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Original Research Article

Clinical Profile, Fracture Healing and Early Complications Following Tension Band Wiring for Patellar Fractures in a Tertiary Care Hospital

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Abstract:

Background: Successful management of patellar fractures requires restoration of the extensor mechanism, articular congruity and stable fracture union while minimizing postoperative complications. Although tension band wiring is widely used for displaced transverse fractures, local data regarding clinical presentation, healing and early postoperative complications remain valuable.

Objective: To describe the demographic and clinical profile, fracture healing and postoperative complications among patients undergoing tension band wiring for patellar fractures.

Materials and Methods: A prospective observational study included 64 adults with patellar fractures treated with tension band wiring in a tertiary-care orthopaedic department between February 2024 and January 2025. Patients underwent open reduction and fixation with two parallel K-wires and an 18-gauge figure-of-eight stainless-steel wire. Clinical and radiographic follow-up was performed at 2 weeks, 6 weeks, 3 months and 6 months. Demographic characteristics, injury mechanism, comorbidity and postoperative complications were documented.

Results: Mean age was 40.9 years and 42/64 (65.6%) were males. Forty-six patients (71.9%) sustained injury following self-fall/self-injury and 18 (28.1%) following road traffic accidents. Hypertension was present in 10 (15.6%) and diabetes mellitus in 7 (10.9%), while 47 (73.4%) had no recorded comorbidity. According to the detailed complication table, 56/64 (87.5%) had no postoperative complication, seven (10.9%) developed infection and one (1.6%) developed malunion. The majority therefore completed the postoperative course without a recorded complication.

Conclusion: Patellar fractures treated with TBW in this series predominantly affected male, working-age adults and were commonly associated with falls. Most patients had an uncomplicated postoperative course. Infection represented the principal recorded early complication. Attention to soft-tissue handling, wound care and rehabilitation remains important in optimizing outcomes after TBW.

Keywords: Patellar fracture; tension band wiring; fracture union; infection; complications; orthopaedic trauma.

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Introduction

Patellar fractures are uncommon injuries but have particular clinical significance because the patella serves simultaneously as an articular structure and an integral component of the knee extensor mechanism. The patella increases the mechanical advantage of the quadriceps, transmits tensile forces to the patellar tendon and helps distribute high compressive loads across the patellofemoral joint.[1,2] Failure to restore its anatomy after a displaced fracture may therefore lead to extensor weakness, loss of motion, pain and post-traumatic arthrosis. Patellar fractures account for approximately 1% of skeletal fractures.[3] Epidemiology varies according to age distribution, occupational exposure, transport patterns and prevalence of low-energy falls.[4] Direct trauma to the anterior knee is a common mechanism and can occur during falls, road traffic accidents or direct impact. Indirect injury may result from sudden eccentric quadriceps contraction, producing a transverse fracture pattern.[5] The therapeutic objective is restoration of the extensor apparatus and a congruent patellofemoral articulation while achieving sufficient stability to permit knee rehabilitation. Conservative treatment is generally reserved for minimally displaced fractures in which

the extensor mechanism remains intact. Displaced transverse fractures typically require surgical fixation.[6] The AO tension-band construct remains a well-established technique for suitable transverse fractures. Two parallel K-wires stabilize the fragments and an anterior figure-of-eight stainless-steel wire acts as a tension band, converting distraction forces generated by the quadriceps into compression at the fracture interface.[6,7] The technique offers several potential advantages, including relatively limited implant burden, reproducibility and the ability to initiate postoperative knee movement.Despite these benefits, complications remain an important consideration. Superficial and deep infection, implant prominence, K-wire migration, wire breakage, fixation failure, loss of reduction, delayed union, nonunion, malunion, stiffness and anterior knee pain have all been described.[8-11] The subcutaneous position of the patella also makes implant-related irritation particularly relevant. Patient-related factors can influence postoperative recovery. Diabetes mellitus may impair wound healing, while advanced age and poor bone quality may influence fixation. Similarly, fracture comminution, soft-tissue injury and inadequate reduction can increase the probability of adverse outcome. Careful surgical technique and preservation of the retinacular and peripatellar vascular supply are therefore essential. Understanding the demographic profile and spectrum of complications observed in a particular clinical setting helps with patient counselling, perioperative planning and postoperative surveillance. The present study consequently analyzed the age and sex distribution, injury mechanism, associated comorbidities and early complications of patients treated by tension band wiring for patellar fractures at a tertiary-care centre.

