

ELASTIC INTRAMEDULLARY NAILING : AN ALTERNATIVE IN ELDERLY OSTEOPOROTIC FOREARM FRACTURES

Original Article Orthopaedics

Gagan Khanna¹, Rajan Sharma¹, Abhishek Rathore², Aditya Bhardwaj²

¹ - Associate Professor, Department of Orthopaedics, Sri Guru Ram Das Institute of Medical Sciences and Research, Vallah, Amritsar

² - Junior Residents, Department of Orthopaedics, Sri Guru Ram Das Institute of Medical Sciences and Research, Vallah, Amritsar

Corresponding Author:

Dr. Gagan Khanna
Associate Professor
Department of Orthopaedics
SGRDIMS, Vallah, Amritsar-143001
drkg75@gmail.com

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Abstract:

Objective : The aim of the study was to evaluate results of Elastic intramedullary nailing using Titanium Elastic nails in elderly osteoporotic displaced radius and ulna diaphyseal fractures.

Patients and methods: Thirty patients who underwent intramedullary nail treatment due to radius and ulna fractures were analyzed. Elderly patients with displaced forearm double fractures were included in this study. Patients with severely comminuted and compound fractures were excluded.

Results: Twenty two patients were female and eight were male. Nineteen patients suffered left and Eleven patients right forearm fractures. Average follow-up period was 6 months to 1 year, average bleeding amount was 51.11 (15–100) ml, average time to bone union was 11.3 (8–20) weeks, average surgery time was 61.94 (45–80) min and average fluoroscopy time was approximately 2 (1–5) min. According to Grace-Eversman criteria, results were excellent in 21 (70 %) patients, good in 5 (16.67 %), acceptable in 3 (10 %) and unacceptable in 1 (3.33 %). Average DASH questionnaire score was 15.21 (4–57.5). There was no iatrogenic vascular, neural and bone injury during surgery.

Conclusion: Intramedullary fixation method using Titanium Elastic Nail has advantages, such as closed application, short surgery period, good

cosmetic results and early return to movement. We think intramedullary fixation method may be used as an alternative treatment method to plate osteosynthesis in surgical treatment of radius and ulna diaphyseal fractures where there is potential risk of plate loosening in elderly osteoporotic fractures.

Key words: Elastic intramedullary nail, Osteoporosis, fracture forearm

Introduction

The human forearm serves an important role in the upper extremity function, facilitating placement of the hand in space thus helping to provide the upper extremity with its unique mobility. The presence of the proximal and distal radioulnar joints allows pronation and supination, and such movements are important to all of us in the usual activities of daily living. Moreover, the forearm serves as the origin for muscles inserting on the hand. Therefore, fractures involving the bones of the forearm present unique problems not encountered with fractures of other long bones and may significantly affect the function of the upper limb.

The relationship between the radius and ulna in the forearm is critical for function, especially pronation and supination. This relationship is so critical that the forearm has been called a "functional joint." Malunited fractures can impair this functional joint, with resulting impairment of pronation and supination. It is important to reestablish length, alignment, and rotation for the forearm to maintain its dynamic function. Anatomic reduction and internal fixation of forearm fractures can facilitate restoration of function and is now the standard for treatment of fractures of the shaft of the forearm. This is supported by the good results of rigid plate fixation in many studies.¹ Dynamic compression plating has been used in the past, application of a plate can disrupt the periosteal blood supply and necessitates skin incisions that may be unsightly; there is also a risk of refracture if the implant is removed.² In an attempt to preserve vascularity of the bone, new plates with limited contact between the plate and the bone have been devised.³ A new

locking screw concept has also been introduced in plate fixation of forearm fractures stabilization but these are costly as compared to other fixation method. Elderly osteoporotic bone are notorious for plate osteosynthesis Intraoperative chances of weak screw purchase is one of the complication with plate fixation method. Chances of Implant loosening in osteoporotic bones may lead to infection, non union and other complications. The use of intramedullary devices to stabilize fractures is not new. Ivory pins, the Küntscher nail, the Rush nail, and Ender nails have all been in use.⁴ The TENS Nail is specifically designed for Elastic Stable Intramedullary Nailing fracture fixation, for fixation of diaphyseal fractures of long bones where the medullary canal is narrow or flexibility of the implant is paramount. Intramedullary nail method has advantages such as closed application, less soft tissue injury, cosmetic advantages and providing rotational stability.⁵⁻⁶ TENS Nail has been used successfully in paediatric age group. The aim of our study was to evaluate the results of Elastic intramedullary nailing using Titanium elastic nail in elderly osteoporotic forearm fractures and their functional outcome.

