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Original Research Article

Comparison of Conservative and Surgical Approaches to Mallet Fractures Treatment

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Abstract

Objectives: The objective of the study is to compare the radiological and functional outcomes of patients who have sustained mallet finger fractures.

Methods: The study involved patients admitted to Indira Gandhi Institute of Medical Sciences Patna, India within a week of their injury for two years, provided they were aged 18 to 55, fit for anaesthesia, and without concurrent fractures in the same finger. Exclusions comprised individuals with open injuries, head injuries, or severe medical conditions.

Results: The majority of patients achieved positive outcomes in terms of both function and radiological union. However, six patients experienced extensor lag due to premature splint removal or inconsistent splint usage, and no other significant complications were observed. Furthermore, all patients demonstrated radiographic union within 10 to 12 weeks, with minimal articular misalignment (<1mm) in 34 individuals and slightly greater misalignment (1-2mm) in 2 individuals, and notably, no signs of joint degeneration were observed during this timeframe.

Conclusion: Although the mallet finger fixation method is technically challenging, it shows favorable outcomes in the short term. Surgical precision, particularly in the one-shot drill and screw insertion, demands a high level of accuracy and patience.

Keywords: Percutaneous Treatment, Mallet Finger, Fracture Fixation.

Introduction

Fracture of the mallet finger describes a deformity that can lead to either a bony avulsion fracture or an avulsion affecting the terminal region of extensor tendon [1, 2]. This type of injury typically occurs when there's forceful bending of the “distal interphalangeal joint” (DIP) of a phalanx that is fully extended, often happening during sports activities [3, 4]. Mallet finger injuries are quite prevalent, accounting for 9.3% of lesions associated with tendon and ligaments present in the body and 5.6% of tendon-related injuries of the wrist and hand [5].

The occurrence of mallet finger fracture is not influenced by gender, although age remains to be a major predisposing factor, with children belonging to the high-risk group [6]. When the displaced fracture affects less than 50% of the joint surface without eliciting any symptoms of joint misalignment, patients typically choose a non-surgical treatment. This involves extending the interphalangeal joint for a period of six to eight weeks [7-9].

Contrastingly, in patients with more than 40% flexion deformity of unstable lesions or fractures with volar subluxation, surgical procedure is adopted [10-13]. The major surgical procedures for this fracture include closed reduction followed by open reduction followed by internal fixation (ORIF), percutaneous fixation, besides external fixation. Among these, closed reduction with K-wire blocking for fixation is the most widely employed protocol in clinical practice these days. This percutaneous method is minimally invasive and largely helps to achieve good efficacy, when compared to the ORIF method [14, 15].

The operative treatment for this fracture utilizes pull-out wires, interosseous wires, micro screws, percutaneous pins, screw fixation and tension band wiring for enhanced reduction accuracy and fixation stability. Despite the advancements in these surgical procedures, this treatment often suffers from complications such as infection, wound breakdown, soft tissue scar formation, necrosis of skin, nail deformity, and increased risk of fracture fragmentation among others [16, 17]. Thus, this study suggests an improved reduction procedure for the treatment of fractures of the mallet finger via percutaneous reduction followed by the utilization of small screws for internal fixations in thirty-six patients. This investigation aims to evaluate and contrast the radiological and functional findings of patients who have suffered fractures to their mallet finger.

Methods

The study included patients who had been admitted to Indira Gandhi Institute of Medical Sciences Patna, India within a week of sustaining their fracture during a two-year study period, and who provided written consent for participation. These patients were also required to be suitable for anaesthesia and not have any concurrent fractures in the same finger. The study encompassed individuals aged between 18 and 55 years and excluded cases with open injuries or lacerations at the fracture site, as well as those with head injuries or severe underlying medical conditions.

In total, 36 cases were part of the study, and all of them underwent surgical procedures under local anaesthesia through a ring block. Data collection involved recording information on the patients' gender, the manner in which the injury occurred, the time passed since the deformity, the level of injury, the dimensions of the fractured area, the affected side, the number of fingers involved, and the specific finger affected. Prior to the surgery, standard X-rays and routine blood tests were conducted, and pre-anaesthetic assessments were carried out.

Operative Procedure: Following stringent aseptic measures, the targeted area was prepared with draping. A local anaesthetic in the form of a ring block was administered to the affected finger. Once the local anaesthesia had taken full effect, a closed reduction was performed and verified using an x-ray intensifier.

