



## FUNCTIONAL OUTCOME OF SURGICAL MANAGEMENT OF TRANSVERSE PATELLA FRACTURES USING CANNULATED SCREWS COMBINED WITH TENSION BAND WIRING

### Orthopaedics

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### ABSTRACT

**Background:** Transverse patella fractures disrupt the knee extensor mechanism and require stable fixation to allow early mobilization and optimal functional recovery. Cannulated screws combined with tension band wiring have been increasingly used to enhance fracture stability while minimizing implant-related complications. This study aimed to evaluate the functional outcome of transverse patella fractures treated using this fixation technique. **Materials and Methods:** This prospective observational study included 36 patients with transverse patella fractures managed surgically using cannulated screws combined with tension band wiring. Patients were evaluated clinically and radiologically at 6, 12, and 24 weeks postoperatively. Functional outcome was assessed using the Lysholm knee scoring system, while clinical parameters included knee range of motion, extensor lag, quadriceps power, and postoperative complications. Radiological union was assessed using serial radiographs. Statistical analysis was performed to evaluate functional improvement over time and to assess associations between functional outcome and clinical variables. **Results:** The mean Lysholm score improved significantly from  $76.8 \pm 6.9$  at 6 weeks to  $92.8 \pm 4.4$  at 24 weeks ( $p < 0.001$ ). At final follow-up, 72.2% of patients achieved excellent outcomes and 16.7% had good outcomes. Mean knee flexion improved from  $95.8 \pm 12.6^\circ$  at 6 weeks to  $128.9 \pm 7.4^\circ$  at 24 weeks. Radiological union was achieved at a mean of  $11.2 \pm 1.6$  weeks, with most fractures uniting within 10–12 weeks. Postoperative complications were minimal, with low rates of implant irritation, superficial infection, and knee stiffness. Absence of complications and achievement of knee flexion  $\geq 120^\circ$  were significantly associated with better functional outcomes. **Conclusion:** Surgical management of transverse patella fractures using cannulated screws combined with tension band wiring provides stable fixation, reliable fracture union, early mobilization, and excellent functional outcomes with a low complication rate. This technique is a safe and effective option for displaced transverse patella fractures when combined with appropriate surgical technique and rehabilitation.

### KEYWORDS

Transverse Patella Fracture; Cannulated Screws; Tension Band Wiring; Lysholm Knee Score; Functional Outcome; Knee Range Of Motion.

### INTRODUCTION

Patella fractures account for approximately 1% of all skeletal injuries and disrupt the knee extensor mechanism, making anatomical reduction and stable fixation essential for functional recovery. Transverse fractures, the most common pattern, typically result from indirect quadriceps traction across a flexed knee. Historically, tension band wiring using Kirschner wires has been the standard treatment, but complications such as wire migration, soft-tissue irritation, and loss of fixation remain frequent. The combination of cannulated screws with tension band wiring provides superior interfragmentary compression, reduces implant prominence, and permits earlier mobilization while preserving the biomechanical principle of converting tensile force into compression across the fracture site. Despite the increasing use of this technique, prospective data on functional outcomes remain limited. This study was undertaken to evaluate the functional outcome of transverse patella fractures managed with cannulated screws combined with tension band wiring.

### MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Orthopaedics, Sri Siddhartha Medical College, Hospital & Research Centre, Tumakuru, Karnataka, over a 24-month period, including 6 months of follow-up. Using purposive sampling, 36 patients aged 18–60 years with displaced transverse patella fractures were enrolled; patients with comminuted fractures, open fractures, or associated ipsilateral lower-limb fractures were excluded. The sample size was calculated based on an expected 84% rate of excellent outcome, with 10% absolute precision at 90% confidence.

All patients underwent open reduction and internal fixation using two parallel cannulated screws combined with a figure-of-eight tension band wire. Demographic, injury, and operative details were recorded prospectively. Patients were followed up clinically and radiologically at 6, 12, and 24 weeks postoperatively. Functional outcome was assessed using the Lysholm knee scoring system; clinical parameters included knee range of motion, extensor lag, and quadriceps power, while serial radiographs were used to assess fracture union and hardware position. Postoperative complications were documented at each visit.

Data were entered in Microsoft Excel and analyzed using SPSS

version 24. Quantitative variables were expressed as mean  $\pm$  SD and compared using the paired sample t-test; qualitative variables were expressed as frequencies and percentages and compared using the chi-square test. A p value  $< 0.05$  was considered statistically significant.

### RESULTS

The study included 36 patients with transverse patella fractures, with a mean age of  $38.6 \pm 9.4$  years (range 18–60 years); most patients (38.9%) were aged 31–40 years. Males predominated (72.2%), and 63.9% had no associated comorbidity. The right knee was involved in 63.9% of cases. Road traffic accidents were the commonest mode of injury (58.3%), followed by falls (33.3%) and non-contact injuries (8.4%). Surgery was performed within 3 days of injury in 61.1% of patients.

Functional outcome, assessed using the Lysholm score, improved significantly across follow-up, from  $76.8 \pm 6.9$  at 6 weeks to  $86.7 \pm 5.6$  at 12 weeks and  $92.8 \pm 4.4$  at 24 weeks ( $p < 0.001$  for all pairwise comparisons) (Table 1). At final follow-up, 72.2% of patients achieved an excellent outcome, 16.7% a good outcome, and 11.1% a fair outcome; no patient had a poor outcome (Table 2).

