

SURGICAL TREATMENT OF MALLET FRACTURES BY EXTENSION BLOCK KIRSCHNER WIRE TECHNIQUE

Muhammad Siraj¹, Manzoor Ilahi², Fahad Wazir³, Wasim Khan⁴, Shahab⁵, Muhammad Ismaeel⁶, Nasir Hussain⁶, Adnan¹

¹Department of Orthopedic Surgery, Khyber Teaching Hospital, Peshawar - Pakistan

²Department of Orthopedic DHQ, Batkhela, KP - Pakistan

³Medical Officer Charsada, KP - Pakistan

⁴Medical Officer, RHC Domel, Bannu, KP - Pakistan

⁵Medical Officer Dir Timergra, KP - Pakistan

⁶Department of Orthopedics, Upperlimb and Microsurgery LRH, Peshawar - Pakistan

ABSTRACT

Objective: The purpose of this study is to assess the functional results of mallet fractures treated in a local population using the extension block Kirschner wire (K-wire) technique.

Materials & Methods: This cross-sectional descriptive study was conducted in Khyber Teaching Hospital's orthopedic surgery department in Peshawar, Pakistan, from October 2022 to October 2024. Under digital block anesthesia, 30 patients (aged 20–50) with closed mallet fractures involving more than one-third of the articular surface underwent surgical repair using the extension-block K-wire technique. Percutaneously, two K-wires were placed: one to transfix the distal interphalangeal (DIP) joint and the other to prevent dorsal reduction. After 6 weeks of progressive mobilization and splinting, the K-wires were removed. We used Crawford's criteria (excellent/good/fair/poor) to evaluate the results at follow-up. Data were analyzed using SPSS v23.0 with pairwise t-tests and chi-square tests ($p < 0.05$).

Results: The mean age was 35.40 ± 8.26 years, and 53.3% of the population was male. After surgery, the preoperative extension lag improved significantly from $27.63^\circ \pm 1.03^\circ$ to $7.57^\circ \pm 1.36^\circ$ ($p < 0.001$). The excellent/good rate was 73.3%, with functional outcomes rated excellent in 36.7%, good in 36.7%, fair in 16.7%, and poor in 10.0%. No discernible gender-based differences were observed ($p = 0.320$). No revision, osteoarthritis, non-union, or malunion surgeries were performed.

Conclusion: The extension block K-wire technique is a reliable and effective surgical option for mallet fractures, offering satisfactory functional outcomes. It is recommended for cases involving significant articular surface compromise or subluxation. Therefore, surgeons should consider this technique a reliable option for treating mallet finger injuries.

Keywords: Mallet Finger, Crawford's Criteria, Finger Injuries/Surgery, Distal Phalanx Fracture.

This article may be cited as: Siraj M, Ilahi M, Wazir F, Khan W, Shahab, et al.. Surgical Treatment Of Mallet Fractures By Extension Block Kirschner Wire Technique. J Med Sci 2026 July - September;34(3):108-112

INTRODUCTION

A rapid flexion or hyperextension force applied to an extended distal phalanx causes mallet finger, also referred to as "drop finger." This injury may or may not involve a distal phalanx avulsion fracture and affects the terminal extensor tendon. Usually closed, it is thought to be the most common hand tendon injury, especially in zone 1. ¹ An avulsion of the extensor tendon and a piece of bone from the distal phalanx are both involved in a bony

mallet finger. ² Sports or work-related activities commonly cause these injuries. ^{3,4} If the oblique retinacular ligament and related lumbrical tendon are not sufficiently relaxed, full recovery of extension is restricted. If treatment is not received, mallet finger can result in swan-neck deformity of the proximal interphalangeal (PIP) joint or osteoarthritis of the distal interphalangeal (DIP) joint. ⁵ Although the mechanism of the condition is well understood, there are disagreements over the most appropriate method of treatment, with some suggesting open surgery with plates, minimally invasive techniques, and conservative splinting. Differences exist in what constitutes a successful course of treatment; acceptable extension deficits range from less than 20° to less than 10° . ⁶ A splint is usually used to immobilize the DIP joint in mild hyperextension for 8–12 weeks as part of conservative treatment. Nevertheless, even small movement during this time can impede healing, resulting in scar tissue formation and functional defi-

