SURGICAL TREATMENT OF MALLET FRACTURES BY EXTENSION BLOCK KIRSCHNER WIRE TECHNIQUE SURGICAL TREATMENT OF MALLET FRACTURES

METIN UZUN[1], MURAT BULBUL[2], KAHRAMAN OZTURK[2], SEMIH AYANOĞLU[2], OKTAY ADANIR[3], HAKAN GÜRBÜZ[2]

ABSTRACT

Objective: We use the extension block Kirschner wire method that orginated from Ishigura to treat mallet fracture and evaluate its efficiency. Methods: 38 patients were treated prospectively. Mean follow-up was 18 months and all patients evaluated radiologically and clinically according to Crawford's criteria. Results: Union was obtained in all patients. The results obtained were satisfactory in 34 cases, unsatisfactory 4 cases. Conclusion: We think that extension block technique is a safe and effective method that can be used in all mallet fractures. ***Level of Evidence: Level IV, Case series.***

Keywords: Hand/surgery. Finger injuries/surgery. Fractures bone/surgery. Fracture fixation, internal.

Citation: *Uzun M, Bulbul M, Ozturk K, Ayanoğlu S, Adanir O, Gürbüz H. Surgical treatment of mallet fractures with the extension block kirschner wire technique. Acta Ortop Bras. [online]. 2012;20(5): 297-9. Available from URL: http://www.scielo.br/aob.*

INTRODUCTION

The mallet deformity can be the ultimate result not only of injuries to the extensor digitorum tendons, but also of an intrarticular fracture of the dorsal lip of the distal phalanx, the so called mallet fracture. Mallet finger usually results from a sudden forceful flexion of the extended distal interphalangeal joint' (DIP); the mallet fracture results from forceful loading on an extended DIP joint, as occurs in sports injuries.[1,2]

The mallet fracture involves more than one-third of the articular surface and sometimes the associated volar subluxation of the distal phalanx.[3] This type of injury is usually treated surgically because it can not be corrected by closed reduction or reduction can not be maintained by closed methods.[4]

The treatment options for mallet fractures range from splinting to surgical fixation using percutaneous pins, pull out wires, screws and modification of these methods.[4-6] While conservative treatment with splints is successful in some cases, many surgeons think that surgery should be considered if one third or more of the articular surface of the distal phalanx is involved or if there is subluxation of the DIP joint. Most of the open surgical techniques are somewhat hazardous with complication that include infection, nail deformity, osteomyelitis, scar formation. With this in mind, Ishiguro *et al.*[7] introduced a new method for close reduction of mallet fracture.

In this article, we use the extension block Kirschner wire method that orginated from Ishiguro et al.[7] to treat mallet fracture and evaluate its efficiency.

MATERIALS AND METHODS

Between 2004 and 2009, 38 mallet fractures that involved one third or more of the articular surface were treated using extension block technique by five physicians. (Figure 1)

Patients included 24 men and 14 women with a mean age of 34,3 years (range, 19-46 years). In 10 cases the finger affected was the fifth, in 16 cases, the forth, in 12 cases, the third. Twenty four injuries occurred in the dominant hand.

All injuries were closed and in four cases showed subluxation of the distal phalanx. The mean time from fracture to operation was 1,7 days (range 0-4 days). Clinical results were assessed using the criteria published by Crawford.[8] Radiographs were taken of all cases after surgery. (Figure 2a and 2b).

On radiographs were evaluated: union, malunion, space, inclination, degenerative changes, subluxation and deformity. The values of the passive range of movement of the joint IFD were measured with a goniometer.

Patients with an average 18 months (12-36 months) were invited to participate in a telephone assessment of the long term results of the treatment

All the authors declare that there is no potential conflict of interest referring to this article.

1. Acıbadem Maslak Hospital, Istanbul, Turkey.
2.Vakif Gureba Teaching and Research Hospital, Istanbul, Turkey.
3. Bağcılar Teaching and Research Hospital, Istanbul, Turkey

This work was done collectively, Acıbadem Maslak Hospital and Vakif Gureba Teaching and Research Hospital.
Mailling Adress: Darüşşafaka Area, Büyükdere street, No:40 Maslak-Sarıyer, Istanbul, Turkey. E-mail: drmetinuzun@gmail.com

Artigo recebido em 31/01/2012, aprovado em 10/04/2012.

