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Functional and radiological outcome of mallet finger fixation with extension block wiring

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Abstract

Extension-block pinning is a popular surgical treatment method, the fixation wires can cause iatrogenic nail bed injury, osteoarthritis. The objective of this study was to determine the result of Extension block wiring technique in mallet fractures with fracture fragment involving more than one-third of the distal phalanx articular surface. The authors are reporting 14 cases of mallet fractures treated with Extension block wiring with good functional and radiologic outcomes. Radiologic outcomes were evaluated on the basis of postoperative and follow-up x-rays and functional outcomes were evaluated using Crawford's criteria. 14 patients (11 males, 3 female) with a mean age of 28.5 years (Range, 20 to 33 y) were included. The mean time between the injury and surgery was 6 days (Range, 3 to 7 d), and the mean follow-up period was 1.4 months (range, 8 to 18 mo). Radiographic bone union was achieved in all patients within an average of 6.4 weeks (Range, 5 to 7 wk). Atth final follow-up, the distal interphalangeal joint had an average degree of flexion of 74 degrees (Range, 70 to 76 degrees) and an average extension deficit of 5.60 (Range, 0 to 8 degrees). According to Crawford's criteria, 8 patient had excellent results and 4 patients had good results, and 2 patients with fair result. No patient reported pain at the final follow-up with a visual analogue scale score mean of 0.6 (Range, 0 to 2). Satisfactory clinical and radiological outcome were obtained with the Extension block wiring technique.

Keywords: Extension block wiring, mallet finger, crawford's criteria, VAS score

Introduction

A mallet fracture involves damage to the terminal extensor mechanism caused by avulsion of extensor tendon only but a smaller subset of these injuries involves bony avulsion at the distal phalanx base. Such fractures typically result from forced flexion of the extended distal interphalangeal (DIP) joint. Although several treatment options have been reported, from nonoperative and non-surgical to surgical management, the optimal treatment continues to be a subject of debate. However, surgery is usually advocated when the dorsal fragment involves more than one-third of the articular surface or when there is volar subluxation. Main surgical options are Kirschner wire fixation, tension band wiring, micro screws, pull-out wire fixation, hook plate, small external fixator.

In 1988, Ishiguro described a closed extension block pinning technique using Kirschner wires (K-wires) placed percutaneously. The extension block K-wire technique allows closed reduction of the fragment with Trans fixation of the distal inter phalangeal joint, and allows early mobilization. The results using different extension block techniques are divers. Extension lag of up to 20 and an overall complication rate of 5%-60% have been reported. The purpose of this study was to evaluate the associated complications and functional outcome of Extension block wiring in Mallet finger fracture. The extension-block pinning technique reported by Ishiguro *et al.* is one of the best surgical treatment methods for mallet fractures with some iatrogenic nail bed injury and chondral damage. Presently described is a simple and minimally invasive technique using local anesthesia is best method of fixation followed by Removal of k wire at 6 weeks, then patient can start Range of motion at early 6 weeks.

Materials and Methods

The study was carried out in the post graduate department of Orthopedics Government medical collage Jammu and hospital from 2020 to 2022. I have obtained approval from hospital ethics committee; written informed consent will be taken from all the patients for their inclusion in this study all the patients were explained the method of treatment and follow up complications were explained in their own language.

This is a type of prospective observational study where in 14 patients were included.

This is the Prospective study of patients admitted under OPD and emergency basis

Inclusion and exclusion criteria

The Inclusion Criteria

Mallet fractures involving more than one-third of the distal phalanx articular surface

