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Complex surgical management of Post-traumatic Carpal Instability Nondissociative; case report and literature review

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ABSTRACT: Post-traumatic Carpal Instability Nondissociative is an extremely rare injury. There is limited evidence in terms of its surgical management and outcomes of operative intervention. In this report, we give a detailed account of complex surgical management of a post-traumatic Carpal Instability Nondissociative in a forty-two-year-old male patient who sustained a road traffic accident. We performed open reduction and internal fixation of scapholunate dissociation by a double approach; extended the flexor carpi-radialis and posterior approach to scapholunate. the patient improved substantially and was discharged home within fortnight in a stable condition. Operative intervention for management of post-traumatic Carpal Instability Nondissociative was successful in our patient. Flexor capri radialis extension was effective and unique method in stabilizing the carpal instability. Further studies should attempt to use robust trial design and large sample size if possible. We recommend operative intervention for management of complex post-traumatic Carpal Instability Nondissociative.

KEYWORDS: Trauma; Carpal Instability Nondissociative; Flexor capi radialis extension; Radial styloid fracture.

I. BACKGROUND

Carpal instability nondissociative (CIND) is a condition when the proximal row of the carpal bones experience kinematic dysfunction. The condition does not involve disruption between bones within the same carpal row, thus is different from its sister condition Carpal Instability Dissociative [Wolfe et al., 2012].

It is extremely rare to get posttraumatic CIND, therefore effective surgical and non-surgical interventions are unknown [Chantelot, 2014]. Earlier reports have highlighted how challenging traumatic CIND could be in terms of presentation, diagnosis, and operative intervention [Arms et al., 1995]. A recent report recommended operative intervention for dorsal intercalated segment instability pattern (CIND-DISI) because of the high likelihood of severing of ligaments in this type. The surgery recommended involves proximal row carpectomy, total wrist fusion, ligament suture, or radiolunate fusion. However, non-surgical or conservative management was recommended for volar intercalated segment instability (CIND-VISI), as it is unlikely to involve ligament rupture [Urbanschitz et al., 2021].

Authors have recommended early recognition of traumatic and management of CIND to safeguard against development of fixed deformity [Loisel et al., 2021].

II. CASE PRESENTATION

We present a case of a 42-year-old male with post-traumatic CIND that occurred in the context of left open humerus fracture and closed distal radius fracture. The injury was quite complex and involved three aspects [See Figure 1]:

1. Carpal instability non-dissociative (CIND)
2. Avulsion fracture radial styloid volar rim of radius ulnar styloid
3. Scapholunate instability
4. Notably the patient had no medical comorbidities and was not on any long-term medications. He had no previous surgery for any reason.

We carried out operative intervention in the form of open reduction and internal fixation. Firstly, we reduced the volar fragments, then fixed it with volar plate. We augmented that with volar ligament suture repair. Secondly, for the open reduction and internal fixation of scapholunate dissociation, we performed a double approach; extended the flexor carpi-radialis and posterior approach to scapholunate [See Figure 2]. the patient improved substantially following surgical intervention. He was discharged home withing fortnight following operative intervention in a stable condition.

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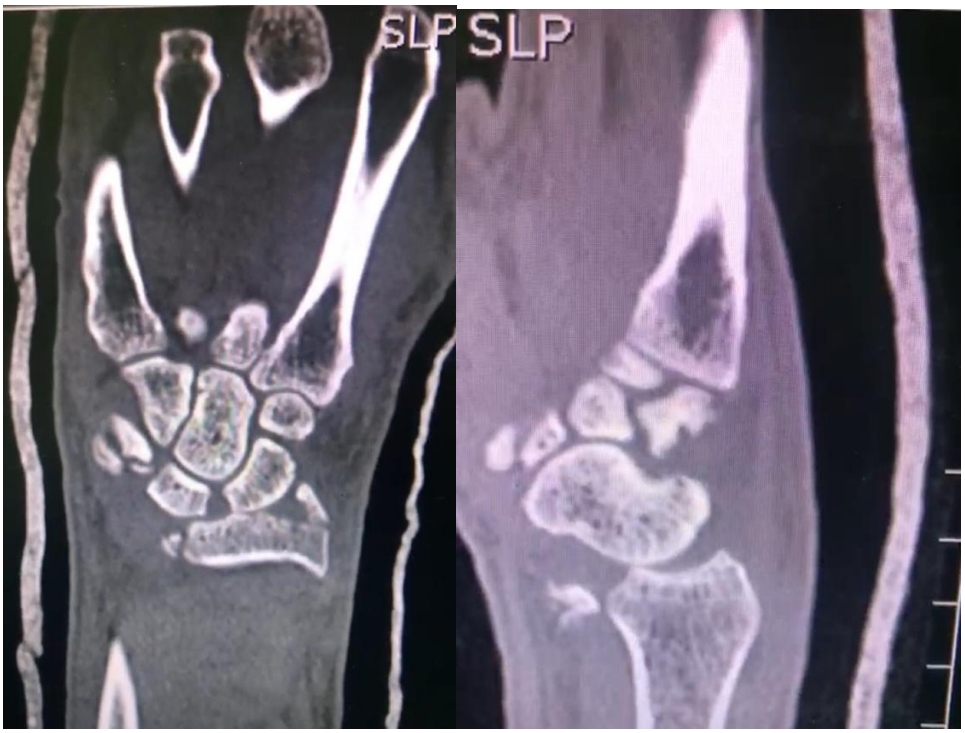

Fig. 1. Preoperative wrist CT sagittal and coronal views demonstrating radiocarpal malalignment and volar rim of distal radial avulsion fracture

