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Early clinical results of volar plate arthroplasty for neglected fracture dislocations of pip joint in hand

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Abstract

We present the early clinical results of volar plate arthroplasty for neglected fracture dislocation of PIP joint in hand, as they most commonly dislocated and are difficult to treat. At one year follow up, patient showed excellent results with range of motion upto 100° and with stronger grip.

Keywords: Volar plate, Arthroplasty, PIP joint, Fracture dislocation

Introduction

The most commonly dislocated joint in the hand, is the proximal interphalangeal (PIP) joint [1-3]. The severity of the injury is usually underestimated, which results in inappropriate treatment and long term morbidity. The spectrum of the pathology ranges from a simple injury treated on site by the patient himself all the way to irreducible fracture dislocations [1, 4, 5]. The direction of the dislocation is usually dorsal, but lateral or volar dislocations may also occur [3, 4-6].

Pain, premature degenerative arthritis, stiffness, and persisting subluxation are common sequelae of fracture dislocation of proximal interphalangeal (PIP) joints. The most severe injuries are caused by longitudinal compression force impacting the volar articular surface of middle phalanx against dorsal condyles of proximal phalanx [7]. The purpose of surgical treatment is to reduce the middle phalanx and restore the broken articular surface. Regardless of the treatment used, the reported complications include limitation of extension, limitation of flexion, instability with recurrent dislocation, residual pain and functional disability [8].

Materials and Methods

This study was conducted in Shri Mahant Indresh Hospital Dehradun from Jan 2016 to Dec 2017. Five patients (4 males, 1 females) with a diagnosis of chronic PIP joint fracture dislocation were included in this study. Only patients with duration of injury more than 6 weeks were included in this study.

Technique

The joint is exposed through a volar incision, elevating a radially based flap. The flexor sheath from midline phalangeal pulley to the web is excised. This allows one to retract the flexor tendons to one side. The floor of the joint can be visualized. The fracture site, in fresh cases, can be best seen by hyperextending the joint. The volar plate, still attached to fragments of the middle phalanx, maintains a normal relationship with the collateral ligament system. The volar plate then is incised along its lateral margins, detaching it from the accessory collateral ligaments, and the comminuted fragments are sharply excised from the distal margin of the volar plate.

In the late cases the changes are not easily demonstrated until the joint has been entered. The volar plate is divided transversely as far distally as possible, leaving some volar periosteum, if necessary, in order to create a pedicle of maximum length for advancement into the joint. In reconstructions it is mandatory, at this point, to do a complete excision of both collateral ligaments. The joint then can be opened by hyperextension. This makes it easy to see both the joint surfaces.

The neurovascular bundle will fall loosely to either side of joint.

Complete exposure of the joint is essential, for one must create a transverse trough across the volar portion of the articular surface of the middle phalanx and this can be done most accurately under direct vision. Failure to create a trough, completely across the phalanx may result in subsequent angular deformity.

It is important then to reduce and test the range of the joint. The fingertip should easily touch the distal palmar crease, placing the proximal interphalangeal joint in 110 degree of flexion. If such flexion is not possible (often in late reconstructions), incision of the dorsal capsule of the joint may be necessary. A pullout non absorbable suture, catching the lateral margins of volar plate is placed so that the ends emerge from each distal corner. If the volar plate cannot be adequately advanced distally, the check ligaments are

fractionally lengthened to mobilize it.

Two small drill holes are placed in the lateral most portion of the trough in the middle phalanx. The pullout sutures are placed through these drill holes to emerge dorsally. Traction on the sutures draws the volar plate into the articular defect, effectively resurfacing the joint and simultaneously reducing the middle phalanx. The joint need to be flexed more then 35 degree to maintain reduction. An intraoperative lateral radiographs should be obtained to check congruity of reduction. A kirschner wire is usually inserted to maintain joint stability. The pull out sutures are then knotted over a normal autoclaved shirt button. The hand and fingers are immobilized for 2 weeks in plaster.