Closed injury

>5week

The Exclusion Criteria

Patients with >5 weeks after trauma

Case presentation

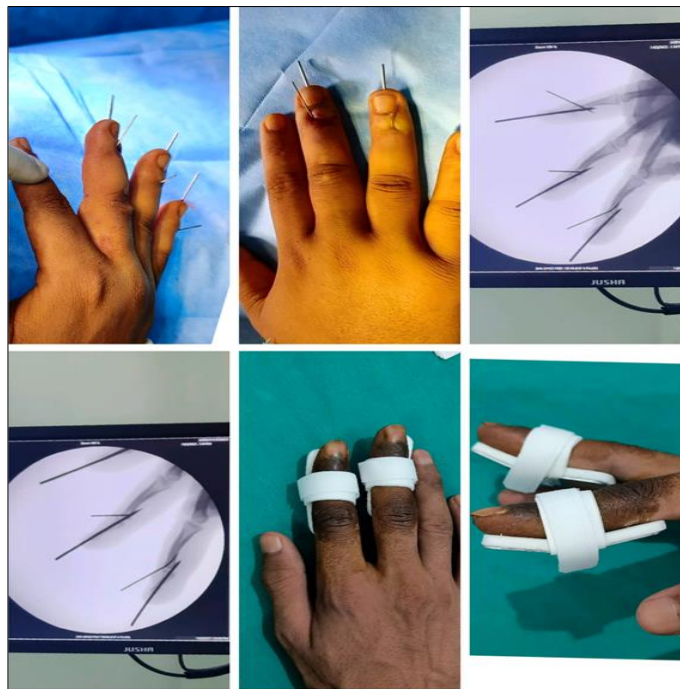


Fig 1: Showing 32 yr old Male sustained a type IIB mallet fracture of the left middle finger during a throw-ball game and presented 21 days after trauma. Intraoperative and post-operative images as well as follow up of 3 month

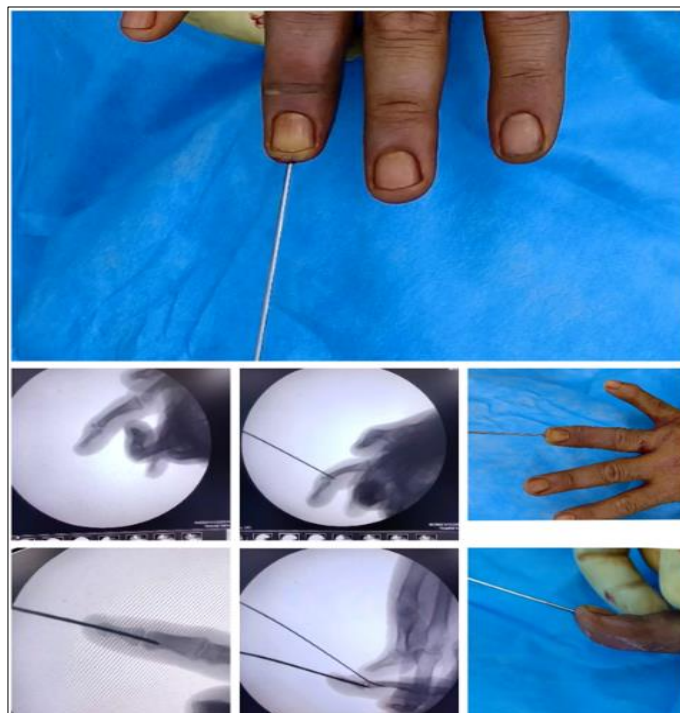


Fig 2: Showing 36 year old history of Fall with Mallet finger index finger Rt hand. Presented 5 days after injury. Intra operative and Post-operative images.

Surgical procedure

All the procedures were performed by a single surgeon, using an image intensifier under digital block anesthesia without a tourniquet. A lateral x-ray with modest flexion and suspension confirms the proper reduction. Patients were operated on while under digital anesthesia, with fluoroscopic supervision of K-wire location. Figure 1 is an illustration of the process. A tiny dressing was applied once the fracture was repaired. Patients were permitted to actively move the finger. They were given instructions on how to care for the pin tract. After 6 weeks, the pins were withdrawn, and the patients were gradually permitted to use Mallet Finger splint for 6 weeks day and night, then increase their load and flexibility over the next few weeks. Patients were encouraged to carry out their daily activities with mobilization of Proximal interphalangeal joint and metacarpophalangeal joints. K wires were removed when fracture healing was noted on radiographs, and rehabilitation

of DIP joint was initiated in the form of active/ passive mobilization.

Table 1: Showing Crawford criteria for Surgical Outcome as Excellent, Good, Fair and Poor Depending upon parameters Pain and Range of Motion.

