

Original Research Article

A study of clinicoradiological and functional outcomes of intramedullary nailing in diaphyseal radius ulna fractures

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ABSTRACT

Background: The aim of this study was to evaluate the results of intramedullary nailing in diaphyseal fractures of radius and ulna in age group of 10 to 49 years and to understand its clinicoradiological and functional results.

Methods: This is a retrospective case series study of forearm bone fractures and the selected management for the same over a period of 3 years. We chose the cases in which intramedullary nailing was the treatment modality which were followed up over a period of minimum 6 months. Patients with galeazzi variety, monteggia variety, pathological fracture or non-union after previous surgery were excluded. The outcomes were then evaluated with disabilities of the arm, shoulder and hand (DASH) score, Green and O'Brien score, and Grace and Eversmann functional outcome score.

Results: Of the 22 patients, 10 patients had excellent functional outcome according to Grace and Eversmann score, 7 patients had good outcome, 4 patients had acceptable while 1 was unacceptable. Green and O'Brien also had similar results, except that patients among fair category were 3 and poor category were 3. The mean DASH score was 16.2.

Conclusions: This study shows that closed method for fixation by intramedullary nailing of both bone forearm fractures leads to excellent to good functional outcomes (according to DASH score, Green and O'Brien, and Grace and Eversmann score) with less complications. In 6 months follow up x ray there is radiological union in all cases with no angulation, malunion or non-union.

Keywords: Radius ulna fracture, Intramedullary nailing, Diaphyseal fractures, Closed fixation

INTRODUCTION

Forearm fractures are one of the most common fractures. Mechanisms of injury of these fractures are generally high energy accidents, direct trauma, fall from height etc. Open wounds along with neurovascular deficit is not uncommon. Both conservative and surgical approaches are being used depending upon the level and displacement of fractures.

Kim et al had documented 7.1 and 15.1 DASH score in their series of group A patients treated with plating and

group B patients treated with combination of plating and nailing respectively.¹ Wilson in their study of outcome of open reduction and internal fixation of both bone forearm fractures had stated similar results in open and close method of operative methods and fixation.² The strong predictors of outcome depend upon the associated hand, wrist and elbow injuries, magnitude of comminution, period of initiation of physiotherapy and subjective pain threshold.

Conservative approach is less frequently used as it is difficult to maintain reduction with forearm shaft

fractures having rotatory as well as angular motions. Also, it is most commonly associated with cast complications, non-union, malunion, compartment syndrome and Volkmann ischaemic contracture. Hence, surgical approach is the preferred option with final decision resting upon the treating doctor.

Adequate and early management of such fractures with internal fixation by nailing or plating must be carried out to avoid complications and to achieve a good range of motion in postoperative period. Supination, pronation of forearm, grip strength of the wrist, as well as complete mobilization at the elbow joint are all connected with proper fixation of the fracture.

George et al had described open reduction with plating, if done properly, restores normal anatomy and helps to achieve clinical and radiological union in most cases.³ However, as described by Lee et al it has its own set of disadvantages, like periosteal stripping, disruption of normal biological anatomy, post-operative infection, neurovascular deficit, direct pressure of the plate and stress shielding, refracture following plate removal and cost, to name a few.⁴ These can be avoided by using nailing as the preferred approach especially in open fractures.

According to Street et al, closed intramedullary nailing has advantages such as lesser incidence of infection, early union, smaller scars, less blood loss and shorter operating time.⁵

The objective of this study was to evaluate outcomes of closed fixation in radius ulna fractures by intramedullary nailing over a period of minimum 6 months. Nailing by using square nails or titanium elastic nail (TENS nail), or long Kirschner wire, have proven to be very efficient. With proper patient selection as well as good surgical technique nailing not only gives good functional outcomes but has also proven to be a better option in countries where cost is a major factor. Nails are cheaper, require less time, have much lesser complication and most importantly does not alter biological anatomy as it can be done in a closed manner.

METHODS

This study was conducted at Department of Orthopaedics, Smt. SCL Municipal General Hospital, NHL Medical College, Ahmedabad. It is a retrospective case series studies of 22 patients with both bone forearm fractures from July 2015 to August 2017 with minimum 6 months follow up. 17 male and 5 female patients of young and adult ages were included. Out of these 22, 9 patients suffered injury due to road traffic accidents, 12 patients had a fall while walking while one patient had direct assault as mode of injury 3 patients had Gustillo Anderson Type I open wound, 1 patient had type II while 18 patients sustained close injuries.

