Case Report

Two stage procedure for neglected transscaphoid perilunate dislocation

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Abstract

We report a two-staged surgical procedure for neglected 3 month old volar transscaphoid, transcapitate perilunate fracture dislocation wrist in an 18 year old right handed male student. The lunate with proximal scaphoid and proximal capitate maintained its articulation with distal end radius while the rest of carpal bones had dislocated volarly. In the first stage, bilateral uniplanar wrist distractor was applied with the aim of stretching soft tissue. In the next stage open reduction and internal fixation was done by a combined volar and dorsal approach augmented by pronator quadratus flap. At 3 years followup the patient was pain free and had a full range of supination pronation of the forearms and radial and ulnar deviation of wrist with 10° dorsiflexion deficit.

Key words: Volar perilunate dislocation, distractor, pronator quadratus flap

Introduction

Transscaphoid volar perilunate dislocation constitutes approximately 8% of all carpal dislocations.[1] It is usually the result of high-energy trauma and is difficult to treat. Because of the variable results obtained with closed reduction,[2] open reduction and internal fixation is recommended. Neglected perilunate or lunate dislocation is often difficult to manage. The soft tissue contracture with inadequate space to seat the carpal bones between lunate–scaphoid block and metacarpals, increases chances of avascular necrosis of scaphoid and lunate and make treatment of this neglected injury difficult.[3] Increased propensity of traction injury to neurovascular structures around wrist, greater chances of stiffness or reflex sympathetic dystrophy after open reduction and fixation compound this problem[3]. The options available to treat such injuries are open reduction and internal fixation, wrist fusion, proximal row carpectomy.[3] Other than salvage operation, there is lack of information in the literature regarding the management of neglected fracture dislocation of the carpal bones presenting 6 weeks after injury. However, most authors agree that open reduction and internal fixation is necessary and may be used up to 2 months following injury.[3] If open reduction is not successful, reconstructive/salvage procedures are indicated.

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Case Report

An 18-year-old, right-handed male student sustained sustained fall from height on a palmar flexed hand 3 months ago. The patient was initially treated by below elbow plaster of Paris slab immobilization. He presented with a swollen, painful, stiff wrist without any neurovascular deficit. The anteroposterior and lateral X-ray of the left wrist revealed a volar transscaphoid perilunate dislocation [Figure 1a]. Comparison with the opposite side X-ray showed no density changes in lunate and scaphoid. Computed tomography (CT) of the wrist showed a fracture of capitate also with no increased density or microarchitectural collapse of lunate and scaphoid [Figure 1b]. Magnetic resonance imaging (MRI) of the wrist revealed no avascular changes in lunate or scaphoid.

We planned two stage treatment. In the first stage, bilateral uniplanar wrist distractor was applied with the aim of stretching soft tissue symmetrically, decreasing the risk of neurovascular traction injury and making subsequent open reduction and internal fixation surgery easier [Figure 2a]. The wrist was distracted daily by half a turn/half mm; the distractor was removed after 3 weeks when adequate space, approximately equal to the height of capitate bone, was

Figure 1: (a) Preoperative antero-posterior radiograph and lateral radiograph of the left wrist. (b) Preoperative CT scan of the left wrist showing perilunate dislocation and yellow arrow showing the capitate fracture

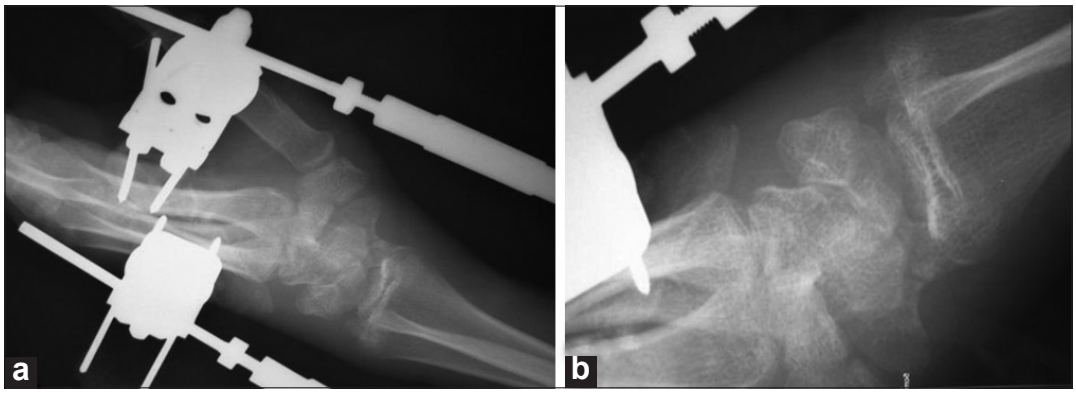

Figure 2: (a) First stage of the surgical procedure showing bilateral uniplanar wrist distractor. (b) End point of first surgical procedure showing adequate wrist distraction