Correspondence

Dr. Manzoor Ilahi

Khyber Teaching Hospital, Department of Orthopedic Surgery, Peshawar, Pakistan

+92-344-9077750

Email: dr.manzoorilahi176@gmail.com

Date Received: 23/05/2025

Date Revised: 26/07/2025

Date Accepted: 10/09/2026

cits.⁷ When more than one-third of the articular surface is affected or when the distal phalanx exhibits volar subluxation, surgery is frequently the preferred course of action.^{8,9} Risks associated with open surgical techniques include infection, nail deformity, and osteomyelitis.¹⁰ Ishiguro addressed these limitations in 1988 by introducing a minimally invasive technique using percutaneous Kirschner wires (K-wires) that allows for closed reduction, secure fixation, and early mobilization. Although complication rates vary by study, the extension block (EB) K-wire technique is recognized for its ease of use, low morbidity, and ability to achieve satisfactory functional outcomes. Given the disparity in the literature currently in publication, this study aims to assess the functional outcomes of applying the EB K-wire approach to treat mallet fractures in a local community. This will direct therapeutic practice and contribute to the body of evidence.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted in the Department of Orthopedic Surgery at Khyber Teaching Hospital, Peshawar, Khyber Pakhtunkhwa, Pakistan, over two years, from October 2022 to October 2024. The Institutional Research & Ethical Review Board approved the study (Reference: 755/DME/KMC). Using a 5% margin of error, a 5% significance level, and an anticipated 89.47% rate of satisfactory functional results, the sample size was determined with the WHO sample size calculator. The method used was non-probability sequential sampling. We used SPSS version 23.0 (Statistical Package for the Social Sciences) to analyze the data. Categorical variables were presented as frequencies and percentages, and quantitative variables were summarized as mean $\pm$ standard deviation (SD). We used the paired t-test and chi-square test after stratification, and a p-value of less than 0.05 was considered statistically significant. Prior to enrollment, all subjects provided written informed consent. Patients of either gender, aged 20 to 50 years, presenting with closed mallet fractures involving more than one-third of the distal phalanx articular surface, as diagnosed by a consultant orthopedic surgeon on clinical evaluation, were included in the study. Patients with comminuted or open fractures, or those who did not provide informed consent, were excluded. The treatment procedure and potential complications were explained to all patients in their native language.

Operative Technique

All patients underwent preoperative radiographic evaluation, as illustrated in Figures 1a and 1b. Eligible patients subsequently received surgical repair of the mallet fracture using the extension block Kirschner wire (K-wire) technique, performed by a single consultant orthopedic surgeon. We administered digital block anesthesia before the procedure.

The distal interphalangeal (DIP) joint was slightly flexed to preserve periosteal continuity and ensure proper placement of the fracture fragment. A K-wire, either 0.035"

(0.9 mm) or 0.045" (1.4 mm) in diameter, was percutaneously placed through the extensor tendon into the middle phalanx's head along the fracture fragment's dorsal border under C-arm fluoroscopic guidance. The distal phalanx was then placed in neutral extension at 0 degrees. A second K-wire was inserted across the DIP joint and secured in the middle phalanx to stabilize the reduction. Figures 2a and 2b illustrate the procedure steps.

Postoperatively, we emphasized regular dressing changes and meticulous pin site care. The protruding wire ends were trimmed as needed. K-wires were removed after six weeks. Following wire removal, patients were instructed to wear a mallet finger splint continuously (day and night) for an additional six weeks. Thereafter, patients were encouraged to gradually increase hand loading and range-of-motion exercises over the following weeks to restore function.

RESULTS

The mean age of the 30 patients in this study was 35.40 ± 8.26 years. No gender predominance was observed, with 16 (53.3%) male and 14 (46.7%) female ($p = 0.62$; Figure 4a). The distribution of mallet deformity types was equal, with 15 patients (50%) presenting with bony mallet injuries and 15 (50%) with tendinous mallet injuries, showing no significant difference between groups ($p = 1.00$; Figure 4b).

The mean interval from injury to surgical intervention was 1.97 ± 0.76 days, and the mean surgical duration was 55.83 ± 7.13 minutes. A statistically significant improvement in distal interphalangeal (DIP) joint extension was observed, with the mean preoperative extension lag of 27.63 ± 1.03 degrees improving to 7.57 ± 1.36 degrees postoperatively ($p < 0.001$).

