Original Article

Hemi-Hamate Arthroplasty for Unstable Dorsal Proximal Interphalangeal Joint Fracture Dislocation of the Fingers

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ABSTRACT

Objective: To assess restoration of finger functions after hemi-hamate reconstruction.
Study Design: Experimental / Analytic study
Place and Duration of Study: This study was carried out at two different centres at Jinnah Hospital, Lahore and King Khalid Hospital, Najran KSA from between 2010 and 2013.
Materials and Methods: We performed hemi-hamate autograft arthroplasty in 20 patients age 16-45 years. All were having comminuted metaphyseal fracture of volar surface of middle phalynx involving more than 50% (55%-90% average 70%) of articular surface with dorsally displaced unstable proximal interphalyngeal joint. Functional outcome was assessed by grip strength, proximal interphalyngeal joint, distal interphalyngeal joint range of motion and residual pain and patient's satisfaction.
Results: At the end of average 24.4 months follow-up mean active range of motion for proximal interphalyngeal joint was 62 °(40°- 90°), distal interphalyngeal joint was 54°(40°-65°) and flexion contracture was 15°(0°-35°).Grip strength was achieved upto 95% (50%-95%) of opposite normal hand. Almost all patients were satisfied with functional outcome and appearance of the finger. We had not come across donor site morbidity, graft resorption, avascular necrosis, subluxation/dislocation, coronal/sagittal instability, infections except 4 patients, one scar tenderness, one ulnar digital nerve paresthesia and 2 with early osteoarthritic changes.
Conclusion: Non-vascularized hemi-hamate autogarft is a good treatment option for comminuted proximal interphalyngeal fracture dislocation having more than 50% volar lip involvement, resulting in satisfactory functional outcome as compared to other surgical treatments. We recommend it in patients of active age group.
Key Words: Hemi-hamte arthroplasty, Unstable, Proximal interphalyngeal joint, Fracture, Dislocation

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INTRODUCTION

Proximal interphalyngeal dorsal fracture dislocation is a rare injury but common in ball handling sports and trauma leading to direct force to finger tip with axial loading and hyperextension of proximal interphalyngeal joint.[1,2] This results in impaction of palmar lip of middle phalynx to proximal phalyngeal condyles.[3,4] This injury is highly unstable if more than 50% of volar lip is involved and further enhanced by comminution of fracture fragments.[5] Treatment options are limited with no role of conservative management. Surgery is mandatory to restore the joint functions. Different options are supported in literature with variable results like volar plate arthroplasty,[6] open reduction and internal fixation,[7] tenodesis of superficialis,[8] external traction system[9], silicon arthroplasty, arthrodesis and non-vascularized distal radius autograft.[10] Hastings[11] first introduced hemi-hamate autograft arthroplasty for comminuted proximal interphalyngeal fracture dislocation in 1999 while emphasizing anatomical resemblance of distal articular surface of hamate with base of middle phalynx and produced good results. Since then, several studies have been published from different hand centres of the world. As osteochondral hemi hamate autograft provides good mechanical stability for comminuted proximal phalynx volar lip fracture.[12] So we believe hemi-hamate resurfacing arthroplasty would restore better contour of proximal phalynx base and provide better functional outcome. Patients with dorsal fracture dislocation of proximal interphalyngeal joint having more than 50% volar lip involvement.

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MATERIALS AND METHODS

Twenty patients with proximal inter-phalyngeal unstable dorsal fracture dislocation were treated with hemi-hamate arthroplasty at two different centers, King Khalid Hospital Najran, KSA and Jinnah Hospital Lahore, Pakistan between 2010 and 2013. There were

15 male and 5 female patients with average age of 29 years (16-45). Long finger was affected in 40% of cases. Ball handling sports injury 35% was the major cause of trauma other than fight 25%, fall 20% and motor vehicle accidents 20%. All the patients presented within 11 days (1-21 days) of injury. Dominating hand was involved in 80% of cases. All were having unstable proximal inter-phalyngeal joint with dorsal fracture dislocation with average 70% (55-90%) of articular surface involvement confirmed with AP and lateral plain radiographs of injured finger. Patients with more than 90% anterior surface involvement of base of proximal phalynx, tendon injury, neurovascular injury, open fracture, failed previous surgery, presented later than 3 weeks, unable to comply with rehabilitation protocol, all were excluded from the study. All the patients and family were given detailed counselling about injury, surgical procedure and possible complications. Pre-operatively, AP and lateral plain x-ray centered over proximal inter-phalyngeal joints done for all the patients (Figs. 1-2).

Figure No. 1: Pre-operative x-ray AP view

Figure No. 2: Pre-operative x-ray lateral view

All patients were operated under general anaesthesia or regional anaesthesia. Torniquet was used. A shotgun approach was used through volar zigzag skin incision. Flexor sheath was exposed, after identifying and protecting neurovascular bundle on either side, thin flexor sheath flap comprising of C1 and A3 elevated on one side saving A2 and A4 pulleys. Long flexor tendons were retracted to expose volar plate and incised from small displaced fragments of middle phalynx, along-with accessory collateral ligaments. The collateral ligaments elevated by dissection to expose the base of middle phalynx. The palmer lip is debrided removing free fracture fragments taking care not to damage the dorsal lip. 4 mm oscillation saw was used to create box-like recipient defect and measured in three dimensions with slight palmer slope.