created between the lunate and third metacarpal on lateral view of the wrist [Figure 2b]. In the next stage, open reduction and internal fixation was done by a combined volar and dorsal approach to the wrist joint. Initially, through a volar approach, the carpal tunnel was released, pronator quadratus osteoperisosteal muscular flap raised, and the scaphoid proximal fracture fragment with lunate was exposed. Then, realignment of the bones was assisted by a second longitudinal dorsal incision. No damage to the articular surface of the proximal fragment of capitate was noted. The scaphoid fracture was reduced and fixed by two 1.5-mm Kirschner wires augmented by the pronator quadratus osteoperisosteal muscular flap [Figure 3a]. The lunate, which was denuded of soft tissue attachments on ulnar side, was stabilized with one Kirschner wire to the capitate (fixing the capitate fracture also) and third metacarpal and the other to the scaphoid [Figure 3b–f]. The width of the pronator quadratus flap was marked up to 1.5 cm at its insertion on the volar aspect of radius. The osteoperisosteal muscular flap was then attached across the scaphoid fracture site and the proximal muscle sleeve's distal part was sutured to the partially ruptured volar radioscaphocapitate ligament as an augment [Figure 4]. Use of musculoperiosteal flaps in fracture neck femur has given good results;[10] the same principle prompted us to use such a procedure for fracture scaphoid in our case. Lunotriquetral ligament repair was not possible due to old nature of injury, but augmentation was done by dorsal capsulodesis and adjacent extensor indicis tendon flap. After the reduction and fixation of the bones to their normal position, an above elbow thumb spica slab was applied in functional position of hand and forearm.

The postoperative course was uneventful. Suture removal was done at 2 weeks and plaster slab was changed to thumb spica cast. The Kirschner wires were removed at 10 weeks. Thumb spica immobilization was continued till 4 months when scaphoid fracture healing was evident to be progressing. The spica was removed and patient was mobilized, graduating from active/assisted hand and wrist mobilization to strengthening exercises over a period of further 2 months. Radiographic evidence of bone healing was present 5 months postoperatively. Six months after the procedure, the patient had nearly normal volar flexion, ulnar deviation, and radial deviation of the wrist. However, a 30° loss of dorsiflexion present initially reduced to 10° at the end of 3 years. He was able to return to his pre-injury lifestyle at one year.[4]

At the 3 year followup visit, the patient was pain free and had a full range of pronation with supination of the forearm and radial and ulnar deviation of the wrist. However, there

Figure 3: (a) Immediate postoperative radiograph; red arrow showing K-wires fixing fracture scaphoid and blue arrow showing wire fixing lunate to capitate. (b-f) Postoperative CT scans: yellow arrow – wires in scaphoid; red arrow: wires fixing lunate to capitate

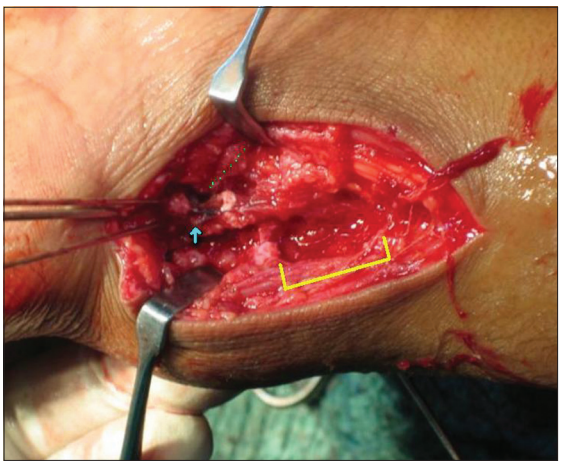

Figure 4: Peroperative photograph showing pronator quadratus flap being attached at scaphoid fracture site. Yellow half rectangle shows the width of the graft raised from distal radius; green arrow is where the graft is attached at scaphoid provisionally fixed by K-wires before being sutured; dashed line indicates the muscle used to augment radioscaphocapitate ligament

was a 10° dorsiflexion deficit in the injured wrist [Figure 5]. MRI of the wrist revealed osseous union of the scaphoid and no evidence of radiocarpal or midcarpal arthritis. No osteonecrosis of the lunate or the proximal pole of

Figure 5: Final followup clinical photograph showing good range of dorsiflexion and palmar flexion at wrist

the scaphoid was evident [Figure 6b]. His carpal indices were: Scapholunate angle 40°, lunocapitate angle 12°, and scapholunate distance 3 mm [Figure 6a].