The kirschner wire may be removed at 2 weeks and the button is removed at 3 weeks and active, guarded flexion, with dorsal block splinting begun. If complete extension is not achieved by 5 weeks after operation, a dynamic splint is used [7]

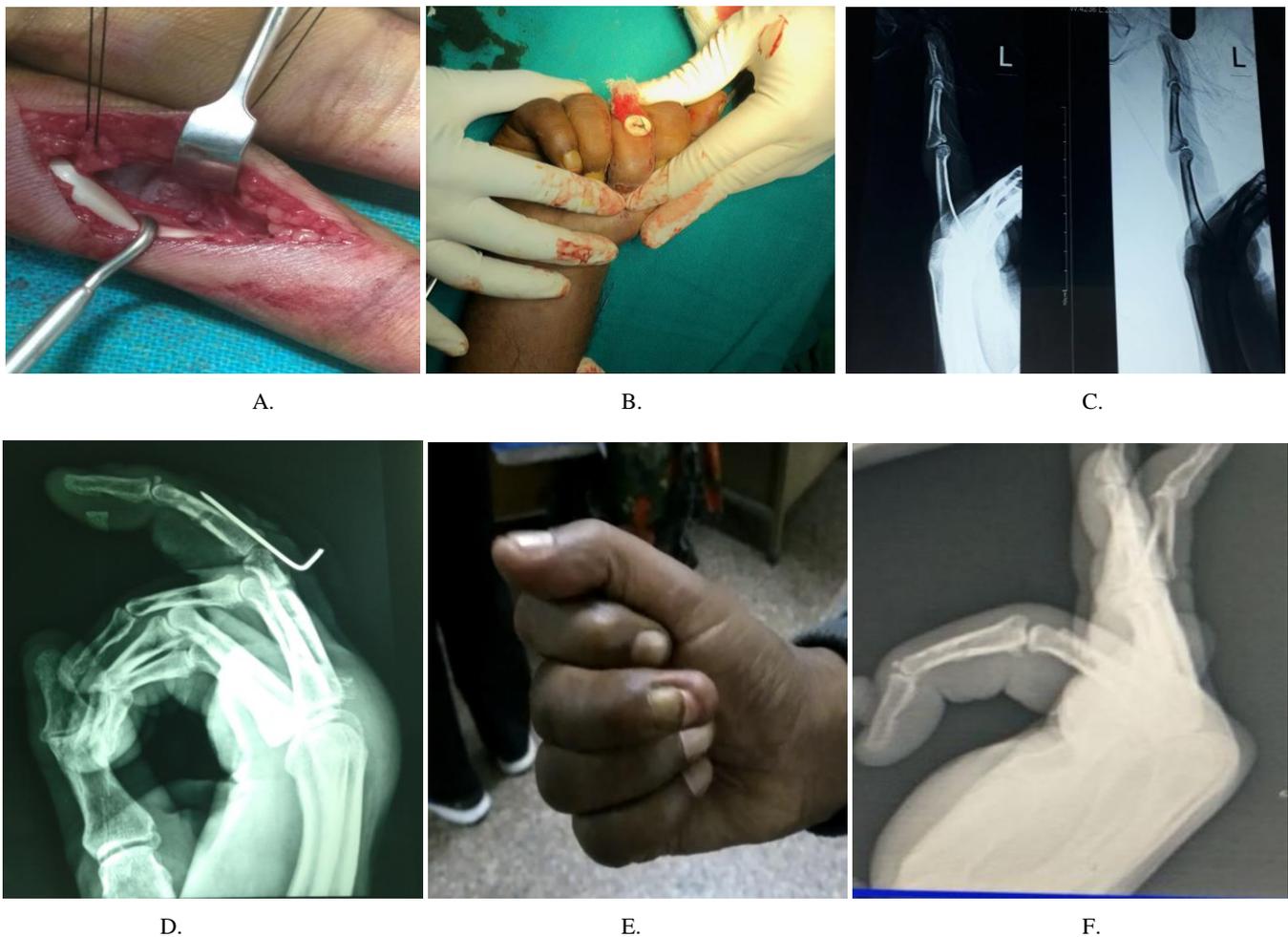


Fig 1: Technique for volar plate arthroplasty: A). Ski gram showing dislocation of pip joint. B). Figure showing volar plate with flexor tendon retracted to side, C). pulled out sutures tied over dorsum of middle phalanx over a button, D). Post op ski gram showing congruent PIP joint stabilized with k wire, E). 9 month follow up showing 90 degree flexion at PIP joint, F). Lateral view of skiagram showing 90 degree of flexion after 9 month post operatively

Results

Five patients (4 males, 1 females) with a diagnosis of PIP joint fracture dislocation were included; they were treated at SGRRIMS between Jan 2016 to Dec 2017. Most of the injuries involved the right hand (66.67%). The average age at the time of surgery was 33.8years. Interval from injury to surgery averaged 10.4 weeks. Two patients were operated before 10 weeks and three patients were operated after 10 weeks.

The average follow up period was 11.2 months. No patient reported pain at rest or with activity. One patient reported pain with major activity. All returned to their original occupation and recreational activities. The total active range of motion was 60 degrees. Average flexion was 85 degrees and average extension lag was 15 degrees. There was no significant difference in grip strength from side to side. Radiographic evaluation showed congruous reduction in all joints. This was best observed in lateral projection

Table

Case no	Age	Sex	Digit	Injury to operation interval	Flexion at PIP joint before surgery (in degree)	Flexion at PIP joint after surgery (in degree)	Follow up (in weeks)	Pain
1	23	M	L	6	20	100	6	None
2	27	M	R	10	20	90	20	None
3	49	F	L	12	10	70	8	None
4	36	M	R	8	20	90	10	None
5	34	M	R	16	0	60	12	None

Discussion

Neglected fracture dislocations of the PIP joint are challenging to treat. Conventional methods, such as reduction of the dislocation followed by temporary joint arthrodesis, if feasible, frequently result in stiffness of the joint and arthritis over a long perspective.