	Full flexion
Excellent	No pain
	Loss of extension between 0° and 10°
	Full flexion
Good	No pain
	Loss of extension between 10° and 25°
	Any loss of flexion
Fair	No pain
	Loss of extension > 25°
	Any loss of flexion
Poor	Persistent pain

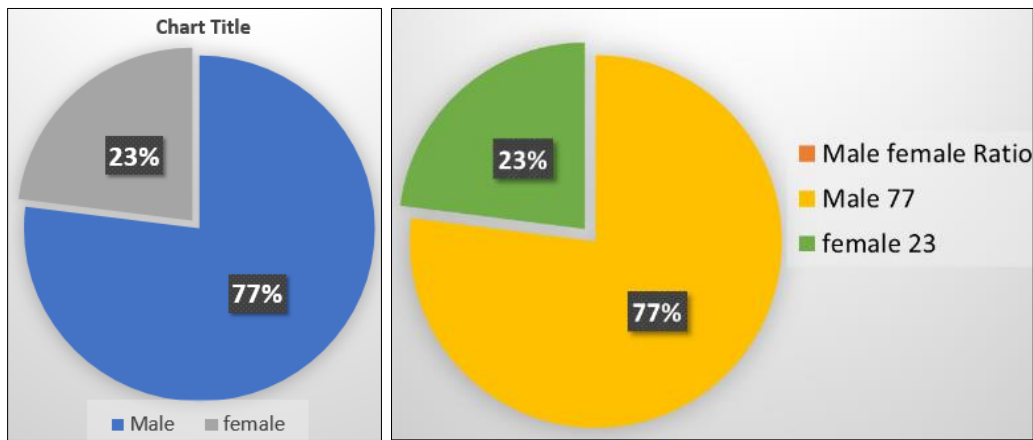


Fig 3: Male female Ratio In this study in >75% were males and 23 percent Females.

Results

Clinical and radiological records of a period of 2 years from 2020 to 2022 were evaluated, which provided 14 cases that satisfied out inclusion criteria. The demographic data revealed an average age of 28.5 years in our sample size with 11 males and 3 females. In our study majority of the cases, 4 out of the 14 were a result of non-sports related

trauma. The digits involved were 3 index fingers, 5 middle finger, 5 ring fingers and 1 little finger. Statistical analysis was carried out to assess for any correlation between the clinical outcome and laterality of digit involved, digit involved, other injuries to the hand, gender, age, aetiology, anatomical reduction, time of K wire removal and time of fracture healing.

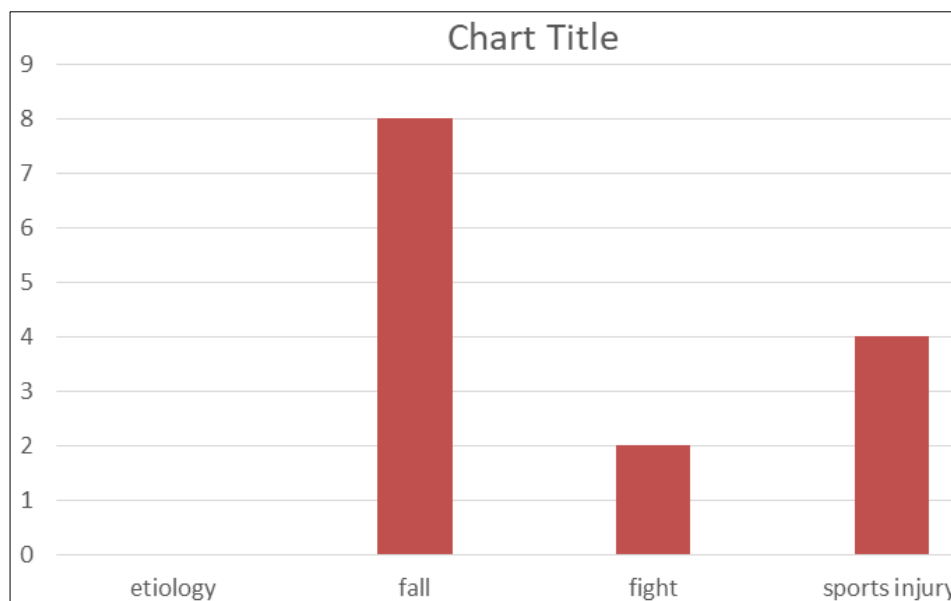


Fig 4: Mode of injury such as FFH, Sports injury, Fight

The statistical analysis showed no significant correlation between the functional outcome when compared with respect to age, sex and aetiology to the final functional outcome. The results of acute and subacute cases were found to be similar when compared against the final range of motion (Time of presentation vs flexion – p value 0.272, time of presentation vs extension lag – p value – 1.000; by Fisher's exact test). A statistically significant correlation was found between the late removal of k wires and flexion loss (p value-0.037), but extensor lag was found to be unaffected by the time of removal of K-wires. There were no cases of non-union, malunion, osteoarthritis in our study.

