

Treatment of Mallet Finger; Conservative or Operative

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ABSTRACT:

BACKGROUND:

Mallet finger injuries, still represent a controversy as the best way of treatment, when to treat conservatively and when to go for surgical management.

OBJECTIVE:

This prospective study was undertaken to evaluate functional outcome of conservative versus surgical treatment of acute and chronic mallet finger injuries.

PATIENTS AND METHODS:

A prospective study was conducted between November 2011 and December 2013. Forty six patients with mallet finger deformity were treated, 21 by non-operative technique and 20 were treated surgically, the time between injury and commencement of treatment ranges from 3 days to 3 years mean (17 weeks). Follow up ranges from 12 months to 18 months mean (15 months).

RESULTS:

Successful outcome was found in 57.15% of mallet fingers treated conservatively by splintage. Patient satisfaction with conservative treatment was 66.7%. Successful outcome of surgical treatment was 65% while patient satisfaction was found in 75% of cases treated surgically. Patients started conservative treatment within 4 weeks of injury had better outcome (success rate 81.8%) than those started treatment after 4 weeks (success rate 30%). Mallet finger injuries treated after 4 weeks from injury, show a better functional outcome in surgically treated group (success rate 61.5%), than injuries treated by splint (success rate 30%).

CONCLUSION:

Conservative treatment is safe, effective, well tolerated, method of treatment for early closed and uncomplicated cases, with better outcome in patient started treatment within 4 weeks of injury than those started treatment after 4 weeks. Surgical treatment is required for open, chronic cases and those complicated by swan neck deformity. Mallet injuries presented after 4 weeks show a better outcome if surgical treatment is undertaken.

KEYWORDS: mallet finger, tenodesis, central slip tenotomy.

INTRODUCTION:

Mallet finger, is commonly encountered injury. It is caused by traumatic rupture of extensor tendon at its insertion in the base of the distal phalanx. It is mostly a pure tendinous injury but sometimes it is associated with fracture of the base of the distal phalanx which varies from a small chip fracture to fracture that involves one third or more of the articular surface. Also it occurs with open injury to the digit which is sometimes associated with skin & soft tissue loss. Cases presented early are often treated conservatively by applying removable splint, which requires the patient cooperation and compliance regarding the method and the period of application⁽¹⁻⁸⁾. This injury often presented late

because it is underestimated by the patient and his family and regarded as a minor injury and doesn't receive serious attention. In those cases, a controversy exists regarding management; operative or conservative⁽⁹⁻¹²⁾. This study was done to compare the effectiveness, safety and functional outcome of conservative versus operative methods in the treatment of mallet finger injuries.

PATIENTS AND METHODS:

This was a prospective study conducted at Orthopedic Department of Basrah General University Hospital between November 2011 and December 2013.

Forty six patients with mallet finger deformity were treated, 21 by non-operative method in form of volar aluminum splint, 20 were treated surgically, the time between injury and commencement of treatment ranges from 3 days to 3 years (mean 17 weeks). Five mallet injuries were excluded from the study because of loss of

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follow up. Mallet fractures involving more than one third of articular surface were also excluded. Conservative group (21 patients) were treated by volar aluminum splint with the distal interphalangeal joint (DIPJ) held in hyperextension and the proximal interphalangeal joint (PIPJ) was free to mobilize. All mallet injuries in this group were closed, time between injury and commencement of treatment was 3 days to 2 months, extension lag ranges from 35 to 60 degrees, average (45.5 degrees) The splint worn full time for 8 weeks and at night for another 2 weeks. The patients were educated about proper care of the finger while the splint is worn throughout the period of treatment. Active PIPJ exercises advised from the outset while DIPJ exercises, active and passive were started after removal of splint. Follow up ranges from 12 to 18 months, mean (15 months).

The operative group (20 patients) were treated by different surgical techniques. Three cases by direct repair, 13 by tenodesis and 4 by fowler central slip tenotomy depending on chronicity of injury and presence or absence of swan neck deformity. Cases included in this group were three open injuries, 4 cases complicated by swan neck deformity, and 13 cases presented 4 weeks or more since injury. Extension lag, ranged from 40 to 60 degrees, average (47.5 degrees) the time between injury and commencement of treatment was from 4 weeks and 3 years.

Surgery performed under general anesthesia with application of digital tourniquet, the average operative time lasts 30 minutes range (20-40 minutes), the patient discharged home at the

same or the next day of surgery, exercises started immediately after surgery for PIPJ and after removal of k wire for DIPJ. In direct repair (3 patients) the tendon approached through dorsal H shaped incision over the DIPJ, the skin and subcutaneous tissue divided and retracted and the proximal and distal ends of tendon identified, freed from adhesions, trimmed and sutured using running suture technique with 4:0 proline, k wire inserted axial through DIPJ with the joint in neutral position to maintain the repair, and the PIPJ is left free to mobilize.

