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Research Article

THE RESULTS OF MIDTERM FUNCTIONAL TREATMENT OF PATIENTS WHORECEIVED SURGICAL TREATMENT FOR MALLET FINGER INJURY

Reşit SEVİMLİ*., Mustafa KARAKAPLAN., Hüseyin KAVAK., Muhammed KÖROĞLU and Kadir ERTEM

Inonu Universty TOTM Medical Center

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A B S T R A C T

Backgraound: The present study aimed to report the functional treatment outcomes in patients who underwent surgery for mallet finger injury, a significant cause of workforce loss.

Methods: Among the patients who referred to our clinics with mallet finger injury between 2009 and 2017, medical files of 22 patients who received surgical treatment were retrospectively reviewed. Demographical characteristics of the patients, dominant hand relation, presence of osseous or tendinous involvement, the hand and fingers involved, comorbidities, type of injury, time until surgical treatment and any treatments received during this time, recurrences and potential complications were recorded, and Crawford criteria during post-operational follow-ups and post-operational patient satisfaction scores were evaluated over a mean follow-up period of 34.09 months (9-84 months).

Results: When the patients were questioned by using Crawford functional scoring at the end of the follow-up period, 68.2% reported very good-good and 31.8% reported moderate-poor functional status. Post-operational satisfaction was reported as very good-good by 86.3% and moderate-poor by 13.7% of the patients. None of the patients experienced recurrence. In total, 3 patients developed minor complications.

Conclusion: In conclusion, the post-operational satisfaction rate of 86.3% in patients referring with mallet finger injury indicated that the outcomes of surgical treatment were satisfactory when the surgeries were performed by experienced hand surgeons.

INTRODUCTION

According to epidemiological studies, the incidence of mallet finger injury is 9.8/ 100.000.(1) Mallet finger injury may occur as a result of an avulsion injury in the bones or in the extensor tendinous structure. Following an avulsion injury, the condition is referred as osseous mallet finger if there is osseous involvement, and as tendinous mallet finger when there is no osseous component. Mallet finger injury is also referred as baseball finger or dropped finger. (2)

The most common mechanism leading to development of mallet finger injury involves a sudden flexion trauma which occurs perpendicular to the longitudinal axis of the finger. As a result, terminal tendon tears occur and a fracture can also be seen at the distal phalange base with the addition of a middle phalange crush to the picture.(3)

Mallet finger injuries are most commonly seen in young and middle-aged men.(1,4)

Corresponding author:* **Reşit SEVİMLİ
Inonu Universty TOTM Medical Center

Mean age of men and women presenting with mallet finger injury is 34 and 41, respectively. Of all injuries, 70% involve the dominant hand. (1)

Currently, Wehbe-Schneider classification is the most commonly used classification system. This classification describes three types of osseous mallet finger injuries, and each type is further classified into three subtypes (Table 1). Type 1 injuries refer to those without subluxation, Type 2 injuries are those accompanied by DIP joint subluxation and Type 3 injuries involve epiphyseal damage. In terms of subtypes, Type A refers to less than 1/3 joint involvement, Type B shows 2/3 joint involvement and Type C are the injuries with more than 2/3 joint involvement.(4)

Table 1 Wehbe and Schneider classification

Types

Type 1	**No DIP joint subluxation**
Type 2	DIP joint subluxation
Type 3	Epiphyseal and physeal injuries

Subtypes

A	**< 1/3 joints involved**
B	1/3 to 2/3 joints involved
C	> 2/3 joints involved

In a previous study, Patel and Gerberman defined a period of 4 weeks as a criterion for acute and chronic mallet finger injuries. They described patients referring before 4 weeks as acute mallet finger cases, and those referring after 4 weeks as chronic mallet finger cases.(5,6)