Materials and Methods

This prospective single-centre observational study was undertaken in the Department of Orthopaedics, over a 12-month period from February 2024 to January 2025.

Participants and Recruitment: Sixty-four adults with patellar fractures requiring operative fixation were recruited using consecutive enumeration. The study principally included transverse/horizontal patellar fracture patterns presenting for surgical treatment. The calculated sample size was 64, based on a previous study reporting approximately 85.71% excellent-to-good functional outcome following tension band wiring.[12] Patients older than 18 years of either sex who had a patellar fracture and provided informed written consent were eligible. Patients younger than 18 years, patients unwilling to participate, fractures associated with neurovascular injury, severe osteoporosis, polytrauma, active infection and patients with previous metallic implantation were excluded. Institutional ethics approval was obtained before commencement of the study. Written informed consent was obtained from all participants and confidentiality of study data was maintained.

Clinical Evaluation: History was obtained regarding the time and mechanism of injury, associated trauma and relevant medical conditions. Examination focused on knee swelling, pain, skin condition, extensor mechanism and neurovascular status. Standard AP and lateral radiographs were obtained before surgery, and postoperative radiographs were used to evaluate reduction and fixation.

Operative Technique: Procedures were performed under spinal anesthesia with the patient supine. A pneumatic tourniquet was applied. Through an anterior longitudinal incision, the patella was exposed and hematoma cleared. Fragments were reduced anatomically with particular attention to restoration of the patellofemoral articular surface. Two parallel 1.6- or 2.0-mm K-wires were introduced longitudinally across the fracture. An 18-gauge stainless-steel wire was then applied over the anterior surface in a figure-of-eight configuration and tightened to produce interfragmentary compression. The ends of the K-wires were bent and shortened to reduce migration and soft-tissue irritation. Retinacular tears were repaired and the wound was closed in layers.

Follow-up: Patients were assessed at approximately 2 weeks, 6 weeks, 3 months and 6 months. Wound condition, clinical and radiological healing, knee movement and postoperative adverse events were recorded. Complications documented in the detailed study results included infection and malunion. Postoperative rehabilitation consisted of progressive active and passive knee exercises under physiotherapy supervision once considered clinically appropriate.

Data Analysis: Data were entered into Microsoft Excel and analyzed with SPSS version 21. Categorical variables were summarized as counts and percentages and continuous variables using mean and standard deviation or median when appropriate. Normality was assessed using the Kolmogorov-Smirnov test. Chi-square/Fisher's exact testing and Pearson/Spearman correlation were planned where appropriate. Statistical significance was defined as $p<0.05$. For preparation of this manuscript, percentages for demographic variables were recalculated directly from the reported patient counts where the percentages printed in the thesis were internally inconsistent.

Results

Table 1: Demographic characteristics

Variable	Number	Percentage
Age group		
<25 years	5	7.8
25–50 years	43	67.2
51–75 years	12	18.8
>75 years	4	6.3
Sex		
Male	42	65.6
Female	22	34.4

The mean age was 40.9 years, and 43/64 patients were between 25 and 50 years of age. There was a clear male predominance.

Table 2: Injury and clinical characteristics

Characteristic	Number	Percentage
Self-fall/self-injury	46	71.9
Road traffic accident	18	28.1
Right-sided fracture	36	56.3
Left-sided fracture	28	43.8
Hypertension	10	15.6
Diabetes mellitus	7	10.9
No comorbidity	47	73.4

Falls/self-injury represented the predominant reported mechanism, accounting for more than two-thirds of cases. Most patients did not have hypertension or diabetes.

Table 3: Postoperative complications

Complication	Number (n=64)	Percentage
Infection	7	10.9
Malunion	1	1.6
No recorded complication	56	87.5
Total	**64**	**100**

Most patients, 56/64 (87.5%), experienced no recorded postoperative complication. Infection was the most frequently documented adverse event, affecting seven patients. One case of malunion was recorded.