After confirming the incision site using the intensifier, an approximately 2-3 mm incision was made with a knife of size number 11. With continuous guidance from the image intensifier, the drilling procedure was carried out, and a 1.5 mm screw was placed to maintain the reduced fracture.

Following the placement of this screw, the reduced fracture was reconfirmed using the x-ray intensifier, and any improvements in the injury were documented. Wound closure was achieved with a single stitch, and handiplast was used to dress the area. To avoid any hyperextension, the finger was immobilized using a frog finger splint.

Management after surgical procedure: Immediately after the operation, an X-ray was taken, and the limb was elevated. Normal hand movement was permitted while wearing the splint. The splint was taken off three to four weeks later, at which point the afflicted joints, especially the distal interphalangeal joint (DIPJ) started to be mobilised. After the 6-week mark, a follow-up X-ray was conducted to monitor for any potential complications. The final follow-up took place after 6 months, including another X-ray, clinical evaluation of finger function, assessing the mobility range, and hand strength.

Results

For this study, 36 patients with mallet ring fractures were included (Table 1). There were 20 men and 16 women, with 12 involving the left hand and 24 involving the right hand. It further included 16 ring fingers, 18 middle fingers, and 7 index fingers. The median time since injury is 39 hrs (6 hrs – 5 days).

Post-operative complications: The complete investigation results are summarized in Table 2. None of the screws showed any clinical or radiological prominence, and all wounds healed satisfactorily without any deformities in the nail. After this procedure, there were no patients who required a second procedure related to their injury or the initial operation. However, six patients experienced some degree of deformity due to early splint removal or irregular splint usage, as observed during clinical assessments.

Radiographic outcomes after surgery: In terms of radiographic findings, all patients showed evidence of radiographic union within a span of ten to twelve weeks. Articular misalignment was identified minimal, measuring <1mm in 34 treated individuals, and slightly greater, falling between 1 and 2mm, in two patients. Importantly, no one displayed indications of joint degeneration during this period of observation.

Table 1: Characteristics and per-op findings of 36 patients

S. No.	Sex	Age (yrs)	Cause of injury	Post-injury period	Side	Degree of deformity	Size of the fragment	Finger name
1.	M	20	Cricket ball	12 Hrs.	Right	300	1/3 to 2/3	Middle
2.	F	19	Household	2 days	Left	300	<1/3	Middle
3.	F	22	RTA	3 days	Right	300	1/3 to 2/3	Ring
4.	M	31	Household	5 days	Right	300	<1/3	Ring
5.	F	26	RTA	1 day	Right	200	<1/3	Middle
6.	F	51	Household	1 day	Left	300	<1/3	Ring
7.	M	47	Cricket ball	6 Hrs.	Right	200	1/3 to 2/3	Middle
8.	F	22	Household	12 Hrs.	Left	200	<1/3	Middle
9.	M	47	Cricket ball	1 day	Left	300	1/3 to 2/3	Ring
10.	F	33	RTA	5 days	Right	300	<1/3	Ring
11.	M	55	RTA	3 days	Right	300	<1/3	Index and Middle
12.	M	31	Cricket ball	1 day	Right	300	1/3 to 2/3	Index
13.	M	45	Household	4 days	Right	200	1/3 to 2/3	Middle
14.	F	19	Cricket ball	1 day	Right	300	<1/3	Ring
15.	M	45	RTA	2 days	Right	200	1/3 to 2/3	Ring and Index
16.	F	28	Cricket ball	12 Hrs.	Left	400	<1/3	Middle
17.	F	49	RTA	12 Hrs.	Right	300	<1/3	Middle
18.	F	32	Cricket ball	6 Hrs.	Left	300	<1/3	Ring
19.	F	19	Household	3days	Right	200	1/3 to 2/3	Middle
20.	M	37	RTA	2 days	Right	300	<1/3	Ring and Index
21.	M	45	RTA	4days	Left	300	1/3 to 2/3	Ring
22.	F	25	Household	1 day	Right	300	<1/3	Middle
23.	F	31	RTA	2days	Right	300	<1/3	Index
24.	M	29	Cricket ball	4days	Right	200	<1/3	Index and Middle
25.	M	41	Cricket ball	1 day	Left	300	1/3 to 2/3	Ring
26.	M	48	RTA	12 hrs.	Right	200	1/3 to 2/3	Ring
27.	M	19	RTA	6 hrs.	Left	200	<1/3	Middle
28.	F	18	Household	1 day	Left	300	1/3 to 2/3	Middle
29.	M	24	RTA	1 day	Right	300	<1/3	Ring
30.	M	35	Household	1 days	Right	300	1/3 to 2/3	Middle
31.	M	22	RTA	2 days	Right	300	1/3 to 2/3	Ring
32.	M	50	Cricket ball	1 day	Right	200	<1/3	Ring
33.	F	42	Household	6 hrs.	Right	300	<1/3	Middle
34.	M	21	Cricket ball	6 hrs.	Left	200	1/3 to 2/3	Middle
35.	F	21	Household	2 days	Left	300	<1/3	Index
36.	M	36	RTA	1 day	Right	200	1/3 to 2/3	Ring