Functional outcomes, assessed using Crawford's criteria, were as follows: 11 patients (36.7%) achieved excellent results, 11 (36.7%) had good outcomes, 5 (16.7%) had fair outcomes, and 3 (10.0%) had poor outcomes. Thus, 22 patients (73.3%) demonstrated favorable postoperative functional recovery (excellent or good outcome), as shown in Figure 5.

When functional outcomes were analyzed by gender, 4 (25.0%) male patients achieved excellent results, 8 (50.0%) had good outcomes, 2 (12.5%) had fair outcomes, and 2 (12.5%) had poor outcomes. Among female patients, 7 (50.0%) achieved excellent results, 3 (21.4%) had good outcomes, 3 (21.4%) had fair outcomes, and 1 (7.1%) had a poor outcome. The difference in functional outcomes between genders was not statistically significant ($p = 0.320$; Table 3). No cases of osteoarthritis, malunion, or non-union were observed during the follow-up period. Additionally, no patient required further surgical intervention at the final follow-up.

DISCUSSION

According to the study's findings, treating mallet fractures with an EB K-wire is a simple, affordable, and

reliable outpatient procedure. Of the 30 patients treated, 73.4% had excellent to good functional outcomes, and DIP joint extension improved significantly ($p < 0.001$), demonstrating the technique's efficacy. These results are consistent with previous studies using the extension block K-wire method. Several retrospective reviews and clinical trials have demonstrated its ability to provide sta-

Table No 1: Crawford's criteria for assessment of clinical criteria

Excellent	Good	Fair	Poor
Full DIP joint Extension.	0° to 10° of extension deficit.	10° to 25° of extension deficit.	More than 25° of extension deficit
Full flexion.	Full flexion.	Any flexion loss.	OR
No pain.	No pain.	No pain.	Persistent pain.

Table No 2: Demographic and Clinical Characteristics of Patients with Mallet Fractures

Demographic and Clinical Characteristic	Mean $\pm$ SD
Age (Years)	35.40 $\pm$ 8.26
Fracture to Operation Time (Days)	1.97 $\pm$ 0.76
Duration of Surgery (Min)	55.83 $\pm$ 7.13
Pre-Op DIP Joint Extension (Degree)	27.63 $\pm$ 1.03
Post-Op DIP Joint Extension (Degree)	7.57 $\pm$ 9.36

Table No 3: Association of Functional Outcomes with Gender of Patients

Functional Outcome	Gender n%		P-value
	Male	Female	
Excellent	4 (25 %)	7 (50 %)	0.320
Good	8 (50 %)	3 (21.4 %)	
Fair	2 (12.5 %)	3 (21.4 %)	
Poor	2 (12.5 %)	1 (7.1 %)	



Fig 1b: Preoperative X-ray of Mallet Finger



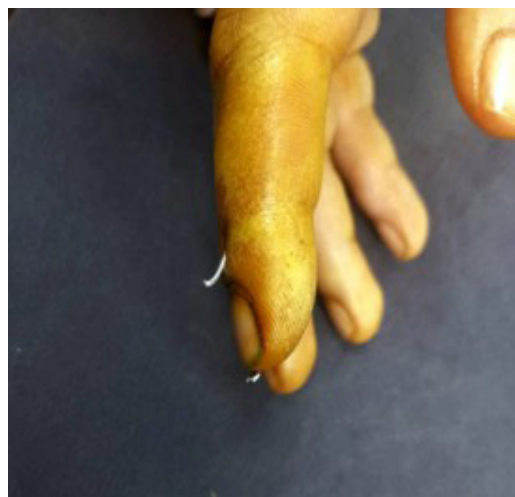
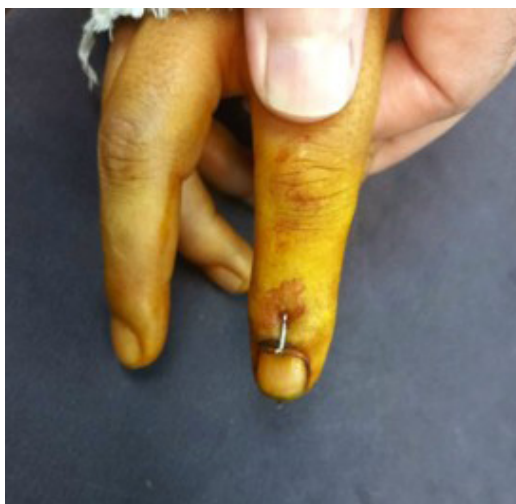
Fig 2a: Dorsal K-wire into middle phalanx.



