Diaphyseal Open Fracture of Forearm Bones Managed by Open Reduction and Internal Fixation with Dynamic Compression Plate

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This study was designed to delineate the outcome of surgical treatment of acute, open and displaced diaphyseal fracture both bones of forearm by early surgical toileting, debridement, reduction and internal fixation with DCP (Dynamic Compression Plate). A prospective study was carried out in 22 consecutive patients of acute, open and displaced diaphyseal fracture of radius and ulna that were treated and evaluated during the period of January 2012 to June 2015. All cases were managed by early surgical toileting, debridement if needed, open reduction and internal fixation with DCP. Two cases were reduced and fixed 3 days after injury. The average follow up was 12 months. All patients were evaluated with radiological and functional assessment. Twenty patients achieved normal union within 4 months of injury. One patient of Type IIIA developed superficial wound infection where delayed union occurred. Excellent results were found in 14 cases and satisfactory in 5 cases, 2 cases of unsatisfactory outcome with 1 delayed union. One patient developed non-union with unsatisfactory result with failure. Patients of open, displaced fracture of radius and ulnar diaphysis managed by early meticulous surgical procedure, open reduction and internal fixation with DCP was found to be a very effective method of treatment option.

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Key words: Diaphyseal fracture, open reduction, internal fixation, DCP, radius and ulna

Introduction

Management of both bones forearm fracture in diaphyseal area can be achieved by several procedure but in displaced fracture open reduction and internal fixation is the best option that is mentioned by many authors.[1-5] Maximum authors, focused on close fracture but comparatively few authors gave attention to open fracture of forearm bones and their management.[6-9] Open fracture management is always a challenge and it should be treated as emergency protocol. Delayed treatment or negligence means invitation of infection, malunion and non union associated with soft tissue scar that leads to over all unsatisfactory outcome.[10,11] So this study was deigns to evaluate the effect of immediate meticulous surgical toileting and debridement, open reduction and internal fixation with DCP in acute, open, displaced diaphyseal fracture of radius and ulna.

Methods

Between January 2012 to June 2015 period, this study was carried out in different Private Hospital of Kishoreganj district. 22 Cases of acute, displaced, open diaphyseal fracture of both radius and ulna were managed by early meticulous surgical toileting and debridement, open reduction and inter fixation with DCP.

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Prophylactic antibiotic with other necessary medication were given accordingly. Ages of the patients were ranging from 18 to 48 years where 18 were male and 4 were female patients. Right sided cases were 14 and left sided were 8 in number. Side of the fracture were distributed as 11 cases in middle third, 8 cases in the lower third and only 3 in the upper third (Table I).

Table I: Fracture site

Fracture site	No of cases	Percentage
Upper third	3	13.6
Middle third	11	50.0
Lower third	8	36.4

Based on the system of Gustilo and Anderson open fracture was classified as Type-I (N=12), Type-II (N=6), Type-IIIA (N=3), Type-IIIB (N=1).[10] (Table II)

Table II: Fracture type

Type of fracture	No of cases	Percentage
Type – I	12	54.5
Type – 6	6	27.3
Type – IIIA	3	13.6
Type – IIIB	1	4.6

Causes of injury in vast majority by road traffic accident (RTA) (N=18), sports injury (N=2), fall from height (N=2). (Table III)

Table III: Mode of injury

Mode of injury	No of cases	Percentage
Road traffic accident	18	81.8
Sports injury	2	9.1
Fall from height	2	9.1

4 Patient of RTA had associate others injuries that were treated accordingly. 14 patient were managed within 24 hours of injury and 5 patients within 48 hours, 2 case after 72 hours. The delayed patients need debridement with copious irrigation with antiseptic and normal saline. All necrotic tissue removed, reduction and internal fixation were performed with DCP. Drain was given in every cases and removed between 48 to 72 hours of operation. Systemic prophylactic antibiotic given in I/V route with other necessary medication. Surgical approach was Thomson or Henry approach for radius and ulna was exposed by incision between flexor carpi ulnaris and extensor carpi uulnairs. One patient of Type-IIIB was treated by delayed splite-thickness skin grafting. Each patient was followed up regularly to assess union and functional outcome for final evaluation. Average follow up of patient was 12 months. The final outcome was categorized with criteria of Anderson et al. The result was graded as excellent, satisfactory, unsatisfactory and failure. [11] (Table IV)