Table 2: Post-op results of 36 patients with mallet finger fracture.

S. No.	Extent of Deformity	Grip strength	Malunion
1.	00	Comparable	No
2.	100	Comparable	No
3.	100	Comparable	No
4.	00 in Ring and 50 in Index	Comparable	No
5.	00	Comparable	No
6.	150	Reduced	Yes
7.	100	Comparable	No
8.	100 in both fingers	Reduced	No
9.	00	Comparable	No
10.	00	Comparable	No
11.	100	Comparable	No
12.	100	Comparable	No
13.	150	Reduced	Yes
14.	100	Comparable	No
15.	00	Comparable	No
16.	00	Comparable	No
17.	00	Comparable	No
18.	150	Reduced	Yes
19.	00	Comparable	No
20.	00	Comparable	Yes
21.	100	Comparable	No
22.	100	Reduced	No
23.	150	Reduced	Yes
24.	100	Comparable	No
25.	00	Comparable	No
26.	00	Comparable	No
27.	100	Comparable	No
28.	100	Comparable	No
29.	00 in Ring and 50 in Index	Comparable	No
30.	00	Comparable	No
31.	150	Reduced	Yes
32.	100	Comparable	No
33.	100 in both fingers	Reduced	Yes
34.	00	Comparable	No
35.	00	Comparable	No
36.	150	Reduced	Yes

Discussion

The recommendation of surgical treatment for mallet finger fractures is not yet full-fledged by all surgeons as some argue that the accompanying risks may not be justified, especially when non-operative methods yield good results [18-20]. However, others believe that operative intervention is necessary to address articular incongruity, which could lead to future issues like symptomatic arthritis, extensor lag, or deformity [21, 22]. It is important to note that mallet fractures should be distinguished from mallet finger deformities, as the former typically involve fractures of the terminal finger bone articulation especially younger people.

While a few authors have reported satisfactory outcomes with conservative treatment using splints, even when the bone fracture covered >1/3 of the joint surface or involved subluxated joint, they noted cosmetic concerns and found that some patients developed degenerative changes on radiographs within a follow-up period of just around 3 years [23-25]. These changes included narrowing of joint space, subchondral sclerosis and osteophyte formation. Degenerative changes and reduced motility range were more frequent in cases with significant displacement of fracture or preoperative subluxation. Therefore, some recommend accurate restoration of the joint surface, particularly when the fractures involve around 1/3 of the joint surface [26-28].

Several surgical techniques have been documented, spanning from percutaneous fixation to ORIF via small screws. Potential complications of surgically invasive treatment encompass wound opening, scarring in the pulp area, pain, deformity of the nail, and mal-union or non-union, as well as infections like osteomyelitis or pyoarthritis [29, 30]. Kirschner

wire fixation, in particular, is more prone to operative complications, often attributed to technical errors [31, 32].

This notable technique offers the benefit of not necessitating pinning of the DIJ, thereby reducing the risk of DIPJ injury. Even in cases where these bone fractures affect a substantial area of the joint surface, they are small and can be treated using small screws with small dimensions.

In the present study, 1.5 mm screws with cross-serrations on the heads were used for better grip during application, allowing us to insert the screws in a single attempt. These screws only required a tiny drill bit of 1 mm, that helped minimize the risk of fragmentation of the fracture.

Conclusion

While this percutaneous surgical procedure followed by internal fixation with screws has high technical complexity, this mallet finger fixation method demonstrates promising short-term results. This technique requires a high degree of precision during surgery, particularly in achieving a single-shot insertion of the drill and screw, demanding patience.

Limitations

The study had a limited number of patients, with only one centre participating, and a short follow-up period. To draw more robust conclusions, further research with a larger patient cohort and a longer follow-up period is necessary.

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