In tenodesis (13 patients) 3-4-mm elliptical wedge of skin, subcutaneous tissue, tendon, and joint capsule was resected. The full-thickness defect is repaired with 3:0 proline sutures in an interrupted way. Before securing the sutures, the distal interphalangeal joint is immobilized in extension with a Kirschner wire, either axial or oblique. In both procedures the k wire was removed after 10 weeks.

In fowler tenotomy (carried on 4 patients with swan neck deformity) mid-lateral incision is used, transverse retinacular ligament is incised. The extensor mechanism over the proximal and middle phalanges is freed from any adhesions, and the central slip is identified and transected with scalpel at its insertion into the middle phalanx base, allowing the extensor mechanism to slide proximally. Postoperatively the DIPJ splinted in extension for 4 weeks. Follow up ranges from 12-18 months, mean (15 months). The outcome of treatment were assessed as success or failure according to the criteria shown in table (1).

Table 1: Criteria used to assess the outcome of treatment of mallet finger injuries.

Measure	Success	Failure
Extensor lag	Less than 20 degree	More than 20 degree
Flexion arc	More than 50 degree	Less than 50 degree
Pain or stiffness	Non or minimal	Noticeable to the patient
Functional impairment	Non or minimal	Noticeable to the patient
Overall patient evaluation	Satisfied at least 90% in patient judgment	Less than 90%

The pain was assessed by visual analogue scale, extensor deficit and arc of movements of DIPJ and PIPJ were measured with goniometer, the patient satisfaction was also recorded, and the results of both group of patient were compared. Successful outcome is required to satisfy all of the above outcome criteria, and regarded as failure if any single criterion is not fulfilled.

RESULTS:

Nineteen males and 22 females, ratio (0.8:1), age range from 24 to 72 years, mean (37.47) years. Dominant hand affected in 26 patients (63.4%), non-dominant hand affected in 15 patients (36.6%) Index finger affected in 9 patients (21.95%), middle finger in 12 patients (29.26%), ring finger in 10 patients (24.39%), little finger in 10 patients (24.39%), figure (1).

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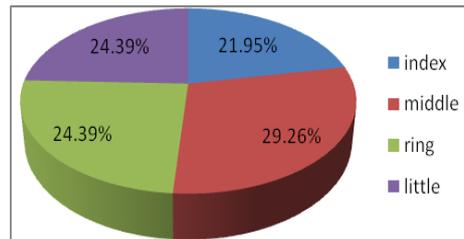


Figure 1: Finger involved by mallet injuries.

The cause of mallet injury was major trauma in 33 patients (80.49%), and minor trauma in 8 patients (19.51%). The mallet injuries were domestic in origin in 47% and work related in 41% and sport related in 12%, figure (2).

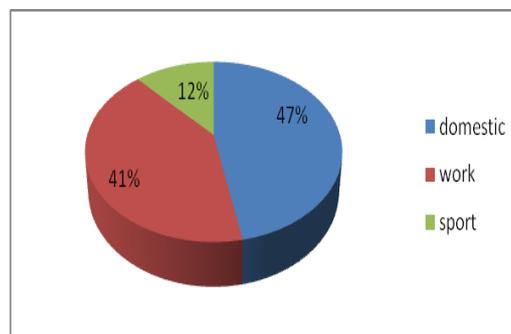


Figure 2: Causes of mallet finger injury.

Thirty one patients (75.60%) were tendinous injuries, 10(24.40%) were with mallet fracture. All male patients were less than 35 years (100%), and 27.27% of female patients were under 35 years and 72.72% sustained major trauma, table (2).

Table 2: Correlation of age and sex with the degree of trauma and the type of mallet injury.

	Age	male		female		Type of Injury		Hand Dominancy	
		severity		severity		Tendinous	Fracture	Dominant	Non-Dominant
		minor	major	minor	major				
Conservative	<35 years	0	10	0	0	10	0	7	3
	>35 years	0	0	2	9	9	2	3	8
Operative	<35 years	2	7	1	5	9	6	12	3
	>35 years	0	0	3	2	3	2	4	1

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Average degree of correction obtained for the conservative group was 29 degrees, range (10 to 45) degrees; the average extensor lag after correction was 17 degrees. Flexion arc more than 50 degrees in 14 patients (66.7%), and less than 50 degrees in 7 (33.3%). 16 patients (76.20%) were pain free at time of splint removal while 5 patients (23.80%) were with mild pain. 14 patients (66.7%), were satisfied with the outcome of treatment and 7(33.3%). were unsatisfied. Average correction of deformity obtained for the

operative group was full with no extensor lag in all 20 patients (100%),with flexion arc is greater than 50 degrees in 15 patients(75%).Two patients (10%) were with mild pain while the other 18 patients (90%) were pain free at the end of treatment. Fifteen patients (75%) were fully satisfied and 5 patients (25%) were unsatisfied with the result of treatment.