Conservative and surgical approaches have been defined for the treatment of mallet finger injuries. Patients monitored by conservative approach may benefit from aluminum or plastazote finger orthesis, which keep the DIP joint in extension. Surgical treatment approaches include discovery by K wire, extension block by K wire, pull out technique and discovery by suture anchor.(7)

Potential complications of treatment include extension defects, flexion contraction, problems in grasping, workforce loss, superficial wound problems, nail problems, pain and infection. The most common complication, on the other hand, involves dorsal skin problems. (7)

MATERIAL AND METHODS

This study was approved by Inonu University Health Sciences Scientific Research and Publication Ethics Committee. Medical records and surgery reports of 22 patients, who referred to our clinics with mallet finger injury and received surgical treatment between January 2009 –May 2017, were retrospectively reviewed. Age and gender of the patients, dominant hand relation, presence of osseous or tendinous involvement, the hand and fingers involved, comorbidities, type of injury, time until surgical treatment and any treatments received during this time, recurrences and potential complications were recorded, and Crawford criteria during post-operational follow-ups and post-operational patient satisfaction scores were evaluated over a mean follow-up period of 34.09 months (9-84 months).

Of all patients, 13 (59.1%) were men and 9 (40.9%) were women and mean age was 30.9 (18-52) years. Dominant hand was the right hand of 19 (86.3%) and the left hand of 3 (13.7%) patients.

Osseous and tendinous mallet finger injuries were identified in 9 (40.9%) and 13 (59.1%) patients, respectively. Irrespective of left-right difference, 8 (36.4%) patients had 3rd finger injury, 8 (36.4%) had 5th finger injury, and 6 (27.2%) had 4th finger injury. None of the patients had a concomitant disease.

Table 2 Demographical characteristics

N		%
Gender		
Men	13	59.1
Women	9	40.9
Dominant hand		
Right	19	86.3
Left	3	13.7
Finger involved		
3rd finder	8	36.4
4th finger	6	27.2
5th finger	8	36.4
Mallet type		
Osseous	9	40.9
Tendinous	13	59.1

The injury occurred due to a blunt trauma in 16 (72.7%) and sharp object injury in 6 (27.3%) patients. When the 4-weeks criterion as defined by Patel and Gerberman was applied, 12 (54.5%) patients were operated before 4 weeks (acute mallet finger) and 10 (45.5%) patients were operated after 4 weeks (chronic mallet finger). Of all patients, 12 (54.5%) received treatment before the operation and 10 (45.5%) did not receive any kind of treatment before operation.

Surgery Technique

All surgical techniques were applied in operating rooms, under local anesthesia and by using a tourniquet. After the extremity surgeon prepared to perform the surgery by washing soup and surgical antiseptic solution, the finger to be operated was marked by a surgical pen. Figure 1

Extension block and pinning technique

Firstly, DIP joint was moved to flexion by volar dislocation of the avulsed fragment. Under fluoroscopy, 0.045inch K wire was inserted obliquely from distal to proximal on the dorsal of middle phalange distal joint surface. Attention must be given to avoid the broken fragment, as dorsal block pin may result in bone fragmentation. Appropriateness of the position was checked in anterior-posterior and lateral images under fluoroscopy. Then, the distal phalange was moved to extension to reduce and compress the fracture. A second K wire was retrogradely inserted from the distal end of the distal phalange until the level of DIP joint. While the finger was in extension to keep the avulsed fragment and DIP joint reduced, the second K wire was retrogradely progressed from the DIP joint to middle phalange. K wires were cut, and open tips were covered by protective plastics. Then the finger was covered by a protective cuff.

Pull Out Technique

Extensor mechanism was exposed by making a H-shaped incision on DIF joint. Attention was paid to avoid damaging germinal matrix during this procedure. Fractured fragment was exposed, and tips of the fragment were curetted. By using 0.9 mm K wire, two tunnels to volar were opened in the distal phalange. Two syringe needles were placed into these tunnels. The fracture was reduced by using one monofilament non-absorbable suture, and the tips of the suture were taken out of the tunnel openings and tied with a certain tension. A knob was used to reduce the pressure when deemed necessary in some cases.