Materials and Methods

The present study was conducted in the Department of Orthopaedics at Sri Guru Ram Das Institute Of Medical Sciences and Research, Vallah, SriAmritsar. In this prospective study 30 elderly patients who were admitted in emergency and OPD with diaphyseal fractures were included with average duration from injury to admission of 12 days.(1-28) All these cases were treated in our Institution between July 2012 to Jun 2015 and followed for 6 months to 1 year.

Inclusion criteria:

1. Age>50yr with or without co-morbid condition.
2. Diaphyseal fractures of radius and ulna

Exclusion criteria:

1. Compound fractures
2. Comminuted fractures
3. Neurovascular injury at presentation
4. Single bone fractures.

Standard forearm antero-posterior and lateral radiographs were taken at first admission to the hospital. In this study, 30 adult patients with displaced radius and ulna diaphyseal fractures were evaluated. 22 patients were females and 8 patients were males.⁵ of the fractures were caused by direct blow,¹⁵ were by fall on outstretched hand and 5 were due to road traffic accidents and remaining 5 were pathological fracture.¹¹ patients had fractures on right side and¹⁹ on left side. Forearm splinting is an option in the first days after surgery in order to alleviate pain in some patients. TENS nails are manufactured from a specific titanium alloy with proprietary surface treatment, which provides increased fatigue resistance.

Nail tip allows easy nail insertion and sliding along the medullary canal, Height of the tip guarantees correct relation to the medullary cavity. Facilitates nail manipulation for fracture reduction. The TENS nail provides the surgeon a means of bone fixation and helps generally in the management of fractures and reconstructive surgeries. These implants are intended as a guide to normal healing, and are NOT intended to replace normal body structure or bear the weight of the body in the presence of incomplete bone healing. Delayed unions or nonunions in the presence of load bearing or weight bearing might

eventually cause the implant to bend due to metal fatigue. All metal surgical implants are subjected to repeated stress in use, which can result in metal fatigue.

Surgical technique

A standard surgical technique was performed. In the majority of cases the radius was stabilised first. This was performed in a retrograde fashion via an entry point made just proximal to radial styloid or through Lister’s tubercle. The ulna wire/nail can be inserted ante grade either via an entry point at the posterior aspect of the olecranon or a lateral approach through the proximal metaphysis. The nail was inserted with a combination of hand pressure and taps from a hammer. In all cases an attempt to pass the nail across the fracture by closed methods was made. If this failed, an open reduction was performed using a small incision over the fracture site. Minimal soft tissue dissection allowed passage of the implant.

Post-operative care

In the postoperative period, immobilization with above elbow slab was given for 3 weeks. Elbow and wrist mobilization was done early according to general condition and co-operation of the patient. Pronation and supination of forearm were started after 3 weeks .Suture removal was done at 12 to 14 days after surgery. Patients were followed up at regular intervals of 6 weeks, 10 weeks, 6 months and 1 year.

Bone union was evaluated according to the lateral and A Pradiographs taken during the follow-up. Bridging call us formation was evaluated as union. Hand grip strength of all patients with union was evaluated with hydraulic hand-

dynamometer. Separate measurements were taken for treated and healthy forearms, when patients were in sitting position with the shoulders in neutral and abduction, the forearm and wrist in neutral and the elbow in 90 of flexion. In order to prevent muscle fatigue, measurements were done within 3 minintervals and average of

three different values was accepted as grip strength. Patients’ wrist, forearm and elbow joint range of motions were measured with goniometer. Functional evaluation was performed according to Grace- Eversmane valuation criteria and DASH (Disabilities of the Arm, Shoulder, and Hand) questionnaire score.

