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Volar plating of isolated ulna shaft fractures

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ABSTRACT

Background: Dorsal plating for ulna shaft fracture is a common practice. But this is associated with hardware prominence on the dorsal subcutaneous border of ulna necessitating implant removal on later days. Volar surface of ulna is flat similar to radius volar surface with good muscle cover reducing the problem of hardware prominence. So, we wanted to study the outcome of volar plating of ulnar shaft fractures.
Methods: Ten patients satisfying our inclusion criteria underwent volar plating using volar approach between FCU and ECU and 3.5 DCP was placed on flat volar surface of ulnar shaft under thick muscle cover of FCU and FDP.
Results: Out of 10 patients, 7 were acute fractures, 2 were neglected non unions and 1was non-union with implant insitu. Bone graft was used in non-union cases. All fractures united at 6-9 month post op without any complications.
Conclusions: Isolated ulnar shaft fractures are common orthopaedic injuries. Displaced fractures require stabilization with dynamic compression plate (DCP). Application of implant on its volar aspect in distal 2/3rd fractures is easy due to flat surface and avoids complications related to hard ware prominence and subsequent need for implant removal.

Keywords: Volar plating, Ulna fractures, Ulna non-union

INTRODUCTION

Fracture of forearm bones are common orthopaedic injuries. Open reduction and internal fixation with 3.5 DCP is the standard of care.[1] Ulna being a subcutaneous bone throughout its length on its dorsal surface makes implant like 3.5 DCP placed on this border to be prominent leading to soft tissue irritation and eventually necessitating implant removal.[2-4] Volar surface of ulna unlike its dorsal border is covered with flexor digitorum superficialis (FDS) and flexor digitorum pro-fundus (FDP), so placing implant like 3.5 DCP on this surface theoretically causes no or minimal soft tissue irritation. Further volar surface of distal 2/3rd ulna is flat like volar surface of radius making 3.5 DCP application easer without need for contouring the plate and overhanging which are common problem when it is applied on the dorsal surface.[5] Publications evaluating volar plate application for ulnar shaft fracture are not known to us on literature review. Most paper in literature are comparing volar plate application following ulnar osteotomy for ulnar impaction syndrome. Volar plating of both radius and ulna fracture may increase theoretical chances of heterotrophic ossification leading to stiffness due to violation of intraosseous membrane. In this view we wanted to study the outcome of volar plating of isolated ulnar shaft fractures.

METHODS

After institutional ethical committee approval, prospective study of volar plating of isolated ulnar shaft fractures was done between August 2021 to August 2022. This study was conducted at department of orthopaedics, Dr Chandramma Dayananda Sagar institute of medical education and research (CDSIMER), Deverakaggalahalli, Kanakapura Road, Ramanagara Dt, Karnataka, India. All patients getting admitted in orthopaedic department with

fracture shaft of ulna are include in the study when they satisfied our inclusion criteria like- age group 18 and above or closed physis, isolated displaced ulna shaft fractures involving distal 2/3rd of ulnar shaft, both closed and open injuries, both simple and comminuted fractures patterns and neglected non-union. Exclusion criteria involve-age group less than 18 or open physis, proximal 1/3rd ulna fracture and non-union with implant in situ on dorsal surface.

After informed consent and anaesthesia work up, all patients are operated under regional block under tourniquet control. Incision made on ulnar border of forearm in line between medial epicondyle and pisiform bone ulnar aspect (Figure 1). Length of incision tailored to site of fracture. Plane developed between flexor carpi ulnaris (FCU) and extensor carpi ulnaris (ECU) with care not damage sensory branch of ulnar nerve in distal 3rd of ulna (Figure 2). Volar aspect of ulna exposed after retracting the FDS and FDP anteriorly and pronator quadratus in distal 3rd of fracture. After fracture reduction 3.5 DCP applied and fixed (Figure 3). Bone grafting in non-union cases taken from proximal ulnar metaphysis. Wound was closed in standard method. After earl wound soft tissue and wound care, exercise for wrist and elbow initiated and followed. Patient reviewed in OPD at 1st, 3rd, 6th, 9th and 12th month interval for clinical improvement using DASH score and radiological signs of fracture union and function (Figure 4 and 5).

