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Corresponding Author
Sanjeev Kumar Gupta,
Department of Orthopaedics, MGM Medical College Vashi, Navi Mumbai, Maharashtra, India

Author Designation
[1]Associate Professor
[2]Assistant Professor

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An Analytical Study on Closed Enders Nailing for Fracture Both Bone Forearm

[1]Sanjeev Kumar Gupta and [2]Shravan Singh Rajput
[1,2]Department of Orthopaedics, MGM Medical College Vashi, Navi Mumbai, Maharashtra, India

ABSTRACT
This study aims to evaluate the functional outcomes of intramedullary nailing with Enders nails in the treatment of closed forearm fractures as primary treatment. 25 patients included in our study out of which, 15 were male and 10 were female patients aged 12-30 (average 14-18) years. Upper third fractures were 6, mid shaft 10 and lower third were 9. Average duration from trauma to surgery was 1-7 days. After a mean follow-up of 20 (range, 10-12) months, results were excellent in 19 patients, good in 5 and fair in one. None was poor. The mean operating time was 45 minutes. The mean time to bone union was 10 (range, 8-12) weeks. The mean time in the cast was 6-8 weeks. All patients regained a full range of movement, except in one who had limited supination and pronation (<20°) due to a degree of malrotation. 3 patients had pain at radial nail insertion site and 2 patients had superficial pin tract infection. Closed Intramedullary nailing using Ender nails plus cast immobilisation is effective method for treating both bone fractures in children and young adults as primary treatment.

INTRODUCTION

Closed Enders intramedullary nailing offers several advantages for managing forearm fractures in children and young adults, including reduced incision size, lower implant costs, shorter hospital stays and a reduced risk of infection[1,2,3,4].

MATERIALS AND METHODS

15 male and 10 female patients, aged 12-30 years (mean age: 14 years), underwent intramedullary nailing using Enders nails, combined with cast immobilization, as the primary treatment for bilateral radius and ulna fractures.

The injuries were caused by motor vehicle accidents (n=10), sports-related falls (n=10) and other falls (n=5). According to the AO classification, 10 fractures were type A, 9 were type B and 6 were type C. Surgery was performed within 1-7 days post-injury. Fractures were located in the upper third (n=6), middle third (n=10), and lower third (n=9).

Under general anesthesia, the radius was pinned from distal to proximal through a small oblique hole just proximal to the physis, while the ulna was pinned from proximal to distal through a hole just distal to the olecranon. The nail diameter ranged from 2.5 mm (n=18)-3.5 mm (n=2) and nails were inserted with image intensifier control. The ends of the nails were kept recessed to avoid skin irritation. Preoperative radiographs of the healthy forearm were used to measure nail length.

Postoperatively, an above-elbow plaster cast or slab was applied until sufficient bone healing occurred.

Patients were followed up every two weeks for the first two months and then monthly thereafter. At the final follow-up, clinical outcomes were graded according to the system described by Price *et al.* (Table).

RESULTS AND DISCUSSIONS

After a mean follow-up of 20 months (range: 10-12 months), outcomes were classified as excellent in 19 patients, good in 5 and fair in 1. None were poor. The mean operating time was 45 minutes, with a mean time to bone union of 10 weeks (range: 8-12 weeks). The mean duration in a cast was 6 weeks (range: 6-8 weeks) and the mean time to implant removal was 8 months (range: 6-10 months). All patients regained a full range of elbow movement, except one who had limited supination and pronation (<15°) due to malrotation. There were no intraoperative complications, re-fractures, non-unions, delayed unions, or deep infections. Two patients experienced pain due to nail protrusion and one had a superficial infection, which resolved with oral antibiotics.

Forearm fractures account for approximately 6-10% of all fractures in children and young adults. Traditional methods such as open reduction and plate fixation are often associated with higher complication rates, including infections, synostosis and re-fracture. Additionally, the long incisions required for plating can lead to significant scarring and increase the risk of nerve injury during plate removal, particularly when nerve identification is complicated by adhesions and fibrosis. Consequently, intramedullary nailing has emerged as a more favorable alternative[5,6,7].