Overall success rate for the conservative group was 57.15% ,and the failure rate was 42.85, while overall success rate for the operative group was65%and the failure rate was 35%. Table(3).

Table 3: Outcome Criteria and overall Success and Failure rate in conservative versus operative group.

Variable	Conservative	Operative
Digit number	21	20
Mean age	44.5 years	29.5 years
Sex	10 males-11 females	9 males-11 females
Pain at rest Non significant	16	18
	5	2
Extensor lag	9	20
	0-10 degrees	
	10-20 degrees	0
20-30 degrees	7	
	5	0
Flexion arc	7	5
	Less than 50 degrees	
More than 50 degrees	14	15
Patient satisfaction	14	15
	Satisfied	
Not satisfied	7	5
success	12(57.15%)	13(65%)
failure	9(42.85%)	7(35%)

Patients started conservative treatment within 4 weeks of injury had better outcome (success rate 81.8%) than those started treatment after 4 weeks (success rate 30%) table(4).

Table 4: Functional outcome in relation to time of commencement of splint treatment of mallet finger.

Splint applied	No. of patients	Mean age	Mean deformity	Ext. lag	Arc of flexion	of pain	satisfaction	Success rate
Within 4 weeks	11	41 years	45 degrees	11 degrees	More than 50 (100%)	2 patients (18.18)	All satisfied (100%)	81.8%
After 4weeks	10	49 years	48.75	<20degrees In5 patients(50%)	More than 50 in 3 patients (30%)	5 patients (50%)	3 patients satisfied (30%)	30%

Mallet finger injuries treated after 4 weeks from injury, show a better functional outcome in surgically treated group (success rate 61.5%),

than injuries treated by splint (success rate 30%) table (5).

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Table 5 :Functional outcome in mallet finger injuries treated after 4 weeks by surgical versus conservative means.

Group	No. of patients	Mean age	Mean deformity	Ext. lag	Arc of flexion	Pain	Satisfaction	Success rate
surgical	13	30.14 years	45.7 degrees	0 degree	More than 50 in 8 (61.5%)	2 patient (15.38%)	10patients satisfied (76.93%)	61.5%
conservative	10	49 years	48.75 degrees	<20 degree in5 (50%)	More than 50 in 3patients (30%)	5 patients (50%)	3patients satisfied (30%)	30%

Complications of treatment

Complications related to splint treatment are usually skin complications, they were transient and responded well to topical applications of soothing agents and modification of splint.

Surgical complications were more serious and difficult to treat like deep infection which needed systemic antibiotics and nail deformity which causes a cosmetic problem, table(6).

Table 6: complications reported with both types of mallet finger treatment.

Complication	Conservative	Operative
itching	9 of 21(45%)	0
Skin maceration	7 of 21(33.3%)	0
infection	2 of 21(9.5%)	5 of 20(25%)
Nail deformity	0	2 of 20(10%)

DISCUSSION:

In this study we found the average age of male patients 30 years with a range (25 - 34 years) while the average age of female patient was 44 years with a range (25- 72 years) which mean that male patient are younger by 14 years than females. This result is close to a study conducted by Geyman et al ⁽⁹⁾.

The male –female ratio was 0.8 to 1 which is unlike the study done by ,Niechajev¹³ which states that males are affected as twice as females. This may be due to most of our cases were domestic in origin 47%. Work related cases were found in 41% and sport related in only 12%,this may be due to the fact that only a

minority of our community practice sports.This is unlike the study done by Foucher et al⁽¹⁴⁾ in which 34% of injuries were domestic in origin, 33% were caused by sports and 21% were work-related.

The dominant hand was involved in 64.7% of patients , while the non-dominant hand was involved in 35.3%, a result comparable to that obtained by Wehbe and Schneider⁽¹⁵⁾.

The index finger was involved in 23.52%, the middle finger in 29.41%, the ring finger in 23.52% and little finger in 23.52%, this is unlike other studies in which the index finger is the least to be involved ^(1,2,10,13) table(7).

Table 7 : Incidence of mallet finger in different studies.