Palmar plate interposition arthroplasty for restoration of metacarpophalangeal (MCP) joint function in rheumatoid arthritis was introduced by Tupper^[9-13].

Volar plate advancement arthroplasty accomplishes two purposes. It provides a volar restraint to maintain reduction while simultaneously resurfacing the irregular or deficient volar articular surface of the middle phalanx.

Satisfactory advancement of the volar plate requires lengthening of the proximal check ligaments.

Sharp teasing of these ligaments will permit 3 to 4mm of distal advancement of the plate. The central areolar tissues between the ligaments through which the vincular vessels pass, provides adequate blood supply to the fibrocartilagenous plate.

A longitudinal Kirschner wire is indicated in all but the easily reduced fresh dislocations. Active flexion with dorsal block splinting is instituted between 2 and 3 weeks after operation, depending upon the intraoperative stability of the advancement. Active extension is begun at 3 weeks, and dynamic extension traction is employed when extension is not rapidly approaching normal by 4 weeks after operation. The return to full motion is gradual and may require 4 to 6 months of persistent exercises.

In this arthroplasty the interposed material is a vascular fibrocartilagenous pedicle.

Since the volar plate is actually stretched around the condyles of the proximal phalanx, it assumes the exact contour of the surface on which it must glide^[7].

Congruity of PIP joint should be restored i.e essentially parallel arcs of gliding surface to thin area should influence favorably the long term prognosis for a mobile pain free joint. Volar plate arthroplasty is a technically demanding economic procedure with minimal complication rates and optimizes motion. This surgery includes great benefit to avoid articular implants, which are costlier and complicated. Moreover the most important benefit is complete satisfaction of the patient with good range of motion.

Complication

Postoperatively no infection, pin tract complication or any neurovascular complication seen. No early or late dislocation of PIP joint seen. No flexion contractures seen later. All the patient were completely satisfied with their postoperative surgical results.

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