Tendon revision and K wire usage technique

A dorsal H-shaped incision was performed on DIF joint. Skin flaps on both sides of incision were removed by sharp dissection and extensor mechanism was exposed. Rupture at the tip of the extensor mechanism or extensionally healing tendon were revised, and sutured end-to-end by providing the necessary and sufficient tension. By keeping the DIP joint in extension, 1 K-wire was progressed from the tip of distal phalange towards the middle phalange.

Statistical Analysis

SPSS for Windows version 17.0 software was used to perform statistical analyses of data collected in this study. Quantitative data were defined by median (Min-Max), while average and qualitative data were shown by numbers (n) and percentages (%).

RESULTS

Based on the type of operation, 13 (59.1%) patients were operated by open reduction and K-wire, 4 (18.2%) were

operated by pull out method and 5 (22.7%) were operated by extension block and pinning method.

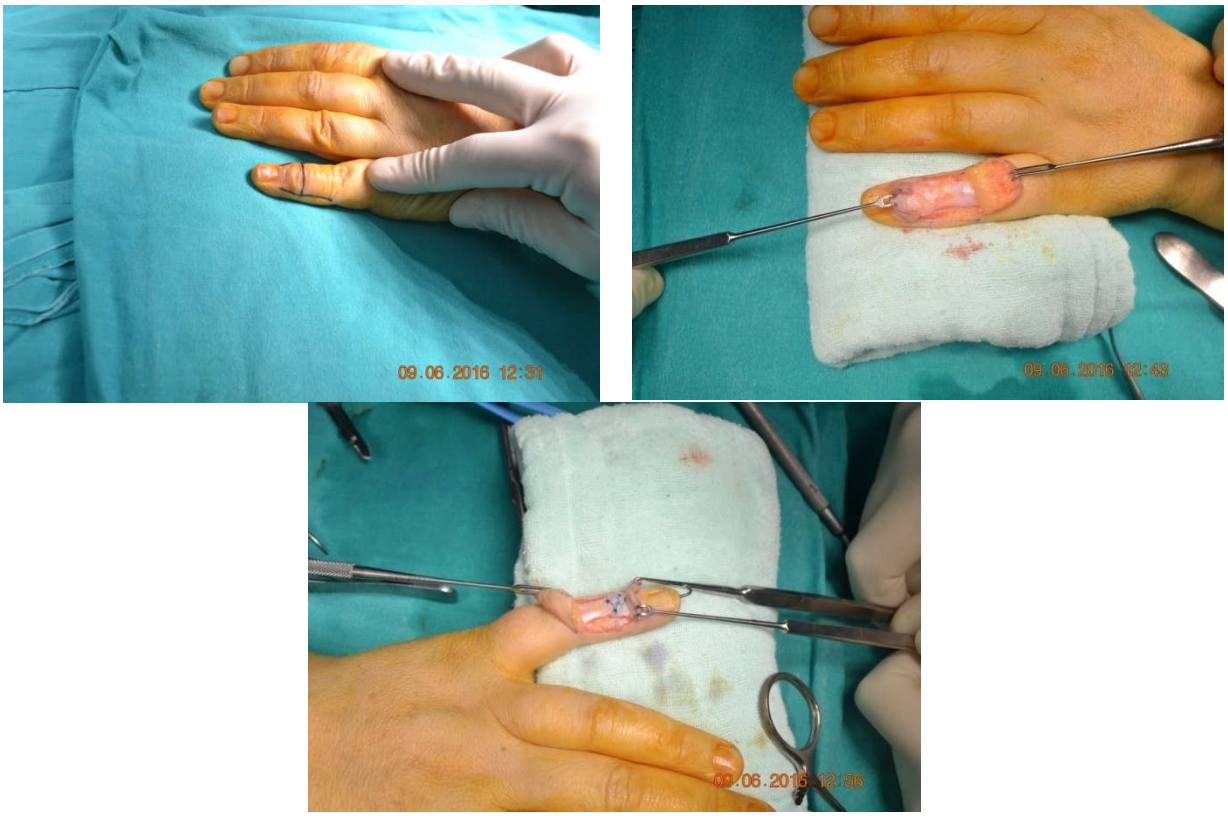

Figure 1 Surgery technique

Crawford criteria indicated that the outcomes were very good in 9 (40.1%), good in 6 (27.2%), moderate in 3 (13.6%) and poor in 4 (18.1%) patients.

Table 3 Crawford criteria

Crawford criteria			
Classification	**Extension loss**	**Flexion**	**Pain**
Very good	*0°*	*Complete*	*None*
Good	*1°-10°*	*Complete*	*None*
Moderate	*11°-25°*	*Present*	*None*
Poor	*>25°*	*Present*	*Ongoing pain*

Postoperative level of satisfaction was reported as very good by 11 (50%), good by 8 (36.3%) and poor by 3 (13.7%) patients.

None of the patients experienced recurrence. One patient (4.5%) reported a complaint concerning the scar tissue on surgery site. One (4.5%) patient reported numbness in that area. One (4.5%) patient complained from mild swelling in the concerned region. No other complication was noted in the remaining patients.

DISCUSSION

Mallet finger is a commonly seen hand injury.(9) The aim of treatment is to reassure DIF joint extension and prevent development of swan neck deformity. There are controversial reports on the treatment of mallet finger.(10) In the present article, we reported the outcomes in surgically treated mallet finger cases.

There is still no consensus in the literature regarding surgical or conservative treatment of mallet finger. Some authors argue for conservative treatment approaches, stating that outcomes are comparable between conservative and surgical treatment options. (11,12) However, a prospective cohort study reported better functional outcomes with surgical treatment. (13)