Grace and Eversman Criteria

Results	Union	Rotation Arc* (Supination/ Pronation)
Excellent	+	≥ 90 % Rotation Arc
Good	+	≥80 % Rotation Arc
Acceptable	+	60– 80 %Rotation Arc
Unacceptable	- Non union*	<60 % Rotation Arc

*Normal arcs of rotation were 80 degree of supination and 80 degree of pronation.

*Non-union was defined as a failure to achieve roentgenographic union.

Statistical Method

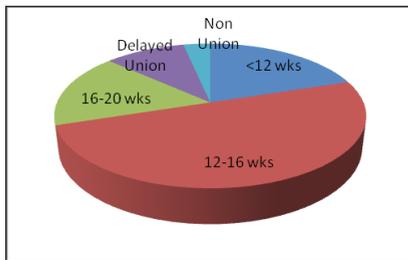
Data were recorded as percentage, arithmetic mean and standard deviation. Spearman’s correlation analysis was used for correlation between parameters. Correlation between pronation, supination and grip strength of the treated and healthy forearms was evaluated with Mann–Whitney U test. Correlation between the grip strength, pronation, supination and DASH of the treated forearm was evaluated with Spearman’s correlation analysis. p>0.05 value was considered as the significance level in evaluation of the results.

Results In our study 30 fractures of diaphyseal fractures of both bone forearm were included. All cases were fresh fractures, 22 patients were females and 8 patients were male. 5 of the fractures were caused by direct blow, 15 were by fall on outstretched hand, 5 were due to road traffic accidents and the remaining 5 were pathological fracture. 19 patients had fractures on right side and 11 on

left side. All patients were operated within 3 days. Average duration of surgery was 45 minutes. 21 patients showed radiological union within 16 weeks. Three patient went for delayed union and 1 patient with non union. We encountered 2 superficial infection,. They were treated with local debridement and antibiotics as warranted by culture report. However fractures went on to heal uneventfull. 70% of patients had excellent results with good range of supination and pronation. The duration of follow up ranged from 6 months to 12 months. Important observations and results are summarized in charts and tables below

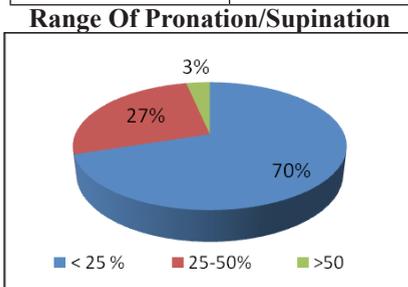
Union (weeks)	No of cases	Percentage
<12 wks	6	20
12-16 wks	15	50
16-20 wks	5	16.67
Delayed union	3	10
Non union	1	3.33

RADIOLOGICAL UNION



Radiological union was defined as presence of bridging callus across three cortex of 30 patients, 21 patients (70%) showed radiological union within 16 weeks.

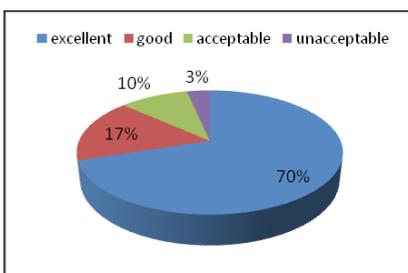
Percentage Loss Of Pronation / Supination	NO of cases
<25%	21
25-50%	8
>50%	1



Functional outcome was assessed using standard Grace and Eversman criteria and DASH questionnaire.

Grade	No of cases	Percentage
Excellent	21	70
Good	5	16.67
Acceptable	3	10
Unacceptable	1	3.33

Functional Results



MeanDASH questionnaire score was 15.21 (4-57.5) In 21 patients closed reduction was successful and

in 9 patient reduction is done with limited open reduction. There was no iatrogenic vascular, neural or bone injury during surgery. Various complications encountered during the study are depicted in the table below.