Figure 1. *Lateral radiography of the finger in the preoperative*

Figure 2. *(A) Postoperative AP radiography. (B) Postoperative lateral radiography*

SURGİCAL TECHNIQUE

The operation is performed under digital block anesthesia. DIP joints are passively flexed so that the displaced fragment moves to its original position because of to maintain continuity periosteal. A 0.035" (0.9 mm) or 0.045" (1.4 mm) K wire is inserted through the extensor tendon at a 45 degree angle into the head of the middle phalanx along the dorsal edge of the fragment under the surveillance of C-arm. (Figure 3)

The distal phalanx is extended to 0 degree. A second K wire is inserted to transfixed the DIP joint in to the middle phalanx to maintain reduction.

Active motion of the PIP and MP joints is started immediately after the surgery. Splinting and antibiotics were not used. The follow up visit was conducted ten days after the surgery to evaluate the site of the pin. At the end of the sixth week, K wires were removed after radiographic control of the healing and a night splint was used for two weeks. The patient was encouraged to do active and passive exercises of range of motion (ROM) immediately with the DIP joint.

RESULTS

In the radiographic assesment, union was obtained in all patients. No malunion or subluxation were found in any patient. Knitting The anatomical union was obtained in 24 cases; in 10 cases there was a gap of less than 2 mm, and in four cases, the gap was of more than 2 mm. (Figure 4)

The DIP joint had an average extension lag of two (0-7) degrees and the final flexion was 70º on average (45º-80º). There were no cases of infection along the pin tract, instability or nail bed injury. At the final follow-up clinical evaluation showed no residual deformities in the proximal interphalangeal and metacarpaphalangeal (MP) joints. (Figures 5a and 5b)

According to Crawford's[8] criteria, the results obtained were excellent in 24 cases, good in 10 cases, fair in two cases, and poor in two cases. In cases with a fair result, the gap extension was greater than 10 degrees.. In cases of poor results, the complaint of the patients was pain. In these four cases, the union had a gap of more than 2 mm.

Figure 3. *Show that clinically K wire inserted techniques.*

Figure 4. *The lateral radiograph shows union.*

DISCUSSION

The untreated mallet fracture causes a painfull finger, swan neck deformity, and degenerative arthritis.[9] Thus, the fracture must be treated by surgical or conservative method. When the conservative treatment is applied, it is necessary to use an extension splint for six to eight weeks and then, use a night splint for one month.[10]

Wehlee and Schneider[11] described that most mallet fractures

Figure 5. *(A)The photograph shows no absence of skin and nail deformity. (B) Photography indicating finger extension function.*

can be treated without surgery, ignoring the joint subluxation and the size or displacement of the bone fragment. Weber and Segmüller[12] reported that mallet fractures that involved one-third to two-third of the joint surface were treated by conservative methods, witht successfull results. Okafor *et al.*[13] reported that osteoarthritic changes in 48% and 29% of their patients showed swan neck deformity, although the clinical results of conservative treatment had rates of 90% of success. Lubahn[14] compared surgical versus conservative treatment and reported that the former provided better cosmetic and functional results. Mazurek *et al.*[2] reported that mallet fractures are common in active indiviuals. If the patients are treated by the conservative method, there is usually a complication of residual loss of extension and secondary displacement of the fracture, unfavorable biomechanics and poor patient compliance. Therefore, he recommended the minimally invasive technique as an alternative to conservative treatment. Nakamura and Nanjyo[15] used surgical intervention with immediate postoperatively and compared the results with to conservative treatment, concluding that the surgically treated group had greater satisfaction than the group treated by conservative method.

Damron and Engber,[5] Jupiter and Sheppard[16] and Stark et al.[17] recommend surgical treatment when the mallet fracture involves more than one-third of the joint surface, because it is usually impossible to obtain good reduction with closed method and finger support. Various techniques of fixation of mallet fractures have been described in the literature, including DIP[18] joint pinning, tension[5] band wiring, extension block[10] pinning, compression screw fixation.[6] This techniques may be used in open or closed methods. Open reduction of mallet fracture is technically demanding and has the potential to entail complications because of the small size of the fragment and the difficulty of observing the articular congruity.[10] The additional soft tissue dissection to accurately place the screws or wires jeopardizes blood supply to the fragment and to the skin.[16] Potential complications of the open surgical treatment have been reported, such as postoperatively infection, fragmentation of the bone, nail deformity, skin problems, loss of fixation.[19]

Bischoff et al.[10] reported skin breakdown, marginal skin necrosis, permanent nail deformities, superficial and deep infection in cases treated by the open methods. Lin and Tseng[1] reported 41% of complication as nail deformities, superficial infection and pin track infection. With the open methods, Stark[17] reported 95% of successfull results and Orhun et al.[9] reported 91%.