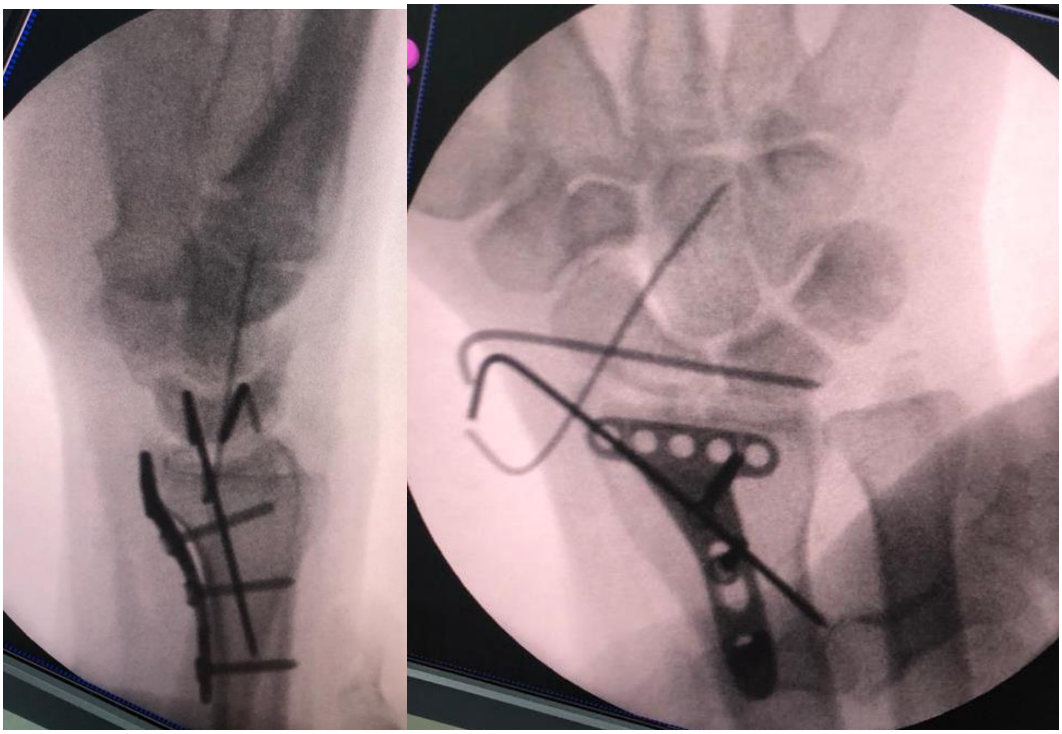

Fig. 2. Postoperative wrist x-ray after reduction of volar fragment and fixation with volar plate in addition to volar ligament repair and scapholunate reduction and fixation

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III. DISCUSSION

In this case study we provide details of success of operative intervention in a treatment of post-traumatic Carpal Instability Nondissociative that occurred in the context of avulsion fracture radial styloid volar rim of radius ulnar styloid and scapholunate instability. Literature indicates that, particularly for palmar CIND that affects primarily the proximal row of carpal bones, surgical intervention involves radiocarpal fusion, intercarpal fusion, arthroscopic thermal capsulorrhaphy [Burn et al., 2020], and soft-tissue reconstruction [Wolfe et al., 2012; Mason and Hargreaves, 2007].

In our approach we extended the flexor carpi-radialis muscle. This approach is unique and, to the best of our knowledge, was not tried before in surgical management of CIND. One recent report suggested partial transfer of the tendon of the flexor carpi radialis in order to stabilize cases of non-traumatic midcarpal instability [Zijlker et al., 2020]. The flexor carpi radialis tendon was used extensively in constructing grafts for reconstructing damaged scapholunate ligaments [Iyengar et al., 2017]. Clearly, these uses were primarily tried for conditions other than CIND. We present evidence that extending the flexor carpi radialis is of help in surgical management of post-traumatic CIND. It is believed that transferring the flexor carpi radialis tendon re-enforces the stability of scaphotrapeziotrapezoidal joint, and, thus, enhances the stability of the wrist joint in its both palmar–radial side and dorsal–ulnar side [Zijlker et al., 2020]. In our approach, however, we believe that extending the flexor carpi radilis could further strengthen midcarpal, thereby further tightening of the scapholunate ligament in our patient, as suggested by previous reports of the importance of wrist muscles in prevention of midcarpal instability [Esplugas et al., 2016].

Avulsion fractures of the radial styloid or ulnar styloid are quite rare also [Weintraub et al., 2020]. Recent reports also advocated operative management for avulsion styloid fractures [Özbek et al., 2018]. Patients with avulsion fractures tend to be excluded from clinical trials [Kazemian et al., 2011] and the evidence is quite limited in terms of their surgical or non-surgical treatment options. Surgical fixation of ulnar styloid fracture was recently reported to produce an overall good clinical outcome [Chen et al., 2020]. Our current case report adds to that evidence of clinical utility of surgical intervention in management of radial styloid and ulnar styloid avulsion fracture.

One advantage we had with our patient is the prompt diagnosis of CIND and prompt management. The recent estimate for the injury-to-diagnosis lapse was 11 weeks [Loisel et al., 2021]. For prevention of complications, the earlier the diagnosis and treatment of traumatic CIND, the better the outcome.

Clearly, we can't rely on a single report in terms of providing robust evidence for surgical intervention as first line in management of post-traumatic CIND. Case reports are limited with reporting bias [Gill et al., 2020] and selection bias [Folkert et al., 2016]. However, given the rarity of the CIND condition, case reports and case series could be the only available options if we are to devise robust evidence for the effectiveness of surgical interventions.

Further studies should attempt to use robust randomized trial design and large sample size if possible.

IV. CONCLUSION

We recommend operative intervention for management of complex post-traumatic Carpal Instability Nondissociative.

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