While some studies reported a complication rate as high as 50% after surgical treatment (14), a recent systematic review showed that the rate of complication after surgical treatment was 14.5%.(10) In the present study, 13.6% of the cases developed post-operational complications. Nail problems and infection were previously reported as the most common complications, (10) but we did not observe these complication in any of our patients in this study. In this study, one patient developed a scar complication, one patient had hypoestasia in surgery site and one patient experienced a local swelling.

Several different surgical techniques have been defined for the treatment of mallet finger, including discovery by K-wire, extensor block, suture pull out and hook plaque.(15-19) Surgical treatment can be applied percutaneously by closed methods, while open surgery is also an option. Open surgeries are associated with complications such as skin necrosis and nail problems, whereas closed surgical methods may fail in providing sufficient reduction.(20) As shown in the present study, outcomes with different surgical methods were not found to be superior to one another.(20) In a study performed by Wang *et al*., ultrasonography was used as a more non-invasive diagnostic method for the diagnosis of mallet finger injuries and the authors concluded the use of ultrasonography was safe in this setting. (21) We did not use this diagnostic method in the present study.

In their study, Gregory *et al*. argued for surgical treatment in all cases with complex mallet finger injuries. But they also reported that the absolute indications for surgery are still controversial. (22)

In another study, Kate *et al*. stated that mallet finger injuries in professional athletes performing important sports like football or rugby had serious outcomes and recommended those athletes to avoid excessive exercising outside the plays or regular trainings and to use protective bands or splinting during trainings. (23)

Limitations of this study include its retrospective design, limited number of patients and low level of evidence.

In conclusion, there are several studies in the literature on mallet finger injuries. As in our study, successful outcomes have been reported also by other methods. Still, prospective studies with a higher level of evidence are required to demonstrate any differences between these treatment methods and to reveal which method is more effective for specific types of mallet finger.

Ethical considerations: Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of Interests: The authors declare that there is no conflict of interest

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