Dorsal longitudinal incision made over 4th and 5th carpometacarpal joints after confirmation under c-arm. After mobilization the dorsal sensory branches of ulnar nerve, 4th and 5th carpometacarpal joint exposed between extensor digitorum communis of ring finger and extensor digitorum quantae tendons. The box shaped 4-mm hemi-hamate auto graft was harvested with oscillating saw according to dimensions of the recipient defect. The graft was secured with two or three lag screws (1.0 or 1.3 mm) after reconstructing the curved shape of the palmar lip. After reduction of PIP joint its stability and ROM were assessed under C-arm. Volar plate reattached to middle phalynx at its distal lateral margins. Tourniquet deflated and haemostasis secured. Wound closed in layers. Dressing done with dorsal splint in 20° flexion. Sutures removed at 10 days and active flexion were encouraged. Extension of proximal interphalyngeal joint blocked for further 4 weeks. Full range of movements started at 6 weeks. X-rays were taken immediate after surgery on 2 and 6 weeks post operatively. Patients were followed up until radiological union of the graft.

RESULTS

Results of hemi-hamate arthroplasty were assessed in 20 pts with average follow up of 24.4 months. The average range of motion of proximal interphalyngeal joint at final follow up was 62° (40° to 90°) and distal interphalyngeal joint 54° (40° to 65°). Average recovery of grip strength on involved hand was 74.5% as compared to opposite normal hand.

Figure No. 3: Postoperative x-ray AP view

Table No.1: Demographic information of the patients (n = 20)

Variable	No.	%
Age (years)		
16-25	9	45.0
26 – 35	4	20.0
36 – 45	7	35.0
Gender		
Male	15	75.0
Female	5	25.0
Finger involvement		
Rt. ring finger	6	30.0
Lt. small finger	3	15.0
Rt. long finger	3	15.0
Lt. long finger	8	40.0
Handedness		
Right	16	80.0
Left	4	20.0
Mode of Trauma		
Sports	7	35.0
Fight	5	25.0
MVA	4	16.0
Fall	4	16.0
Joint involvement (%)		
51-75	12	60.0
76-100	8	40.0
Grip strength (%)		
51 – 70	10	50.0
71 – 90	10	50.0

Table No.2: Outcome of hemi-hamate arthroplasty

Outcome	No.	%
Active range of motion		
PIP		
40-70	16	80.0
71-100	4	20.0
DIP		
40–55	15	75.0
56 – 70	5	25.0
Radiological osteoarthiritis		
Yes	2	10.0
No	18	90.0

Mean fixed flexion contracture noted at proximal interphalyngeal joint was 14.75° (0°-35°) of involved finger. All of the patients were satisfied with functional outcome and appearance of fingers. Proper reduction and congruency of proximal interphalyngeal joint were noted both AP & lateral x-rays (Figs. 3-4). We had not come across any infection, joint subluxation, coronal/sagittal instability, dislocation graft resorption or AVN and donor site morbidity. Two patients were having early osteoarthritic changes on x-rays and complaint of pain off and on especially on exertional work. Two patients were observed, one with scar tenderness and one with ulnar digital nerve paresthesia (Tables 1-2).

Figure No.4: Postoperative x-ray lateral view

DISCUSSION

Proximal inter-phalyngeal joint fracture dislocations are relatively uncommon and usually mismanaged while considering minor injuries especially in developing countries.[13] Available treatment options depend upon percentage of articular surface of proximal phalynx base.[1] Less than 30% is stable injury and can be managed with extension block splint.[14] Between 30%-50% need surgical stabilization and are effectively treated with volar plate arthroplasty[15-16], open reduction internal fixation[15,17] or external fixator.[18,19] Over 50% of articular surface involvement leads to instability and treatment is more demanding.[14] Open reduction internal fixation is not possible because of communition.[16] Literature does not support volar plate arthroplasty[14] and external fixator[15] because of high complication rate like persistent joint instability, inadequate arc of motion of proximal inter-phalyngeal and distal inter-phalyngeal joints and joint stiffness plus pin track infections respectively. Hasting hemi-hamate arthroplasty has the advantage of replacing the injured proximal phalynx base with hemi-hamate osteochondral fragment providing relative congruent joint for stability and immediate range of motion.[14] The results of present study are comparable with Afendras et al[20] who reported range of motion at PIP joint 67° and DIP joint 47°, which were 62° and 54° in our series.

The recovery of grip strength of our patient is inferior to Yang et al[21] 95%, Lindenblatt et al[22] 94%, Bigorre et al, 92%, because of less percentage involvement of articular surface which is 58%, 60% and 62% respectively in their series. None of our patients developed joint collapse, subluxation, severe osteoarthritis, cut out screws, graft loss which were reported by William et al[23], Afendras et al[2`] and Lindenblatt et al. However a large number of patients is recommended to assess long term results of hemi-hamate reconstruction.

CONCLUSION

Hemi-hamte resurfacing arthroplasty is useful procedure for dealing with proximal interphalyngeal fracture dislocations involving 50% of articular surface. It reproduces stable joint contour allowing early recovery. However, aggressive postoperative rehabilitation is advised to get maximum functional outcome. We preferably recommend this procedure for comminuted unstable proximal interphalyngeal dorsal fracture dislocations of the fingers over the other treatment options.

Conflict of Interest: This study has no conflict of interest to declare by any author.

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