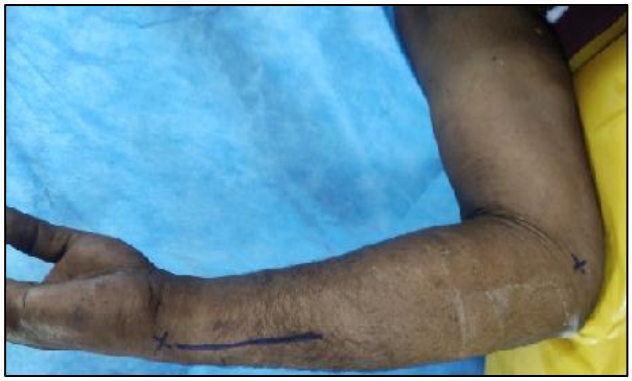

Figure 1: Skin incision marked between medial epicondyle and ulnar aspect of pisiform bone.

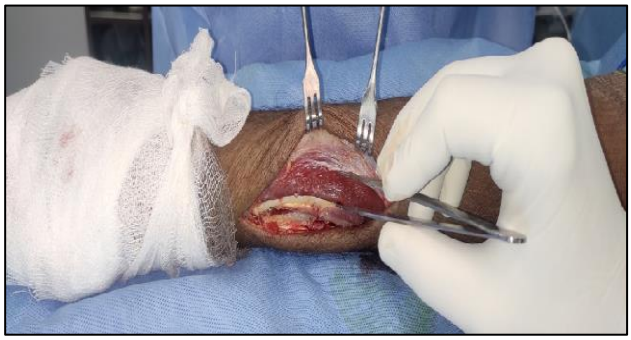

Figure 2: After skin incision plane developed between ECU () and FCU to expose volar aspect of ulna.

Figure 3: Implant is completely contoured to volar surface of ulna and covered by FCU preventing hardware prominence.

Figure 4: X-rays showing immediate post op and complete union at end of 6 months.

Figure 5: Near complete range of movements at wrist joint.

The data regarding demographic details, clinical features and DASH score was recorded in a semi structured pro forma. Data was entered in an MS excel spreadsheet. The statistical analysis was performed using SPSS v21.

RESULTS

Ten patients who satisfied our inclusion criteria were included in the study. Nine are male patients with age ranging from 24 years to 74 years and 1 female of 33 years (Figure 6). Seven cases were fresh traumatic injuries, 1 case was non-union with intramedullary nail in situ and 2 cases were neglected non-union cases (Figure 7). Bone grafting was used for non-union cases. All cases healed well at end 9 months. None of the patients complained about plate prominence or soft tissue impingement, however two patients complained about screw irritation on dorsal side. none of the patients had infection, implant failure or wound healing problems.

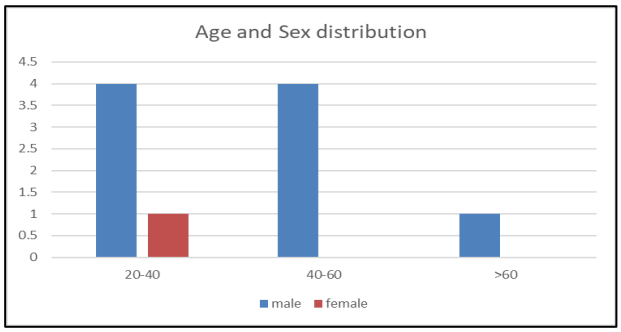

Figure 6: Demonstrating demographic data of study population. Indicating isolated ulna shaft fractures are common in male patients.

