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Outcome assessment of management of fractures of the radius and ulna in adults using two different techniques: A retrospective study

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Abstract---Aim: To determine relationship between subjective, objective and radiographic outcome of two different method of treatment of fracture radius and ulna. Material & Methods: The present comparative study was carried out among 30 patients in the department of Orthopaedic, Indira Gandhi Institute of Medical Science, Patna, Bihar, India, for the period of 4 years after taking the informed consent and ethical approval from the concerned ethics committee. Complete information was available for 30 patients who had sustained mid-shaft fractures of radius and ulna. Data collection and radiographic findings were standardized for all 30 patients. All 30 patients were followed for 24 months. Results: In the present study 80 percent of patients reported no pain. The union occurred in 90 percent of radius fractures and 93 percent of ulna fractures. An average time for union was 17.14 weeks for the radius and 18.2 weeks for ulna. Conclusion: Outcome of open reduction internal fixation (ORIF) with plates and screws were better than close reduction internal fixation (CRIF) with IM nail, as former minimizes malalignment and resulting loss of forearm rotation. The

interpretation of radiological finding was associated with radiological alignment and functional outcomes.

Keywords---fractures, radius, ulna shaft, plate, nail.

Introduction

Diaphyseal fracture of radius and ulna are one of the most common orthopedic injuries, most of the cases requires surgical attention [1] therefore, familiarity with these topics is necessary for the inter-professional team in academic, clinical and community settings. Despite the commonality of radius and ulnar shaft fractures, studies that define the epidemiology are scarce. It appears that there is bimodal age distribution with peaks before age 40 and after age 60. Men have similar rates of both bone fractures compared to women early in life. However, women experience a higher proportion of fractures after the age of 60. [2] High school athletes and active individuals have also been shown to be at-risk populations. [3]. The most common cause is trauma, typically from an axial load on an outstretched hand or a direct blow to the forearm. In the elderly, forearm fractures are often the result of poor bone quality secondary to osteoporosis. Less commonly, both bone forearm fractures can be an insufficiency fracture due to cancer or other pathologic bone disorders. [4]

Osteosynthesis with Plate and screws and intramedullary nailing are most popular options among various surgical methods described for its treatment. [5] and ORIF with plate and screws had shown good functional results since many years. [6] However IM nailing offers various advantages in comparison with plates-screw fixation in form of fracture hematoma preservation, less stripping of periosteum and various biomechanical advantages. [1,5,6]. This study was to determine the relationship of outcome to modality of treatment, type of fractures and presence of associated injuries in adults who sustained fractures of the shafts of both radius and ulna. Measures of outcome investigated were patient satisfaction (amount of pain), rotation of forearm, radiographic findings and work status.

Material and Methods

The present retrospective comparative study was carried out among 30 patients in the department of Orthopaedic, Indira Gandhi Institute of Medical Science, Patna, Bihar, India, for the period of 4 years after taking the informed consent and ethical approval from the concerned ethics committee. All admitted patients more than of 18 years of age of acute fracture shaft radius and ulna were included in this study. Exclusion criteria were open both bone forearm fracture grade-2 and grade 3 (Gustilo-Anderson), pathological fractures and associated with multiple co-morbidities. Complete information was available for all 30 patients who had sustained mid-shaft fractures of radius and ulna. Data collection and radiographic findings were standardized for all 30 patients. All 30 patients were followed for 24 months. Out of 30 subjects, 18 were male and 12 were female. Average age of patients was 29 yrs (ranging from 18 years to 79 years). Two methods of treatment were utilized:

- Open reduction with plating (ORIF)
- Closed reduction with intramedullary nailing(CRIF)

The method of treatment was chosen by surgeon and the type of injury. Minimal displacement of closed fractures was the most frequent indication for closed reduction, and marked comminution was the primary reason for treatment with intramedullary nails and plaster. All reductions were performed under intra venous regional anesthesia (IVRA) with c-arm machine monitoring. The definitive treatment was ORIF with plate-screws in 15 patients, CRIF with IM nail in 15 patients. The union was defined as presence of bridging callus across the fracture site and nonunion was identified by the absence of callus within twenty-eight weeks following surgery. The standards for alignment of radiographs were based on Sage's study, which defined normal as nine degrees of radial and six degrees of dorsal bowing of the radius and zero degrees in both planes for the ulna. The end result ratings were made on a 14 point scale in four. Categories: (a) according to the level of pain in the injured limb; (b) by the range of forearm rotation; (c) radiographic criteria of union, synostosis, and malunion; and (d) economic-impact of the injury on the patient's employment status (Table 1).