Discussion

Perilunate dislocation, dissociative or non-dissociative, is common because the lunate is relatively fixed rigidly in its position by various extrinsic, intrinsic carpal ligaments and the radial strut formed by radial styloid, scaphoid and the volar radioscaphoid ligament.[5] This makes lunate relatively more stable than the other carpal bones and increases the relatively higher incidence of perilunate versus lunate dislocations.

Figure 6: (a) Recent followup PA and lateral radiograph showing scapholunate angle of 40° and lunocapitate angle of 12° with no evidence of osteonecrosis of scaphoid/lunate and osteoarthritis. (b) Followup MRI scan of wrist T1and T2 images showing good alignment of carpal bones with no degenerative or avascular changes

Volar transcaphoid transcapitate perilunate fracture dislocations as in our case are not so common injuries.[6] They are caused by fall on palmar and ulnar deviated wrist.[7] The factors that have a negating impact on the clinical and radiographic results after such injuries include delay in reduction, severely contracted soft tissue and atrophied ruptured ligaments, inadequate reduction, and fracture malunion. Carpal instability, degenerative changes of the radiocarpal and midcarpal joints, and osteonecrosis of the lunate and scaphoid often complicate the injury.[8]

The fracture of scaphoid and capitate in the index case showed substantial displacement. Ligaments of significance which were ruptured were partial volar radioscaphocapitate and lunotriquetral, and dorsal radiocarpal ligament which was partially torn. We planned a two stage procedure for the following reasons: 1) First stage distraction helped to make subsequent open reduction easier in this 3-month-old case. 2) It also decreases the incidence of soft tissue complication, viz., skin necrosis, infection and decreases the need for release of already precariously injured ligaments to achieve reduction. This reduces the chances of subsequent carpal instability. 3) Distraction also reduces the chances of inflicting an acute traction causing median nerve injury and thus reduces the incidence of reflex sympathetic dystrophy. Subsequent reduction was achieved by combined volar and dorsal approach.[8] The reasons to do a combined approach are: 1) We were not able to reduce only from the volar side as the the chip fracture of capitate was making the reduction solely from volar side unstable. So, with the intent to achieve reduction and fix this capitate fracture, we opened the wrist also from the dorsal side. 2) we also wanted to add the pronator quadratus flap which could only be done by volar approach.

Volar approach to wrist also helped in median nerve decompression besides fixation of fracture of scaphoid. Pronator quadratus osteo-periosteal muscular flap was used to increase blood supply of scaphoid and hasten healing of any microscopic osteonecrosis if it had occurred. It enhances the chances of union of fracture scaphoid. It also acted as a bone graft and augmented the partially rupture volar radioscaphocapitate ligament.

The dorsal approach was used to reduce the fracture capitate, the dislocation itself, repair of partially ruptured dorsal radiocarpal ligament and lunotriquetral ligament was augmented by capsulodesis and part of extensor indicis tendon. We used Kirschner wires instead of Herbert screw for fixation of fracture scaphoid because Kirschner wires are easier to insert, permit better rotational control, and do not cause any additional damage to the soft tissues.[9]

In our patient, neither the scaphoid nor the lunate demonstrated any evidence of osteonecrosis or instability, despite the magnitude of displacement and the absence of any soft tissue attachments. The pronator quadratus flap inspired from the use of musculoperiosteal flaps for old fracture neck femur[10] was used by us for three reasons: 1) to increase the vascularity of scaphoid; 2) it also provided a bone graft which hastens its fracture union; and 3) it was used to augment the partially ruptured volar radioscaphocapitate ligament. At the final followup, the lunate was relatively volar flexed on the lateral view but the lunocapitate angle was 12° [Figure 6a]; this might be the reason for decreased dorsiflexion.

The preoperative distraction followed by open reduction and fracture fixation by musculoperiostal flap gave good outcome in neglected transcaphiod perilunate dislocation, though this procedure requires two surgeries.[11]

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