Complications	No of cases
Tendon Rupture (Extensor pollicisbrevis)	1
Nuerovascular Impairment	-
Loss of movements	1
Infection - Superficial	2
Deep	-
Loss of grip strength	-



PRONATION AND SUPINATION MOVEMENT AT 12 WEEKS POST OP



PRONATION,SUPINATION,FLEXION AND EXTENSION MOVEMENTS AT 12 WEEKS POST OP

Discussion

Plate fixation has been considered the gold standard for fixation of both

bone forearm fixation. Several studies have shown good results⁷. However, Closed nailing offers many advantages, including early union, low incidence of infection, small scars, less blood loss, and, frequently a relatively short operating time with minimal surgical trauma. Another important advantage of intramedullary implants is their stress-sharing behaviour, which facilitates secondary periosteal callus formation⁸. Our study comprised of 30 patients with diaphyseal fractures of both bone forearm who were treated by TENS nail. Overall final outcome was assessed by Grace and Eversman scoring system.

Reviewing the literature of standard studies, J Moerman, A Lenaert, DE Coninck, 1996⁹ presented a retrospective of acute fractures of diaphysis of ulna and radius an adults treated with intramedullary nailing. A modification of rush pin was used 70 diaphyseal fractures in 38 patients were treated by intramedullary fixation. The mean age of the patients was 31.5 years. Union occurred in 66 fractures (94%). The average union time was 73 days. There were no delayed unions. Non-union was seen in 4 cases (6%) The average time in the cast was 7.9 weeks. No postoperative infection was noted. The overall success rate was 83%. No failure of fixation or material breakage was seen in the study. They concluded that closed nailing does have many advantages, including early union, low incidence of infection, small scars, less blood loss and short operating time with minimal surgical trauma.

Ufuk OZKAYA, Ayhan KILIC, Umit OZDOGAN, Kubilay BENG¹⁰ evaluated the results of two different surgical methods (locked intramedullary nailing and plate osteosynthesis) for the treatment of

adult diaphyseal fractures of both forearm bones. Forty-two adult patients with forearm fractures were retrospectively evaluated. Of these, 22 patients (7 women, 15 men; mean age 32 years; range 18 to 69 years) underwent open reduction and plate-screw fixation, and 20 patients (6 women, 14 men; mean age 33 years; range 18 to 70 years) underwent closed reduction and locked intramedullary nail fixation. The fractures were classified according to the AO/OTA system. The patients were assessed using the Grace-Eversmann criteria and the DASH (Disability of the Arm, Shoulder and Hand) questionnaire. The mean operation time was 65 minutes (range 40 to 97 min) with plate-screw fixation, and 61 minutes (range 35 to 90 min) with intramedullary nailing ($p>0.05$). The mean time to union was significantly shorter with intramedullary nailing (10 weeks vs. 14 weeks; $p<0.05$). According to the Grace-Eversmann criteria, the results were excellent or good in 18 patients (81.8%) and acceptable in four patients (18.2%) treated with plate-screw fixation, compared to 18 patients (90%) and two patients (10%), respectively, treated with intramedullary nailing. The mean DASH scores were 15 (range 4 to 30) and 13 (range 3 to 25), respectively. The two groups did not differ significantly with respect to functional results and DASH scores ($p>0.05$). Postoperative complications were seen in three patients (13.6%) and two patients (10%) with plates crew fixation and intramedullary nailing, respectively. They concluded that two fixation methods yield similar results in terms of functional healing and patient satisfaction in the management of adult forearm fractures.

Haider Mohammed, Fareed Salloom et al, 2009¹¹ conducted a retrospective Study Between May 2004 and April 2006, twenty one pediatric patients with displaced forearm fractures were treated with flexible intramedullary nails at SMC. The study group included 19 boys and 2 girls aged 6 and 14 years (mean 9.3). Closed reduction and percutaneous introduction of nails was tried in all patients. Closed reduction and percutaneous introduction of the nails was possible in 9 patients. In 8 patients, a mini incision was needed for either the radius or the ulna. In 4 patients, both the radius and ulna needed exposure through mini incision. The patients were followed- up for a period between 6.7 to 35.7 weeks (mean 18.7 weeks). All fractures were united in acceptable alignment and nails were removed at a mean interval of 18.7 the two complications occurred were delayed union and mild limitation of forearm motion. However, the functional outcome was excellent

Conclusion

Use of TENS nail has resulted in and continues to result in predictable and good results. Complication rates are lower as compared to plateosteosynthesis and even locked intramedullary nails, although application of above elbow slab after nailing is a down side of the procedure. The TENS nail still has a future in repair of forearm fracture considering its complications rates, cost and acceptable results.

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