Fig 1a: Preoperative X-ray of Mallet Finger



Fig 2b: 2nd K-wire into distal phalanx



3: 29-year-old male with a right index finger mallet injury, presented 5 days post-injury. Postoperative images were shown

ble fixation, promote radiological union, and restore joint function (12–15). Furthermore, the method has shown encouraging outcomes in both early and delayed interventions. In situations where volar subluxation or more than 30% of the articular surface is affected—conditions in which conservative treatment is often inadequate—surgical intervention is especially advised (16–18) but the evidence is sparse. This randomized clinical trial aimed to compare nonoperative splinting versus extension-block pinning of bony mallet fingers with involvement of more than one-third of the joint surface but without primary joint subluxation. Thirty-two patients were randomized and 28 fulfilled the protocol. At 6 months follow-up, there were no significant differences in active extension lag in the distal interphalangeal joint (the primary outcome. Splinting remains a good option in some situations, but research shows it may not be enough to prevent joint instability or swan-neck deformity, particularly when extensor force is imbalanced (17, 17,18) but the evidence is sparse. This randomized clinical trial aimed to compare nonoperative splinting versus extension-block pinning of bony mallet fingers with involvement of more than one-third of the joint surface but without primary joint subluxation. Thirty-two patients were randomized and 28 fulfilled the protocol. At 6 months follow-up, there were no significant differences in active extension lag in the distal interphalangeal joint (the primary outcome. Pseudoarthrosis, chronic stiffness, and additional joint damage can result from inadequate conservative therapy. However, despite being minimally invasive, the extension block technique successfully counteracts the intrinsic muscle traction on the bone fragment and DIP joint. Although postoperative temporary joint stiffness is possible, active mobilization usually alleviates it (19). Notably, this study reported no cases of osteoarthritis, malunion, or non-union, and no patients needed revision surgery. These findings further support the technique's safety profile and overall effectiveness in treating mallet fractures. However, despite a high case volume in the clinic, the study's limited sample size and descriptive cross-sectional design are drawbacks. Future studies

with larger cohorts and comparative designs are needed to assess long-term outcomes across different treatments and further validate these findings.

CONCLUSION

The extension-block K-wire technique is a reliable and effective surgical option for mallet fractures, yielding satisfactory functional outcomes. Therefore, surgeons should consider this technique a reliable option for treating mallet finger injuries.

ACKNOWLEDGEMENTS

We appreciate the Khyber Teaching Hospital orthopedic surgery department for granting us permission to conduct this study. We also thank the supervisors, data collectors, and research participants.

REFERENCES

1. Chee WH, Gunasagaran J, Ahmad TS. A comparison of delta wire technique versus extension block pinning in the treatment of bony Mallet finger. *Handchir · Mikrochir · Plast Chir.* 2020 Jun;52(03):176–81.
2. Geyman JP, Fink K, Sullivan SD. Conservative Versus Surgical Treatment of Mallet Finger: A Pooled Quantitative Literature Evaluation. *J Am Board Fam Med.* 1998 Sep 1;11(5):382–90.
3. Bloom JMP, Khouri JS, Hammert WC. Current Concepts in the Evaluation and Treatment of Mallet Finger Injury: *Plast Reconstr Surg.* 2013 Oct;132(4):560e–6e.
4. Rockwell BW, Butler PN, Byrne BA. Extensor Tendon: Anatomy, Injury, and Reconstruction: *Plast Reconstr Surg.* 2000 Dec;106(7):1592–603.
5. Nashi N, Sebastin SJ. A Pragmatic and Evidence-Based Approach to Mallet Finger. *J Hand Surg Asian-Pac Vol.* 2021 Sep;26(03):319–32.
6. Suffa N, Merkel P, Horch RE, Arkudas A, Ludolph I, Stumpfe MC. Temporäre Endgelenkstransfixation bei subkutanen Strecksehnenabrissen der Zone 1 am Fingerendglied. *Handchir · Mikrochir · Plast Chir.* 2021