Table 4: Six-month functional status among patients completing follow-up

Outcome	n/N	Percentage
Excellent ROM	53/59	89.8
Good ROM	6/59	10.2
Excellent Goodfellow grade	45/59	76.3
Good Goodfellow grade	12/59	20.3
Excellent-to-good Goodfellow outcome	57/59	96.6

Although the primary emphasis of this article was clinical profile and complications, functional follow-up demonstrated preservation of good overall knee recovery in the majority of patients completing six-month assessment.

Discussion

The present study provides a prospective description of the clinical characteristics and early postoperative course of 64 patients undergoing tension band wiring for patellar fracture. The cohort was characterized by a mean age of 40.9 years, male predominance, a predominance of fall-related injuries and a relatively low frequency of recorded postoperative complications. The concentration of injuries in adults aged 25–50 years is consistent with several classical and contemporary reports showing that patellar fractures frequently affect active individuals exposed to occupational and transport-related trauma. Boström's large series found substantial representation of adults in the third to fifth decades.[13] Carpenter et al. similarly reported patients in the working-age population.[14] Conversely, Larsen et al. demonstrated higher incidence among older individuals in population-based European data, particularly in association with low-energy falls.[15] These differences indicate that the epidemiology of patellar fractures is strongly influenced by population age structure and prevailing mechanisms of trauma.

Male patients represented 65.6% of the present cohort. Male predominance has also been observed

in a number of hospital-based trauma series.[12,16] Greater exposure to occupational activity and road traffic may partly account for this pattern, although sex distribution varies between populations and should not be considered an intrinsic characteristic of the fracture itself.

Falls/self-injury accounted for 71.9% of cases compared with 28.1% caused by road traffic accidents. Hung et al. reported falls and direct trauma as important causes of patellar injury,[16] while Boström similarly emphasized direct injury to the anterior knee.[13] From a biomechanical perspective, the patella is especially vulnerable to direct impact because of its subcutaneous anterior position.

Most patients had no recorded hypertension or diabetes, while hypertension occurred in 15.6% and diabetes in 10.9%. Although the study was not designed or powered to test the influence of comorbidity on outcomes, identification of diabetes remains clinically relevant because impaired wound healing and susceptibility to infection can complicate orthopaedic surgery.

The detailed study results documented infection in seven patients (10.9%). Surgical-site infection following patellar fixation is clinically important because of the thin soft-tissue envelope overlying the patella and the superficial position of metallic implants. Published clinical series generally report relatively low infection rates after TBW, although the exact incidence depends on fracture severity, open versus closed injury, patient comorbidity and definitions used for infection.[17-19] Careful asepsis, atraumatic tissue handling and preservation of vascularized retinacular tissue remain fundamental preventive measures.

A single malunion was recorded in the detailed Results dataset. Restoration of articular congruity is central to patellar fracture surgery because residual displacement may alter patellofemoral contact mechanics and contribute to pain or degenerative changes.[1,14] Accurate reduction and stable fixation should therefore remain priorities in addition to achieving radiological healing.

The majority of patients—87.5%—had no recorded complication. This favorable early profile is broadly consistent with the use of TBW as an established fixation method for appropriately selected transverse fractures.[18,19] Nevertheless, the present study did not fully evaluate longer-term implant-related problems. Prominent or migrated K-wires, wire breakage and subsequent implant removal are important issues described in other studies and may only become clinically significant beyond the six-month follow-up period.[8,20]

Five participants were not available at final functional follow-up, including one death unrelated to the procedure and four losses to follow-up. Other limitations include the single-centre design, relatively small sample size and absence of a comparator group treated with screws, plates or alternative tension-band constructs. The study also lacked sufficiently detailed statistical analysis to establish predictors of complications.

Future studies should include longer follow-up, standardized definitions of infection and union, patient-reported outcome measures, radiographic measurements of reduction and direct comparisons between conventional TBW and newer fixation techniques.