We performed a thorough clinical examination of the patients with both bone forearm fractures who came to our emergency department. Their fractured limbs were splinted immediately after assessing neurovascular status, distal movement and associated upper extremity injuries with radiographs. Preoperative planning with all haematological survey and necessary investigations were done. After taking informed written consent and obtaining institutional ethical procedural permission, we posted all patients for intramedullary nailing for both bone forearm fractures.

Inclusion criteria

Inclusion criteria includes those patients between the ages group of 10 to 49 years, those who has both bone forearm upper, middle and lower third fractures and patients with Gustillo Anderson type I and type II open injuries.

Exclusion criteria

Exclusion criteria are patients with fracture dislocations at elbow or wrist, old malunited fractures and old operated non unions.

All patients were given axillary block anaesthesia. Parts were prepped and draped. Tourniquet was not used in any of the cases. Traction view assessment of the fractures was done under image intensification. Majority of the radius fractures (midshaft and upper third shaft) were attempted to be reduced in closed manner. Proximal third radius fractures were reduced in closed manner and first nail was introduced upto fracture site from Lister's tubercle. Second entry was selected from radial styloid after safeguarding superficial radial nerve and thumb tendons. Having reached and crossed the fracture site, the two nails are advanced simultaneously stabilizing the fracture length and alignment. Ulna fractures were treated with intramedullary nailing in closed procedures. Rotations and flexion extension of upper extremity were checked after nailing both the bones of forearm and assessed under image intensification. Wound closed at entry site with non-absorbable sutures. Open wounds were cleaned and debrided. Dressings were applied and the extremity was splinted.

Dressings done were changed on 2nd day and X-rays were taken. Mobilisation of fingers and elbow in sugar tong cast was initiated within 10 to 15 days of surgery. Cast was removed after 6 to 8 weeks. Follow up X-rays were taken at serial intervals. Functional outcome assessment was at each follow up by DASH score, Green and O'Brien score, and Grace and Eversmann scoring system.

RESULTS

We had conducted a study of functional and radiological outcome of 22 patients treated by a single surgeon between July 2015 to August 2017 at our institute with a

mean follow up time of 6 months. There were 17 male (77.2%) and 5 female (22.8%) patients of age groups 10 to 49 years with mean age 24.23 (Figure 1). Among 22 patients 12 (54.54%) had domestic fall, 9 persons (40.9%) had roadside accidents while 1 patient (4.56%) had direct assault injury (Figure 2). 18 patients (81.8%) had closed injuries, 3 patients (13.63%) had type I open and 1 patient (4.56%) had type II open injury (Figure 3).

One patient had associated scaphoid waist transverse fracture while 1 patient had head injury which was investigated accordingly. 19 patients (86.36%) were operated within 24 hours of injury while 2 patients (9.09%) were operated within 24 -72 hours. One patient with head injury was operated on 5th day after head injury treatment. Mean days from injury to surgery was 1.5.

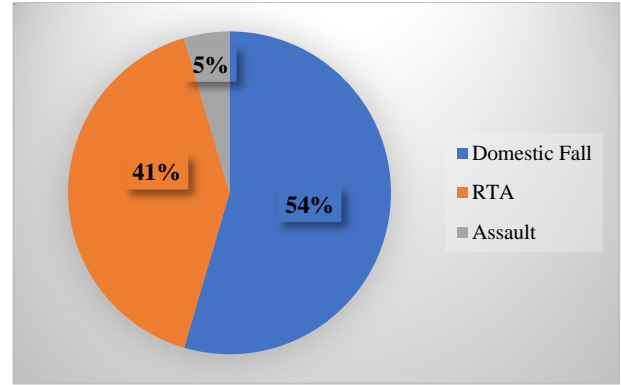


Figure 2: Mechanism of injury.

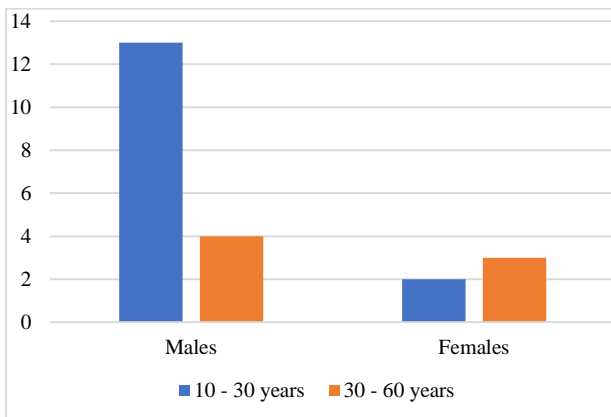


Figure 1: Age and gender distribution.