Discussions

The treatment options for a mallet fracture range from conservative methods like splinting to open methods. Conservative management was recommended primarily due to the high complication rates of open methods. But conservative treatment by splinting is also associated with complications such as skin maceration, slough and dorsal tendon prominences. The extension block pinning method as described by Ishiguro in 1988 provides a stable fixation without the complications of open surgical methods. Several studies have shown the advantages of extension block pinning over other methods for treatment of mallet fractures with many modifications to this technique. Studies have also shown a risk of arthritic changes in the DIP joint if multiple attempts are taken for fixation of the transarticular pin. Another technical point is to pass the extension blocking wire and axial wire in two different planes in the AP plane.

Acute or subacute presentations that is cases that present within 4 weeks from date of injury do not have a significant difference in post-operative functional outcome when treated by this method. The average age was 28.5 in our study compared to Kumar *et al.* where 33.4 was the average age in 19 patients case series 2013. There were 2 cases in which flexion loss was noted out of which one patient had a superficial pin tract infection and the other 2 presented late for pin removal. Hofmeister *et al.* had reported an average flexion of 78, whereas the average flexion in our study was 75.60 on follow up. Jillian S. Grube *et al.* showed that some cases of displaced bony mallets have decreased mechanical advantage and have marked residual droop and extensor lag compared to our Cases in our series we observed loss of flexion in 3 cases that presented beyond 6 weeks for K wire removal, hence we would recommend not retaining the K-wires beyond 6 weeks Skin maceration was noted in 4 cases which were managed with early removal of the extensor blocking pin at 4 weeks. Pegoli *et al.* reported nail deformities in 2 out of 65 cases and Lee *et al* reported transient nail riding in 3 out of 32 cases in their series. Joideep Phadnis *et al.* in 2010 [12] showed Excellent to Good Functional outcome in 80% cases out of 20 patients compared to our study we have 85 percent Excellent to Good Outcome in 14 patients. In our study there was no complications related to Nonunion, Osteoarthritis, Malunion compared to Joideep Phadnis *et al.* 2010 [12]. In our study Average Radiological union was seen in 6.9 weeks in Follow up period of 12 months to 26months.compared to Joideep Phadnis *et al.* 2010 [12] it was 7.2 weeks.

Master chart

S.no	Age/sex	Finger	Etiology	Classification type	Outcome	Radiological union	Follow up (Years)
1	25/M	Rt2 nd	Sports injury	2B	excellent	5.6	1.6 year
2	26/M	Rt3 rd	Fall	2a	excellent	4.6	1.4
3	24/F	Left 4 th	Fall	2b	Good	6.6	1.6
4	28/M	RtI F	Fall	2b	Good	5.2	1.6
5	29/M	RT4 th	Sports injury	3a	excellent	7.2	1.3
6	30/F	Rt3 rd	Fight	3a	Good	7.1	1.6
7	31/M	Left2 nd	Fall	2b	Good	5.4	1.5
8	32/M	Rt3 rd	Fall	2b	excellent	6.5	2.1
9	23/M	Rt2 nd	injury	3c	Fair	7.1	1.6
10	34/M	LeftIF	Sports injury	2c	excellent	8.2	1.7
11	26/F	Rt2 nd	Fall	2b	excellent	6.4	1.8
12	36/M	RtIF	fall	2b	Good	6.5	1.8
13	27/M	left2 nd	Fall	2b	excellent	8.2	2.4
14	38/M	left3 rd	Fight	2b	fair	6.5	2.2

Conclusions

Extension block pinning is a simple and effective treatment modality for mallet fractures when performed correctly. It provides excellent functional outcome in acute and subacute presentations. It also gives the advantage of treating the fracture as a day care procedure with minimal instruments and no post-operative scars.

Conflict of Interest

Not available

Financial Support

Not available

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