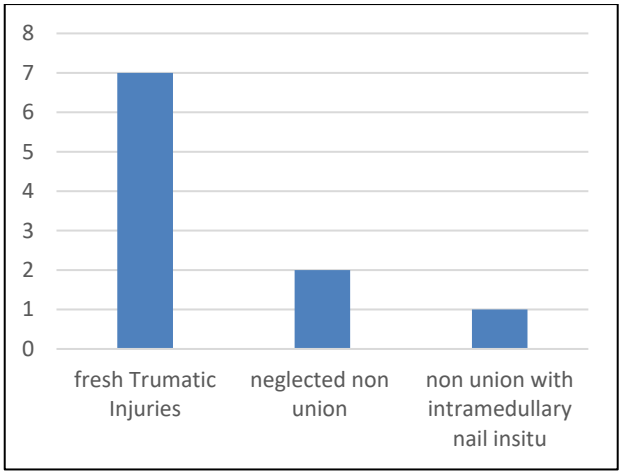

Figure 7: Different Diagnosis of ulna shaft fractures treated in this study.

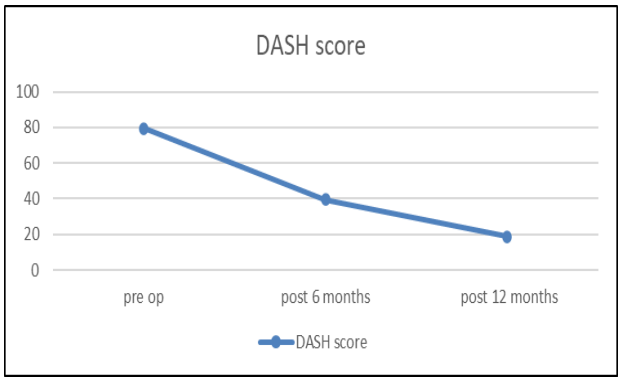

Figure 8: Comparison of pre-operative, 6 months and 12 months post-operative DASH Score. Indicating progressive improvement in functional recovery noted in this study.

DISCUSSION

Anatomic open reduction and stable fixation with 3.5 DCP is the standard of care for fracture of both bones forearm.[1-3] Routinely ulnar shaft fractures are fixed with 3.5 DCP on its dorsal surface and radius on its volar surface. Unlike radius which is flat on its volar aspect, dorsal surface of ulna is rounded making plate placement on this surface difficult without proper contouring and also plate over hang leading to soft tissue irritation and plate prominence on this dorsal surface.[4] Most paper comparing volar fixation of ulnar are from ulnar osteotomy for ulnar impaction syndrome.[6,7] We wanted to study the outcome of using volar plating in fracture scenario that is isolated displaced fractures of ulna shaft.

Dorsal placed ulnar plates require reoperation to removes the plates due to its prominence and soft tissue irritation.[4,9,10,12] In our study since plating for ulna shaft fractures are done on its volar surface none of the patients complained about plate prominence which required implant removal. However, two patients complained of

palpable screw on the dorsal surface. On evaluating these screws very found to be applied with more than 2 screw threads crossing the dorsal cortex effectively breaching the periosteum cover and impinging on musculotendinous covering sheath. So, to prevent this screw prominence we recommend not to cross the dorsal cortex of ulna beyond the 2 threads of screws.

Refractures after plate removal for dorsally applied plates was a known complication due to local osteoporosis under the plate with loss of vascular supply.[2,3] So, in our study none of patients required plate removal as there is no issue with soft tissue irritation from sub muscularly placed implant.

DASH score system using in our study to measure the outcome following the procedure.[8] This is particularly useful when we are dealing with non-union of ulna shaft fractures with implant *in situ*. We hand 3 non-union cases, one with IM rod and another 2 cases were failed conservative management with pop cast. Both these patients showed significant improvement in the DASH score following volar plating of ulnar fractures.

Ulnar fracture healing is delayed compared to radius fracture due to unfavourable corticomedullary ratio and disruption of dorsal periosteum both of this problem can be avoided by volar plating of ulnar shaft fractures.[1,13] Reduction of fracture and implant application is much easier with volar approach due to its flat surface and easy reduction along gravity assisted supine position, compared to dorsal approach where we have to position the forearm flexed at elbow which creates an antigravity force making fracture reduction and implant application difficult.

Limitation in our study is small cohort with short duration follow-up.

CONCLUSION

Isolated ulnar shaft fractures are common orthopaedic injuries. Displaced fractures require stabilization with DCP. Application of implant on its volar aspect in distal 2/3rd fractures is easy due to flat surface and avoids complications related to hard ware prominence and subsequent need for implant removal.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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