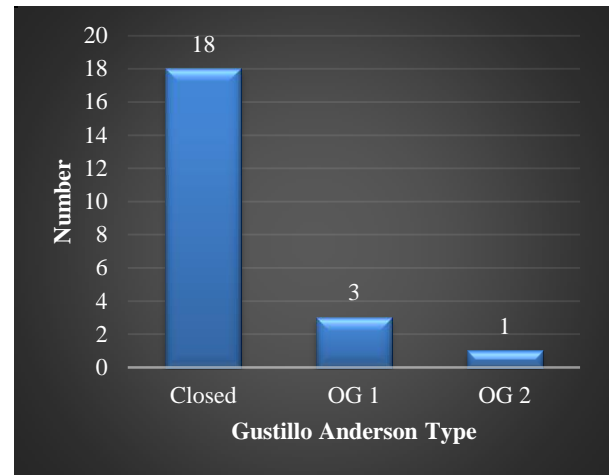


Figure 3: Type of injury.



Figure 4: Radiological union and functional outcome in 35 year old male.



Figure 5: Radiological union in 10 year old female, (A) pre-operative and (B) 1 year follow up.

Nine patients (40.9%) who sustained injury to middle third of shaft fractures were treated with radius and ulna square nail. Nine patients (40.9%) who sustained injury to proximal third shaft ulna with radius mid shaft fracture were treated in a similar fashion. Four patients (18.18%) with middle third-distal third junction radial shaft fracture with ulna fracture at variable shaft level were treated with

two simultaneous radius nail and/or rush pin/elastic titanium nail and ulna square nails.

All the patients were followed up for minimum 6 months. Radiological union was seen in all cases with no case of mal-union or non-union and with complete range of flexion and extension movements (Figures 4-6). Mean DASH score at final follow up was 16.2 (Figure 7). According to Green and O'Brien score 10 patients (45.45%) had excellent, 7 patients (31.81%) had good, 3 (13.63%) had fair while 1 (9.09%) patient had poor outcome (Figure 8). Grace and Eversmann score at final follow up depicted excellent outcome in 10 patients (45.45%), good in 7 patients (31.81%), acceptable outcome in 4 patients (18.18%) while unacceptable outcome in 1 patient (4.54%) (Figure 9).

Two patients (9.09%) with proximal ulna fracture treated with square nail had back out from entry site at 6 weeks of follow up. One patient (4.54%) had stiffness at elbow at final follow up. One patient had ulna nail back out with infection which was removed at 7 weeks and above elbow cast was applied for 4 weeks (Figure 10).



Figure 6: Functional outcome in 10 year old female.

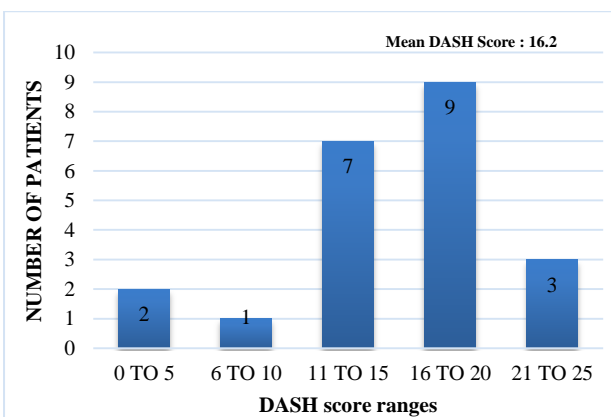


Figure 7: DASH score range.

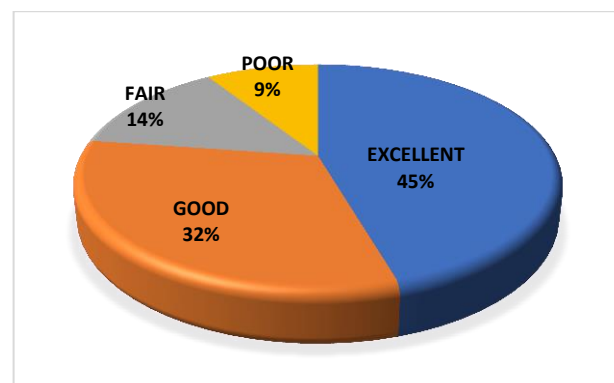


Figure 8: Functional outcomes based on Green and O'Brien score.

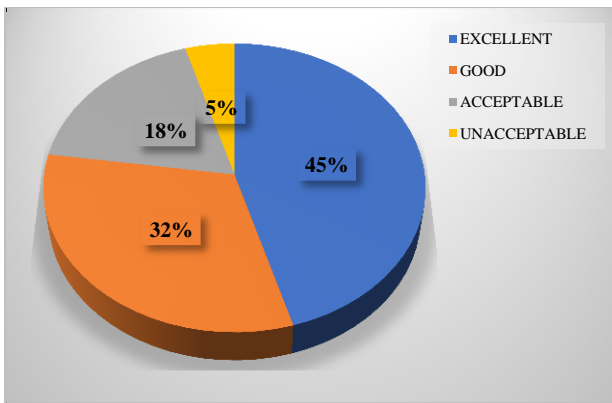


Figure 9: Functional outcomes based on Grace and Eversmann score.

