering the range of knee motion. Since the knee is immobilized in extension in the early post-operative period and early mobilization, the quadriceps pull is straight and thus may exert traction on the K-wires leading to loss of reduction. To overcome these shortcomings a new technique has evolved replacing the K-wires with cannulated cancellous screws .The screws act as lag screws compressing the fracture site . Mechanically, the addition of the screws to the tension band techniques reduces fracture separation by providing compression throughout the range of motion and by resisting the tensile loading during terminal extension.Burvant *et al* , (Burvant, 1994) investigated TBW with screw and found them to perform biomechanically superior to other techniques for transverse patellar fixation. The constructs has been proved to be mechanically stronger than modified tension band biomechanically. Also by Carpenter *et al* (Carpenter, 1997). shows that functional outcome of the patients by CCS with TBW construct better and depends on the ability to achieve

early, pain-free, stable range of motion. The aim of our study is to know the functional outcome in patients with transverse patella fracture treated with cannulated cancellous screw tension band technique.

## MATERIAL AND METHODS

This prospective study was conducted in PG department of orthopaedics, VIMSAR, BURLA. The patients were selected randomly on the admission basis.The study period was from november 2014 to November 2016.18 patients with transverse patella fracture treated in our department with CCS TBW. Follow-up was done at 3weeks, 6 weeks, 10 weeks and then at monthly interval for first 6 months and then at 3 monthly interval for next 12 months. The aim of our study is to know the functional outcome in patients with transverse patella fracture treated with cannulated cancellous screw tension band technique.

**Inclusion Criteria**

- Displaced transverse fracture of patella. (Displacement ≥3mm)
- Age of the patients in between 20 to 50 years.

***Exclusion Criteria***

- Communated fractures of Patella.
- Open fractures
- Three part fractures
- Medical co morbidities

Initially patients were stabilized in the emergency ward and associated trauma were excluded with thorough clinical examination. Then x ray of the knee joint including AP and Lateral view were taken. A long leg cylindrical POP slab was given. Pre operative complete blood analysis and anesthetic check up were done. After anasthetia fitness patients were posted for surgery. Under all available aseptic measure and spinal anasthetia, patient was on supine position proper draping and betadine painting done. After application of torniquate, anterior longitudinal midline incision was given. Unneessary undermining of tissue was avoided to preserve blood supply and viability of skin flaps. After exposure of the fracture lines, all clots and devitalized debries should be cleared. With the knee slightly flexed the fracture fragments were anatomically reduced and held using reduction clamp or towel clips. Articular congruity was assessed by digital palpation through the retinacular tear and confirmed on fluoroscopy. Two parallel 2 mm guide wires were passed from proximal to distal at a level 5mm below the anterior cortical surface and their position checked under C ARM. After confirming the screw size with the depth gauze, the 4 mm CCS screws were passed over the guide wires after drilling the fracture fragments. The guide wires were removed and an 18G stainless steel wire was passed through the cannulated screws and crossed over the anterior aspect of the patella in a figure of 8 fashion. The wire ends were tightened with the knee in full extension. Bend wires twist posteriorly into deep soft tissue. The articular surface was evaluated by palpating the articularsurface through the retinacular defect and by fluoroscopy. To compress the fracture site the wires were sequentially tightened both medially and laterally. Final stability of the construct was tested by taking the knee through the range of motion. Finally the soft tissues were repaired including the synovium, capsule and extensor mechanism and the wound closed in layer and sterile dressing done and the knee immobilized in a hinged knee brace in extension. All patients were initiated physiotherapy and rehabilitation 24 hours after surgical procedure which comprised of isometric and isotonic quadriceps muscle strengthening exercises. A knee immobiliser was given so that the patient could walk and bear weight as early as day 2. Post operative dressing was done on 3 rd post operative day. Intravenous antibiotics such as cefuroxime (1.5 gtwice a day) and analgesics drugs such as diclofenac (75 mg twice daily) were prescribed during hospitalization. On discharge, oral antibiotics such as cefuroxime (500 mg twice a day) and oral analgesics and antiinflammatory drugs such as diclofenac (100mg twice daily) were used. Clinical evaluation of the wound and suture removal was conducted at the 12th postoperative day. Follow-up was done at 3weeks, 6 weeks, 10 weeks and then at monthly interval for first 6 months and then at 3 monthly interval for next 12 months. Both clinical and radiological assessments were done for fracture healing and functional recovery. Loss of fixation was defined as a gap at fracture site more than 3mm or articular step more than 2mm. Radiological union was established when the bony trabeculae crossed the fracture line. Patients were evaluated using the IOWA knee score criteria one year after surgery, the function was evaluated according to through inquiring joint pain during weight bearing, assessing walking gait, the existence of deformity or instability, and joint ROM.

According to IOWA criteria:

No Pain And ROM $\geq 135^0$ Excellent
No Pain And ROM $\geq 90$ To $<135^0$ Good
No Pain With ROM $< 90^0$ Fair
Pain With ROM $< 90^0$ Poor

## RESULTS

There are 18 patients in our series out of which 12 male and 6 female. The mean age of the patients were 35 years (20-50 years). Out of which 14 patients had fracture occure in left and 4 on right side.9 patients had fracture due to forceful quadriceps contraction, 6 due to fall and 3 due to road traffic accident.