To prevent these complications, Ishiguro *et al.*[7] described a new technique for closed reduction of mallet fractures using extension block K wire, in 1988. This technique has also advantages over the treatment with splint which has complications like skin maceration, ulceration, allergy, pain related to the splint and the open treatment which has complications such us nail deformities, osteomyelitis, skin necrosis and superficial or deep infection.[1,14,19] Lee and Hyun[20] reported success rates of 100%, Lin and Tseng[1] 92% and Inoue[21] 84%, in treatments with the surgical closed technique.

Lee and Hyun[20] compared same methods applying open and closed techniques. There was no statistical difference in the results, but in the group of open reduction there were 22% of temporary skin problems, tenderness at the incision and an increased surgical time.

CONCLUSION

The learning curve of this technique is easier compared with the open techniques. A possible disadvantage of the extension block technique is the joint cartilage damage, which leads to secondary osteoarthritis, especially when it is needed more than one attempt to insert the pin We think that extension block technique is a safe and effective method that can be used in all mallet fractures.

REFERENCES

1. Lin CL, Tseng CH. Treatment of mallet fracture with the extension-block K-wire method. Taipei City Med J 2006;3(8):792-7
2. Mazurek MT, Hofmeister EP, Shin AY, Bishop AT. Extension-block pinning for treatment of displaced mallet fractures. Am J Orthop (Belle Mead NJ). 2002;31(11):652-4.
3. 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;120(1-2):9-13.
4. Tetik C, Gudemez E. Modification of the extension block Kirschner wiretechnique for mallet fractures. Clin Orthop Relat Res. 2002;(404):284-90.
5. Damron TA, Engber WD. Surgical treatment of mallet finger fractures by tension band technique. Clin Orthop Relat Res. 1994;(300):133-40.
6. Kronlage SC, Faust D. Open reduction and screw fixation of mallet fractures. J Hand Surg Br. 2004;29(2):135-8.
7. Ishiguro T, Inoue K, Matsubayashi T, Ito T, Hashizume N. A new method of closed reduction for mallet fractures. J Jpn Soc Surg Hand 1988;5:444-7.
8. Crawford GP. The molded polythene splint for mallet finger deformities. J Hand Surg Am. 1984;9(2):231-7.
9. Orhun H, Dursun M, Orhun E, Gürkan V, Altun G. [Open reduction and K-wire fixation of mallet finger injuries: mid-term results]. Acta Orthop Traumatol Turc. 2009;43(5):395-9.
10. Bischoff R, Buechler U, Roche RD, Jupiter J. Clinical results of tension band fixaion of avulsion fractures of the hand. J Hand Surg. 1994;19(6):1019-26.
11. Wehbé MA, Schneider LH. Mallet fractures. J Bone Joint Surg Am. 1984;66(5):658-69.
12. Weber P, Segmüller H. [Non-surgical treatment of mallet finger fractures involving more than one third of the joint surface: 10 cases]. Handchir Mikrochir Plast Chir. 2008;40(3):145-8.
13. Okafor B, Mbubaegbu C, Munshi I, Williams DJ. Mallet deformity of the finger. Five-year follow-up of conservative treatment. J Bone Joint Surg Br. 1997;79(4):544-7.
14. Lubahn JD. Mallet finger fractures: a comparison of open and closed technique. J Hand Surg Am. 1989;14(2 Pt 2):394-6.
15. Nakamura K, Nanjyo B. Reassessment of surgery for mallet finger. Plast Reconstr Surg. 1994;93(1):141-9.
16. Jupiter JB, Sheppard JE. Tension wire fixation of avulsion fractures in the hand. Clin Orthop Relat Res. 1987;(214):113-20.
17. Stark HH, Gainor BJ, Ashworth CR, Zemel NP, Rickard TA. Operative treatment of intra-articular fractures of the dorsal aspect of the distal phalanx of digits. J Bone Joint Surg Am. 1987;69(6):892-6.
18. Auchincloss JM. Mallet-finger injuries: a prospective, controlled trial of internal and external splintage. Hand. 1982;14(2):168-73.
19. Stern PJ, Kastrup JJ. Complications and prognosis of treatment of mallet finger. J Hand Surg Am. 1988;13(3):329-34.
20. Lee SY, Hyun YS. Clinical results of two operative treatments in mallet fracture. J Korean Soc Surg Hand. 2007;12(2):67-73.
21. Inoue G.Closed reduction of mallet fractures using extension-block Kirschner wire. J Orthop Trauma. 1992;6(4):413-5.