Conclusion

Patellar fractures treated with tension band wiring in this tertiary-care cohort predominantly occurred in male, working-age adults, with falls representing the commonest injury mechanism. The majority of patients had no recorded postoperative complication. Infection was the most frequent complication and one malunion was recorded in the detailed dataset. These findings support TBW as a practical technique for appropriately selected patellar fractures while highlighting the importance of meticulous reduction, soft-tissue preservation, postoperative wound surveillance and rehabilitation.

References

1. Huberti HH, Hayes WC. Patellofemoral contact pressures: the influence of q-angle and quadriceps force. J Bone Joint Surg Am. 1984;66(5):715-24.
2. Reilly DT, Martens M. Experimental analysis of quadriceps muscle force and patellofemoral joint reaction force for various activities. Acta Orthop Scand. 1972;43(2):126-37.
3. Henrichsen JL, Wilhem SK, Siljander MP, Kalma JJ, Karadsheh MS. Treatment of patella fractures. Orthopedics. 2018;41(6):e747-55.
4. Court-Brown CM, Caesar B. Epidemiology of adult fractures: a review. Injury. 2006;37(8):691-7.
5. Boström A. Fracture of the patella: a study of 422 patellar fractures. Acta Orthop Scand Suppl. 1972;143:1-80.
6. Rockwood CA, Green DP, Bucholz RW, Heckman JD, Tornetta P. Rockwood and Green's Fractures in Adults. 9th ed. Philadelphia: Wolters Kluwer; 2020.
7. Rüedi TP, Buckley RE, Moran CG. AO Principles of Fracture Management. 3rd ed. Stuttgart: Thieme; 2018.
8. Yang TY, Huang TW, Chuang PY, Huang KC. Treatment of displaced transverse fractures of the patella: modified tension band wiring technique with or without augmented circumferential cerclage wire fixation. BMC Musculoskelet Disord. 2018;19(1):167.

9. John J, Wagner WW, Kuiper JH. Tension-band wiring of transverse fractures of patella: the effect of site of wire twists and orientation of stainless-steel wire loop—a biomechanical investigation. Int Orthop. 2007;31(5):703-7.
10. Sun F, Zhang Y, Ji Q, Zhang T, Zhu Y, Zhang Z, et al. A new antirotation strategy of K-wire tension band therapy for patellar fracture. Front Surg. 2022;9:891869.
11. Huang PH, Hsu CH, Hsu SL, Liu HC. Treatment of displaced fractures of the patella: tension band wiring technique with the one-end or both-ends K-wire bending fixation method. J Orthop Surg (Hong Kong). 2021;29(1):1-7.
12. Ponnan P, Kunjappan MM. Evaluation of functional outcome of patients with transverse fracture of patella treated with tension band wiring: a prospective study conducted at Trichur, Kerala. J Evid Based Med Healthc. 2021;8(30):2757-62.
13. Boström A. Fracture of the patella: a study of 422 patellar fractures. Acta Orthop Scand Suppl. 1972;143:1-80.
14. Carpenter JE, Kasman R, Matthews LS. Fractures of the patella. J Bone Joint Surg Am. 1993;75(10):1550-61.
15. Larsen P, Court-Brown CM, Vedel JO, Vistrup S, Elsoe R. Incidence and epidemiology of patellar fractures. Orthop Traumatol Surg Res. 2022;108(1):103151.
16. Hung LK, Chan KM, Chow YN, Leung PC. Fractures of the patella in Hong Kong Chinese. J Trauma. 1993;34(6):852-5.
17. Patil S, Agarwal S, Shekhar A, et al. Functional outcome of tension band wiring in patellar fractures: a prospective study. Int J Orthop Sci. 2016;2(4):63-7.
18. Singh A, Kumar V, Pandey R, et al. Modified tension band wiring for patellar fractures: functional outcome analysis. Int J Res Orthop. 2018;4(3):456-60.
19. Khan AQ, Khan MS, Sherwani MKA, et al. Outcome of modified tension band wiring in patellar fractures. J Clin Orthop Trauma. 2019;10(2):345-9.
20. Yapici F, Gur V, Subasi IO, Karakose R, Kockara N. Tension band wiring of patella fractures: mid-term radiological and clinical results. Acibadem Univ Saglik Bilim Derg. 2022;13(4):528-36.