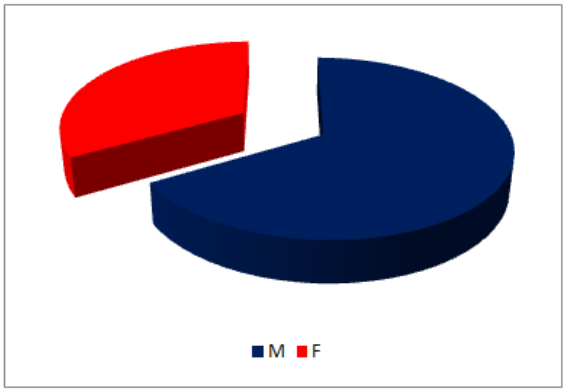


**Fig. 1. Sex distribution of patients in our study**

In our series $C_1$ type was found to be 83% and $C_2$ type was 17%. Average displacement of fracture fragment was found to be 4 mm. In our series mean radiological union type found to be 11 wks (9-13 wks). Average range of motion at 3 month

and 1 yr follow-up was found to be 100˚ and135˚ respectively. Functional outcome in most of the cases was found to be satisfactory.

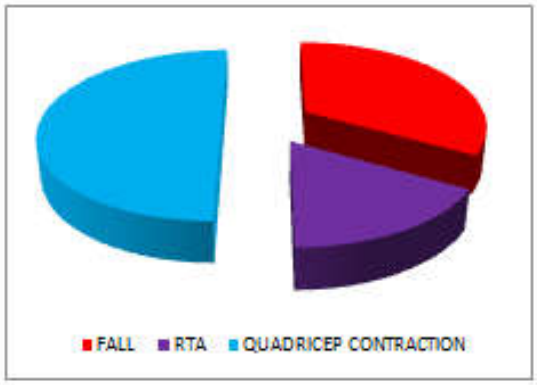


**Fig. 2. Mechanism of Injury**

**Fig. 3(a). pre op. X-ray**

***Fig.3(b). Intra op***

**Fig. 3(c). Post op. X-ray**

Only one case outcome was fair. 1 patient developed complication like infection, soft tissur irritation and another patient develop knee stiffness. None of the patient complaining of pain in knee joint at final follow-up.

## DISCUSSION

Treatment options for patellar fractures depends on the type of fracture, size of the fragments, stability of the extensor mechanism, and regularity of the articular surface (Burvant, 1994). Surgery is indicated if there is damage to the extensor mechanism or in fractures associated with 2 mm step-off in-congruity (Burvant, 1994). The main goal of the treatment of patella fractures is to provide a regular articular surface, to maintain rigid fixation, and to preserve joint function by initiating early knee range of motion (Burvant, 1994; Carpenter, 1997; Kaylor, 1996). Displaced transverse fractures of the patella are commonly treated by internal fixation. The widely accepted surgical technique is open reduction and the modified tension band technique (Burvant, 19994; Carpenter *et al*., 1997). Although open surgical techniques are the standard method for reduction and fixation of displaced patellar fractures, Many reports describe the disadvantages and complications associated with traditional surgical treatments of patella fractures (Smith, 1997). The common complications of these techniques are: infection, loss of fixation, knee stiffness, posttraumatic osteoarthritis, nonunion, irritation of the anterior knee pain caused by internal fixation devices. Because the patella is a subcutaneous bone, fixation devices that have been used for fracture fixation are frequently irritating. Wires and wire knots seem to be particularly irritating to the soft tissues of the anterior knee area. In a report of a large series of patella fractures, the incidence of complications related to wire cerclage materials was 47% (Hung, 1985). These complications resulted in a delay for patients in returning to their activities of daily living and a need for additional surgery Although the modified tension band wiring is still the most frequently applied internal fixation technique for transverse patella fractures, postoperative symptoms and complications related to this technique are not uncommon.

A fragment displacement of 2 mm was observed in 22%–30% of the patients with early mobilization after tension band wiring. Secondary postoperative pain due to skin irritation caused by the K-wires or the stainless steel wire is also a common problem which may require an extra surgery for fixation removal (Carpenter, 1997). Moreover, the “Figure of 8” tension band configuration was proved not the most stable construct for fixation of transverse patella fractures. Carpenter *et al* (1997) have demonstrated through biomechanical evaluation that among the three methods for patella fixation (modified tension band, lag screws or cannulated screws with a tension band wired through the screws), the cannulated screws plus the tension band provided the most efficient stabilization, indicating that combining interfragmentary screw fixation with the tension band principle seems to provide improved stability over the modified tension band or screws alone for transverse patella fractures (Carpenter, 1997). According to CHANG *et al* anterior tension band wiring through cannulated screws for displaced inferior pole patella fractures is a safe, simple, and reliable alternative treatment with minimal soft tissue irritation. (Chang *et al*., 2014) Tian *et al* also showed that the cannulated screw tension band was better than the modified K-wire tension band technique (Tian, 2011). Thus this technique should be a effective device for fixation of transverse patella fracture.

Hoshino *et al*. compared the incidence of complications after tension-band fixation of the patella with Kirschner wires as compared with cannulated screws and observed Symptomatic implants, as the most common complication, were twice as frequent in patients treated with Kirschner wires. (Hoshino *et al*., 2013) According to the IOWA scoring system 13 patients showed excellent result .4 patients showed good results. The results of our study showed that the CCS with tension band wiring technique could provide satisfactory osteosynthesis, good functional outcome, few complications and reoperations.

**Conclusion**

The surgical management of patella fracture is constantly changing with the latest additions being mini screw fragment fixation systems, fixed angle plate, titanium breaded cable systems. The evolution in patellar fracture management has been necessitied by the need of stable fixation to allow early mobilization and aggressive rehabilitation to preserve the ROM in the young physically age group. In this study cannulated cancellous screw fixation with tension band wiring increases the interfragmentry compression and anatomical reduction, the probability of screw loosening is very low owing to cancellous bone density of patella and the fact that distal end of cannulated cancellous screw is threaded. The IOWA score was excellent in majority of the cases and has a good functional outcome. The drawback with our study is that it is not a comparative study and short follow up. We need prospective comparative studies with longer follow up to establish these advantages.

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