Several types of nails, including Kirschner wires, Steinmann pins, Lottes forearm medullary nails and forearm interlocking intramedullary nails, have been utilized in clinical practice. However, Kirschner wires and Rush nails are rigid, making their insertion through the metaphyseal bones challenging. Enders nails were developed to address this issue, providing three points of stability: the insertion site at the metaphysis, the contact of the nail apex with the inner wall of the cortex near the fracture site and the anchoring of the nail tip into the opposite metaphysis. This design's flexibility facilitates callus formation by allowing minimal movement at the fracture site[8,9,10].

Fig 1: 3 months old post-operative X-ray with good union

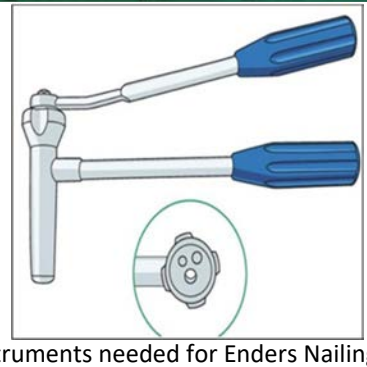

Fig 2: Instruments needed for Enders Nailing

Table 1: Sex Ratio

	Male	Female
No. of Patients	15	10
Percentage	60%	40%

Table 2: Percentage of Level of Fracture

Left Forearm	16	64%
Right Forearm	9	36%
Upper Third	6	24%
Mid Shaft	10	40%
Lower Third	9	36%

Table 3: Grading System of Price *et al.*

Outcome	Symptoms	Loss of orearm Rotation
Excellent	No complaints with strenuous activity	<15°
Good	Mild complaints with strenuous activity	15°-30°
Fair	Mild complaints with daily activities	31°-90°
Poor	All other results	>90°

While the distal approach for nail insertion is generally more convenient for both the radius and ulna, it can lead to elbow discomfort if the proximal ulnar incision is used. In our practice, we prefer a proximal approach for the ulna due to the narrower medullary canal at this location, which complicates pin insertion[13,14]. To mitigate potential irritation from the ulnar pin at the elbow, we opt for insertion below the olecranon through a lateral incision, relative to the anconeus muscle[15].

Single-bone fixation is technically less complex and requires less operating time., it also helps prevent the development of a cosmetically unacceptable bow in the forearm and provides a stable fulcrum to maintain the radius in a favorable position[17,18,19]. However, there remains a risk of re-displacement of the non-fixed bone and loss of reduction[21,22].

To optimize soft tissue and bony healing, mobilization and range-of-motion exercises are strongly recommended. It is noteworthy that re-displacement without cast immobilization has been reported in about 5% of cases. While intramedullary nailing tends to be less biomechanically stable than plating-allowing for 2° of motion at the fracture site during 20° of pronation and supination-our protocol of utilizing Enders nails in conjunction with cast immobilization appears to enhance fixation stability. Remarkably, all patients in our study regained full elbow and forearm rotation, along with bony union[23].

The removal of intramedullary nails is generally less complicated than the removal of plates. Patients who have undergone plate fixation often face an increased risk of re-fracture following hardware removal, primarily due to bone resorption that can occur under the plate as a result of necrosis from circulatory disturbances. In our study, no re-fractures were observed after nail removal, as we ensured that nails were not extracted until robust homogeneous callus formation was evident[24].

Although this study did not include a control group for comparative analysis, our findings suggest that intramedullary nailing with Enders nails is an effective and minimally invasive treatment option for managing unstable forearm fractures in children and young adults as primary treatment.

CONCLUSION

Closed Intramedullary nailing using Ender nails plus cast immobilisation is effective method for treating both bone fractures in children and young adults as primary treatment.

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