Author	Year	Index	Middle	Ring	Little
Auchincloss	1982	7%	29%	29%	34%
Niechajev	1985	5%	33%	31%	26%
Groth et al	1994	7%	23%	30%	40%
Okafor et al	1997	6%	20%	42%	32%

There are many scales for assessment of the functional outcome of treatment , some were regarded as stringent because they used extension lag of less than 5 degree as success,6-15 degree for improved and more than 16

degree as failure¹⁶, while other studies found that less than 20 degree extension lag and no stiffness doesn't represent functional disability ^(2,3,17) , so we used the latter outcome criteria to evaluate our functional results, table(1).

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In patients treated with splint overall success rate was reported in 57.15% of the patients while failure reported in 42.85% which is similar to the results obtained by Maitra and Dorani⁽⁴⁾, and to a

study conducted by Warren et al⁽⁵⁾, but unlike the results reported by Okafor et al, Groth, Shankar and Goring⁽¹⁻³⁾, table (8).

Table 8: Functional outcome of conservative treatment mallet finger injury in different studies.

Author	Digit no.	Mean age	Success	Failure
Okafor et al 1997	31	54.5 years	77%	23%
Groth 1994	44	41.7	64%	36%
Maitra and Dorani 1993	60	44.5	55%	45%
Shankar and Goring 1992	100	49.8	85%	15%
Warren et al 1988	107	46.1	52%	48%

There are different types of splints used to treat acute mallet injuries including stack, dorsal aluminium, volar aluminium, and custom thermoplastic splint, non had shown superiority^(6,8). We used volar aluminium splint which is cheap and easily available. The patient is instructed to apply the splint continuously with every effort to keep DIP joint extended throughout the period of eight weeks, with additional two weeks of night application although some studies found that night splinting does not improve outcome of mallet finger⁽¹⁸⁾.

Surgical treatment is usually reserved for chronic complicated cases. Many surgical options are available like tenodesis, fowler central slip tenotomy⁽¹⁹⁻²⁴⁾, in addition to other new surgical techniques^(12, 25). We used tenodesis and fowler central slip tenotomy according to chronicity and presence of swan neck deformity. In patients treated operatively the success rate was 62.5% and the failure rate was 37.5% which is comparable to result obtained by Lind & Hansen, and Grundberg & Reagan^(19,26), but different from the results reported by other studies⁽²⁰⁻²²⁾, table (9).

Table 9: Results of surgical treatment of mallet finger in different studies.

Failure	Success	Mean age	Digit no.	Author
3%	97%	52 years	35	Houpt et al 1993
40%	60%	44.2 years	40	Lind and Hansen 1989
40%	60%	37 years	20	Grundberg and Reagan 1987
4%	96%	NA	27	Kon and Bloem 1982
50%	50%	NA	26	Iselin et al 1977

We found the success rate of operative group (62.5%) slightly higher than splint group (57.15%), this is almost comparable to other studies comparing conservative & operative results in which both methods of treatment achieved a similar results⁹⁻¹¹. Complications associated with splint were mostly skin related in the form of itching and skin maceration which are transient while surgical treatment is complicated by infection and nail deformity which are more serious and difficult to treat, this is comparable to results of Stern & Kastrup⁽²⁷⁾, but skin complication in our study were higher (78%) than Stern & Kastrup (45%), this may attributed to low patient education about splint care in our sample. The success rate of

conservative treatment were found better in early treated cases (81.8%), than late cases treated after 4 weeks (30%), this is similar to the results of Auchincloss⁽¹⁰⁾, but unlike the results found by other studies^(23,28) which found no difference between the two group of patients. Mallet injuries presented after 4 weeks show a better outcome in surgically treated cases (success rate 61.5%) than cases treated by splint (success rate 30 %). we haven't found similar results in the literature review, this may be attributed to the type of our patient with poor compliance to splint treatment which require continuous application without any loss of position of the distal phalanx during cleaning or inappropriate splint removal.

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Volar aluminum splint, used for conservative management Skin complications associated with splint of mallet finger application.



A patient with mallet finger treated by tenodesis with .oblique k wire fixation .Full correction obtained.



k-wire fixation of the distal interphalangeal joint in axial direction, proximal interphalangeal joint not included.



Direct tendon repair through H-shaped incision

Wound infection complicating surgical treatment With axial K-wire fixation of DIP joint

CONCLUSION:

Conservative treatment is safe, effective well tolerated, method of treatment for early closed and uncomplicated cases, with better outcome in patient started treatment within 4 weeks of injury than those started treatment after 4 weeks. Surgical treatment is required for open, chronic cases and those complicated by swan neck deformity. Mallet injuries presented after 4 weeks show a better outcome if surgical treatment is undertaken.

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