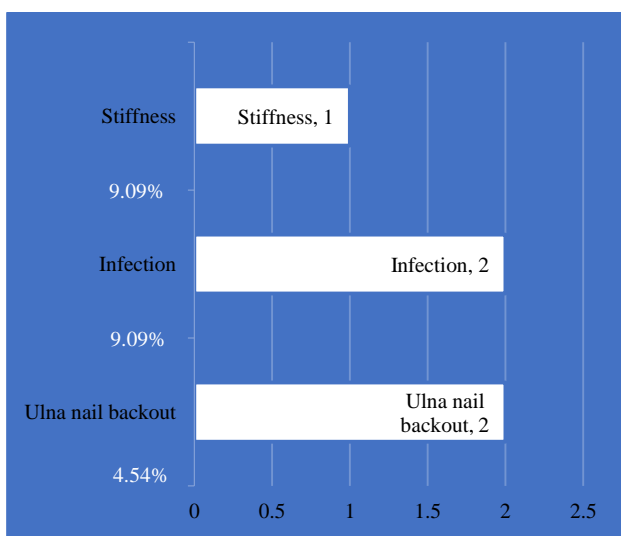


Figure 10: Complications.

DISCUSSION

Kapoor et al described results of intramedullary nailing in children with complete union in 95% patients with excellent functional outcome in all of them.⁶ Sahu et al had described advantages of TENS nailing in pediatric radius ulna fractures and concluded that it gave many advantages like better cosmetic and functional outcome with minimal complications⁷. Our study has a mean DASH score of 16.2 suggesting similar results.

Axial loading which is vertical compression along with rotational force leads to variable level of shaft of both bone forearm injuries. Supination of the forearm with a backward and upward loading force with a forward angulation while falling on an outstretched hand is comparatively a less severe mechanism than pronation and upward force. Direct impact which is referred to as ‘Nightstick injury’ also lead to shaft of ulna fracture.

Dhariwal has described sequential stacked flexible intramedullary nailing forearm fixation via close method

in mid shaft fractures.⁸ We have demonstrated stacked intramedullary introduction of nails at different sites and achieved medullary jamming in particularly middle-distal third junction fractures of shaft of radius.

Agarwal et al have reported similar functional outcomes in their study of radius ulna diaphyseal fractures treated with plating vs nailing methods.⁹ The advantages of nailing methods such as simpler technique, less soft tissue damage, inexpensive surgical devices make it a viable option to consider while selecting a method of surgical intervention for patients.

Restoration and maintenance of anatomic alignment of forearm fractures needs individual attention to the complications of forearm injuries with utmost care and diligence. In our study we had reported open injuries as well as closed injuries with skin abrasions. Soft tissue injuries are prevalent among the forearm region compared to other bones and due care and watchful observation are mandatory during the course of perioperative period.

Period of immobilisation should be minimum in the post-operative period of forearm nailing to prevent stiffness and Sudeck’s osteodystrophy. We mobilised patients of all fracture pattern immediately in a sling with above elbow loose splint encouraging flexion from 90 degree to 120 degrees for 15 to 20 days. Later we advised sugar tong cast with sling mobilisation preventing rotations upto 3 weeks. None of the cases were done with open method in our study group. Open method with plating is the treatment of choice which controls forearm rotations and achieves adequate length. But it carries the risk of extensive periosteal stripping, nerve damage and infection.

Pre bending and intra operative curve measurement is not necessary in radius nailing in distal third - middle third site fractures. Incarnation of parabolic curve is necessary in isolated fractures of radius in mid shaft region where interosseous membrane is relatively intact to generate deforming forces.

Azboy had described a unique locking intramedullary nails for forearm fractures in 32 patients where Grace and Eversmann score was excellent in majority of the cases with lesser complications.¹⁰ We had ulna nail back out with delayed union in ulna mid shaft fracture in 2 cases. This risk can be mitigated with locking design nails with jig assembly for ulna.

CONCLUSION

We thus conclude from this study that selecting closed method for fixation of both bone forearm fractures leads to excellent to good functional outcomes in patients (according to DASH score, Green and O Brien score, and Grace and Eversmann score) with a mean DASH score of 16.2 and a lower rate of complications (22.72%). In one

month follow up X-ray there is radiological union in all cases. This was achieved without any biological disturbance or risk of postoperative neurovascular deficiency.

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