Results

Out of 22 cases 19 achieved normal union within 16 weeks of operation. One patient with open fracture Type-IIIA where delayed union occur. Initially this patients had compound fracture in nature. One patients developed non union in both radius and ulna which was Type-IIIB with secondary soft tissue infection left for further procedure next with unsatisfactory result and failure. Another patient with soft tissue injury with infection controlled with appropriate antibiotic after culture and sensitivity and ultimately healed with unsatisfactory outcome. So, only two patients of superficial wound infection that was controlled after using appropriate antibiotic in intra-venous route. One patient with posterior interossious nerve injury that healed spontaneously after 8 weeks. Final outcome revealed that 14 cases (63.6%) achieved excellent result, 5 cases (22.7%) got satisfactory result, 2 patients (9.1%) with unsatisfactory and one (4.6%) had non union which left for further surgical intervention (Figure 1).

Table IV: Anderson et al criteria for assessment of functional outcome

Result	Union	Flexion and extension at wrist joint	Supination and pronation
Excellent	Present	$<10^0$ loss	<25% loss
Satisfactory	Present	$<20^0$ loss	<50% loss
Unsatisfactory	Present	$<30^0$ loss	<50% loss
Failure	Nonunion with or without loss of motion		

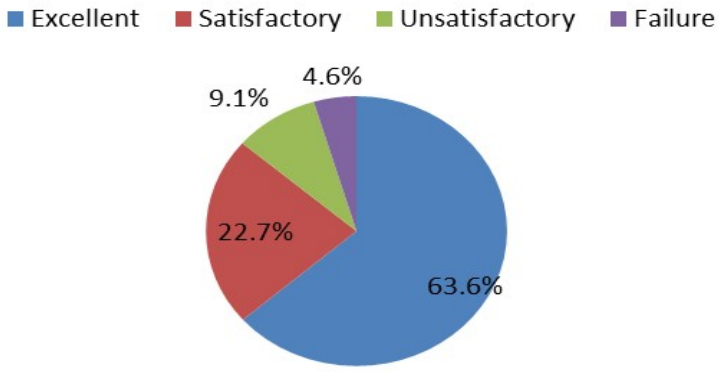

Figure 1. The representation of the results

Discussion

Diaphyseal open fracture of radius and ulna is not uncommon in orthopaedics practice. In this series 22 cases with acute, open, displaced fracture involving both radius and ulna treated by early meticulous debridement, open reduction and internal fixation with DCP. Associated injuries were found in 3 cases (13.6%) with tendon and soft tissue injury which also treated by appropriate procedure. Union occur in 16 weeks in 86.3% (19 cases) which is compatible with other series of reports including other series of close fracture.[7,8,9,12,13] This emphasizes fixation with DCP in achieving union of the fracture of both radius and ulna even in open fracture. In this series infection occur in 2 cases (9%) which is higher rate to that reports by others investigators is 5% but without deep infection.[7,8,11] Several studies indicated that immediate plating of open fracture in forearm bones does not increase the rate of infection and complication which are compatible with close fracture.[6,8,9,14,15] Meticulous debridement, copious irrigation, prophylactic antibiotic are the key to preventing infection in the management of open fracture. On the other hand early reduction and rigid fixation restore forearm stability earlier and prevent mal-union and shortening, thus, such procedure is more effective in soft tissue injury management also and subsequently improve wound care and avoid complication. In this series excellent and satisfactory result is 86.4% (19 cases). Full range of movement regain within 8 months of injury (Figure 2). Almost same results was found in Anderson et al in open fracture (80%).[11] Long time immobilization is most likely to cause joint stiffness and loss of motion in close procedure of treatment. In case of this series post operative long arm back slab were removed within 10 days of operation. So no chance of joint stiffness or motion limitation present in

this series. This is good that in internal fixation device post operative long time immobilization is unnecessary. Thus good early reduction and rigid internal fixation which made post operative long time immobilization unnecessary and early range of motion and rehabilitation may influence in obtaining good outcome. However severity of trauma is also important factor that indicate unsatisfactory result in one patient and failure of 1 case.

Figure 2. Initial R-ray of affected forearm fracture of a patient, B, C, D – Clinical photo showing follow up at 8 months with achieved full range of supination and pronation

Conclusion

Early meticulous surgical toileting, debridement when necessary, good reduction and rigid fixation with DCP are very effective in management of acute, displaced, open diaphyseal fracture of both radius and ulna in case of Gustiolo Type-I, Type-II, Type-IIIA and B. More precious comment can be made if sample size is large and follow up period is more for long time evaluation.

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