- Sep;53(05):441–6.
7. Hong IT, Baek E, Ha C, Han SH. Long-term Stack splint immobilization for closed tendinous Mallet Finger. *Handchir · Mikrochir · Plast Chir*. 2020 Jun;52(03):170–5.
 8. Mazurek MT, Hofmeister EP, Shin AY, Bishop AT. Extension-block pinning for treatment of displaced mallet fractures. *Am J Orthop Belle Mead NJ*. 2002 Nov;31(11):652–4.
 9. Takami H, Takahashi S, Ando M. Operative treatment of mallet finger due to intra-articular fracture of the distal phalanx. *Arch Orthop Trauma Surg*. 2000 Jan;120(1–2):9–13.
 10. A new method of closed reduction for mallet fractures. | CiNii Research [Internet]. [cited 2025 Jun 8]. Available from: <https://cir.nii.ac.jp/crid/1571698599622546816>
 11. Crawford GP. The molded polythene splint for mallet finger deformities. *J Hand Surg*. 1984 Mar;9(2):231–7.
 12. Jerome TJJ, Malshikare VA. Fragment specific dorsal kirschner wire extension block pinning in mallet fractures-a retrospective study of 20 cases. *Orthoplastic Surg*. 2021 Jun;4(C):1–5.
 13. Lee YH, Kim JY, Chung MS, Baek GH, Gong HS, Lee SK. Two extension block Kirschner wire technique for mallet finger fractures. *J Bone Joint Surg Br*. 2009 Nov;91-B(11):1478–81.
 14. Surucu S, Aydin M. Extension Block Pinning of Mallet Fractures: Comparison Between Early and Delayed Surgery. *Konuralp Tıp Derg*. 2022 Mar 14;14(1):30–4.
 15. Kim B, Nho JH, Jung KJ, Yun K, Park E, Park S. Reduction Loss after Extension Block Kirschner Wire Fixation for Treatment of Bony Mallet Finger. *Archives of Hand and Microsurgery*. 2018 Dec 1;23(4):239–47.
 16. Weber P, Segmüller H. Konservative Behandlung von großen ossären Malletläsionen: 10 Fälle. *Handchir · Mikrochir · Plast Chir*. 2008 Jun;40(3):145–8.
 17. Thillemann JK, Thillemann TM, Kristensen PK, Foldager-Jensen AD, Munk B. Splinting versus extension-block pinning of bony mallet finger: a randomized clinical trial. *J Hand Surg Eur Vol*. 2020 Jul;45(6):574–81.
 18. Gumussuyu G, Asoglu MM, Guler O, May H, Turan A, Kose O. Extension pin block technique versus extension orthosis for acute bony mallet finger; a retrospective comparison. *Orthop Traumatol Surg Res*. 2021 Sep;107(5):102764.
 19. Aydin M, Surucu S, Capkin S, Atlihan D. Comparison of extension block pinning technique versus pin orthosis-extension block pinning technique for acute mallet fractures: a prospective randomized clinical trial. *Archives of Orthopaedic and Trauma Surgery*. 2022 Jun;142(6):1301–8.

CONFLICT OF INTEREST: Authors declare no conflict of interest

GRANT SUPPORT AND FINANCIAL DISCLOSURE: NIL

Authors Contribution:

Following authors have made substantial contributions to the manuscript as under

Authors	Conceived & designed the analysis	Collected the data	Contributed data or analysis tools	Performed the analysis	Wrote the paper	Other contribution
Siraj M	✓	✓	✗	✗	✓	✗
Ilahi M	✓	✗	✓	✓	✓	✗
Wazir F	✓	✓	✗	✗	✗	✓
Khan W	✓	✗	✓	✓	✓	✗
Shahab	✓	✓	✗	✗	✗	✓
Ismaeel M	✓	✓	✗	✗	✗	✓
Hussain N	✓	✗	✓	✓	✓	✗
Adnan	✓	✓	✗	✗	✗	✓

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Ethical Approval:

This Manuscript was approved by the IREB of Khyber Teaching Hospital, Peshawar. Vide No. 755/DME/KMC. Dated: 24 01 2024



This work is Licensed under a Creative Commons Attribution-(CC BY 4.0)