**Table 1: Mean Lysholm Functional Outcome Score at Follow-up Intervals**

| Follow-up | Mean $\pm$ SD  | Comparison     | p value   |
|-----------|----------------|----------------|-----------|
| 6 weeks   | $76.8 \pm 6.9$ | 6 vs 12 weeks  | $< 0.001$ |
| 12 weeks  | $86.7 \pm 5.6$ | 12 vs 24 weeks | $< 0.05$  |
| 24 weeks  | $92.8 \pm 4.4$ | 6 vs 24 weeks  | $< 0.001$ |

**Table 2: Functional Outcome Grading at 24 Weeks (n = 36)**

| Outcome   | n  | %    |
|-----------|----|------|
| Excellent | 26 | 72.2 |
| Good      | 6  | 16.7 |
| Fair      | 4  | 11.1 |
| Poor      | 0  | 0    |

Knee range of motion also improved progressively, from a mean of  $95.8 \pm 12.6^\circ$  at 6 weeks to  $128.9 \pm 7.4^\circ$  at 24 weeks ( $p < 0.001$ ), with 88.9% of patients achieving  $\geq 120^\circ$  flexion by final follow-up. Extensor lag was present in only 11.1% of patients, and quadriceps power was Grade 5 in 80.6% of patients and Grade 4 in the remainder.

Radiological union occurred at a mean of  $11.2 \pm 1.6$  weeks; 61.1% of fractures united within 10–12 weeks and only 8.3% took longer than 14 weeks. Postoperative complications were infrequent: superficial infection (2.8%), implant irritation (5.6%), and knee stiffness (2.8%). No implant migration or breakage occurred, and only 5.6% of patients required implant removal.

Statistical analysis showed that patients achieving final knee flexion  $\geq 120^\circ$  had significantly better functional outcomes ( $\chi^2 = 3.96$ ,  $p = 0.046$ ), as did patients without postoperative complications, who had a higher mean Lysholm score than those with complications ( $94.1 \pm 4.2$  vs  $85.2 \pm 6.1$ ;  $p < 0.02$ ). Comorbidity status was not significantly associated with functional outcome ( $p = 0.156$ ).

## DISCUSSION

The present study demonstrates that cannulated screws combined with tension band wiring provide reliable fixation and excellent functional recovery in transverse patella fractures. The predominance of patients in the third and fourth decades (38.9% aged 31–40 years; mean age  $38.6 \pm 9.4$  years) and the male preponderance (72.2%) observed in this cohort are consistent with several comparable series, including those of Tan et al. (2016), Lin et al. (2015), and Han et al. (2023), who similarly reported operative transverse patella fractures to be more frequent among young to middle-aged, active males exposed to high-energy trauma.

The progressive improvement in Lysholm scores observed in this study, from  $76.8 \pm 6.9$  at 6 weeks to  $92.8 \pm 4.4$  at 24 weeks, mirrors the trend reported by Cho (2013) and Prasad et al. (2025), who attributed early and sustained functional gain to the stability afforded by screw-based tension band constructs, which convert quadriceps tension into interfragmentary compression while permitting earlier joint mobilization than conventional K-wire tension band wiring. In the present series, 88.9% of patients achieved excellent-to-good outcomes at 24 weeks, comparable to the high excellent/good rates reported by Tan et al. (2016) and Han et al. (2023).

Restoration of knee range of motion emerged as a significant determinant of functional outcome ( $p = 0.046$ ), a finding consistent with Lin et al. (2015) and Tian et al. (2011), both of whom reported that superior postoperative range of motion translated directly into better Lysholm grading. Likewise, the inverse relationship between complications and functional score observed in this study ( $94.1 \pm 4.2$  without complications versus  $85.2 \pm 6.1$  with complications;  $p < 0.02$ ) parallels observations by Tan et al. (2016), who noted that implant-related irritation and stiffness reduced final knee scores despite overall favourable outcomes with this technique.

Radiological union occurred at a mean of  $11.2 \pm 1.6$  weeks in this study, comparable to the union times reported by Tian et al. (2011) and Prasad et al. (2025), reinforcing that screw-based compression preserves the biological milieu required for timely healing while providing mechanical stability. The low complication rate observed, with no implant migration or breakage and implant removal required in only 5.6% of patients, is consistent with the favourable complication profile described by Baid et al. (2024) in their review of evolving patella fracture fixation techniques, and supports the biomechanical rationale that cannulated screws reduce the wire-cutting and migration problems traditionally associated with pure K-wire tension band constructs (Avery et al., 2019).

Comorbidities such as diabetes mellitus and chronic smoking did not significantly affect functional outcome in this cohort ( $p = 0.156$ ), suggesting that with stable fixation and structured rehabilitation, patient-related systemic factors are less influential than mechanical and technical factors in determining final knee function. This study is limited by its relatively small sample size, absence of a comparator fixation group, and reliance on a single functional scoring instrument; larger comparative trials are warranted to validate these findings.

## CONCLUSION

Surgical management of transverse patella fractures using cannulated screws combined with tension band wiring provides stable fixation, reliable radiological union, and excellent functional recovery, with a low rate of complications. Restoration of knee range of motion  $\geq 120^\circ$  and absence of postoperative complications were the strongest determinants of a favourable outcome. This technique is a safe and effective option for displaced transverse patella fractures and may be preferred over conventional K-wire tension band wiring when

appropriate surgical technique and structured rehabilitation are followed.

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