Rating	Subjective	Objective	Radiographic
4	No pain	Combined loss of forearm rotation <30degree	Fracture united .combined malalignment (radius and ulna)<20degree
3	Mild pain, present with overuse	Combined loss of forearm rotation 31-60degree	Union, with combined malalignment 21-40degree
2	Moderate pain present with routine activities	Combined loss of forearm rotation 61-90degree	Union, with combined malalignment>40degree
1	Severe pain prevent routine activities	Combined loss of forearm rotation >90degree	Nonunion, synostosis or osteomyelitis

Results

Subjective Outcomes

80 percent (24 Patients) of total patients reported no pain, with no difference between patients with open and those with closed fractures. 80 percent (12 Patients) of patients treated with ORIF were pain free at 24 months, and 60 percent (9 Patients) treated with CRIF were pain free at the end of 24 months. Out of 30 patients, none of the patients had significant loss of wrist or elbow motion compared to the uninjured side. Average decrease in forearm rotation was 29 degrees with loss of slightly more supination than pronation. No significant difference was present in the loss of forearm rotation between closed and open surgical method.

Radiographic Outcomes

The union occurred in 90 percent(27 Patients) of radius fractures and 93.3 percent(28) of ulna fractures. An average time for union was 17.14 weeks for the

radius and 18.2 weeks for ulna. The union was more frequent after closed than after open method. Difference was most apparent in radius fractures and opened fracture compared to closed injuries. Average time for union was 15 percent longer for open than for closed fractures of the radius. 30 percent longer for open fractures of the ulna. Frequency and time for union were unaffected with the method of treatment. After 24 months of treatment the amount of forearm rotation lost was directly proportional to the loss of normal alignment. 63.3 percent(19) of patients had less than twenty degrees of malalignment of the radius and ulna. No difference was present between those patients with open and closed fractures. Modality of treatment, however, had a significant effect on the final radiographic alignment. 80 percent(12) of patients treated with ORIF had less than 20 degrees combined malalignment of the radius and ulna.

Complications

Infection: Overall Infection rate was 1.8 percent and more in open fractures. Infections were not observed in open fractures treated by immediate ORIF. Infections resolved with surgical debridement and appropriate antibiotic therapy. [Figure 1 & Figure 2]



Figure 1. Patient 1



Figure 1. Patient 2

Discussion

ORIF with plate is the commonly adopted method of treatment for both bone forearm fractures. Various articles have written about frequency of union which was good to excellent results ranging from 96% to 98% [7,8], in this study union rate in ORIF with plate-screw was 96.6 percent(n=29) which is comparable with the previous studies. In a retrospective study of fracture both bone forearm treated with CRIF with IM nail reported union of 94 percent with average union time of 73 days. None of their cases were landed up with postoperative infection and delayed union, only 6 percent of cases having non- union and there were no bio-mechanical failure. [9] In our study union rate of CRIF with IM Nail was 86.6 percent (n=26). In our study average union time for both bone fracture forearm is

17.67 weak (n=124 days) union time is slightly greater in CRIF with IM Nail, in ulna and in open fractures which is comparable with the other studies. [10-12].

Surgical treatment options include open reduction internal fixation (ORIF) and intramedullary nailing. Shorter intraoperative times and decreased scarring are observed benefits following fixation with intramedullary nailing. [13] However, achieving rotational stability as well as restoration of the radial bow is difficult with the use of intramedullary nailing. ORIF with plate and screw construct is generally accepted as the gold standard for treatment. [14] Comparison of ORIF and intramedullary nailing has been inconclusive. [15,16]. Some authors have stated that closed methods of treatment for displaced diaphyseal fractures of the radius, ulna, or both forearm bones produce unacceptable results. [17-19] Sarmiento et al. [20] reported excellent functional results after closed treatment in 43 patients.

There were various methods to assess functional outcome which includes range of motion on wrist and elbow, forearm rotation, subjective contentment[21]. No study demonstrated any significant difference in functional outcome. Two studies identified patients in the IMN group with rotational deformity and loss of pronosupination, while no patients in the ORIF group had similar deficit. However, statistical significance could not be attributed [22, 23]. In this study out of 30 patients, none of the patients had significant loss of wrist or elbow motion compared to the uninjured side. Average decrease in forearm rotation was 29 degrees with loss of slightly more supination than pronation. No significant difference was present in the loss of forearm rotation between closed and open fractures. The current study's limitations included a short-term follow-up and a lack of blinding. Studies with long-term follow-up and blinding are recommended to validate the findings.

Conclusion

The present study concluded that at the end of 24 months following treatments of fractures of the shaft of radius and ulna were good to excellent regardless of the method of treatment, except for longer time to unite. Rate of infection, outcomes of open and closed fractures were also similar. Results with ORIF were better than CRIF, as ORIF minimizes malalignment and resulting loss of forearm rotation. The interpretation of radiological finding was associated with radiological alignment and functional limitation.

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