



Diaphyseal Fractures of the Forearm in Adults, Plating Or Intramedullary Nailing Is a Better Option for the Treatment?

Tabet A. Al-Sadek^{1*}, Desislav Niklev², Ahmed Al-Sadek³

¹Department of Orthopaedics and Traumatology, Belhoul European Hospital, Dubai, United Arab Emirates; ²Trakia University, Faculty of Medicine, Stara Zagora, Bulgaria; ³Medical University, Sofia, Bulgaria

Abstract

Citation: Al-Sadek TA, Niklev D, Al-Sadek A. Diaphyseal Fractures of the Forearm in Adults, Plating Or Intramedullary Nailing Is a Better Option for the Treatment? Open Access Maced J Med Sci. <http://dx.doi.org/10.3889/oamjms.2016.138>

Keywords: diaphyseal fractures of the forearm; plating; intramedullary nailing.

***Correspondence:** Tabet Al-Sadek, MD, PhD. Belhoul European Hospital, Dubai, United Arab Emirates. Mobile: +971551503964. E-mail: drthabet@abv.bg

Received: 09-Sep-2016; **Revised:** 09-Oct-2016;
Accepted: 11-Oct-2016; **Online first:** 24-Nov-2016

Copyright: © 2016 Tabet A. Al-Sadek, Desislav Niklev, Ahmed Al-Sadek. This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0).

Funding: This research did not receive any financial support.

Competing Interests: The authors have declared that no competing interests exist.

BACKGROUND: Fractures of the radius and ulna occupy a large field of the modern traumatology. Therefore, these fractures are a major subject in modern orthopaedics and traumatology. The study of the mechanisms of the trauma, and the pathophysiological changes that occur are of great importance for the development of ever more efficient and varied ways of the treatment and prophylactics of this type of fracture.

AIM: The aim of this paper was to study the pattern of the diaphyseal fractures of the forearm in adults, to decide the modalities of surgical management, to observe the period of fracture healing clinically and radiologically, as well to study the rehabilitation of the patients.

MATERIAL AND METHODS: The present study included 45 cases of diaphyseal fractures of both bones forearm in adults presenting to the orthopaedic outpatient department. For all the patients a detailed history was taken. A thorough clinical examination was carried out, required X-rays were taken, and initial treatment was given and admitted as in all patients. After careful pre-operative planning and evaluation for anaesthetic fitness, patients were operated for the fractures of both bone forearms. Twenty-three cases with 46 fractures were treated by open reduction and rigid fixation with DCP & Semi-tubular plates and 22 cases with 44 fractures were treated by closed reduction and fixation with "Talwarkar" intramedullary square nails.

RESULTS: United results were found in 100% of plating group vs. 86% in the nailing group. Delayed and non-union results were found in 9% of the nailing group only. Average time to union in weeks was 9.4 weeks in the plating group vs. 10.2 weeks in the nailing group.

CONCLUSION: Open reduction and internal fixation with compression plates with strict adherence to surgical technique is the gold standard method of treatment in both bones forearm fractures with excellent results than closed reduction, internal fixation with "Talwarkar" square nails which is also again a simple method with better results than conservative methods.

Introduction

Fractures of both radius and ulna are one of the most common fractures in adults in upper extremity [1]. In this era of active life, rapid industrialisation, increasing road traffic accidents, competitive sports, the incidence of fractures of forearm bones are increasing in frequency [2]. It is essential to regain length, apposition, axial alignment and normal rotational alignment while treating diaphyseal fractures of the radius and the ulna to gain good range of pronation and supination. The chances

for the occurrence of malunion and non-union are greater because of the difficulties in reducing and maintaining the reduction of two parallel bones in the presence of the pronating and supinating muscles, which have regulatory as well as rotatory influences [3]. To obtain and hold an accurate reduction internal fixation is usually necessary.

The aim of this paper was to study the pattern of the diaphyseal fractures of the forearm in adults, to decide the modalities of surgical management, to observe the period of fracture healing clinically and radiologically, as well to study the rehabilitation of the patients.

Material and Methods

The present study included 45 cases of diaphyseal fractures of both bones forearm in adults presenting to the orthopedic outpatient department. For all the patients a detailed history was taken. A thorough clinical examination was carried out, required X-rays were taken, and initial treatment was given in all patients. After careful pre-operative planning and evaluation for anaesthetic fitness, patients were operated for the fractures of both bone forearms.

Twenty-three cases with 46 Fractures were treated by open reduction and rigid fixation with DCP & Semi-tubular plates and 22 cases with 44 fractures were treated by closed reduction and fixation with Talwarkar" square nails.

Postoperative management: Patients who were operated by compression plates or intramedullary nails are immobilised in the above elbow POP (plaster of Paris) slab immediately after the surgery, and the operated limb is elevated continuously and the distal neurovascular status is checked.

Antibiotics are given IV for the first 5 days and then replaced with oral antibiotics till the 12th day after the surgery. Anti-inflammatory agents, analgesics and other supplements were given.

The post-operative dressing of the surgical wound is done on the 2nd, 5th and 8th day after the surgery. Sutures are removed on the 12th day after the surgery, and in the case of suture line gapping they can be removed on the 15th day after the surgery. Appropriate active physiotherapy started.

Follow up: All patients followed up in outpatient department for a period of one month post-operatively for the clinical and radiological union, functional recovery and for the complications. All patients were evaluated based on the Anderson scoring system.

Elbow movements and wrist movements were noted and the union was assessed radiologically and clinically. Results were evaluated by the radiological outcome, functional outcome and postoperative complications in both groups according to the Saikia et al., 2011 (Table 1) [3].

Table 1: Radiological outcome, functional outcome and post-operative complications [3]

Results	Loss of flexion /extension	Loss of pronation/supination
Excellent	Union <10	<25
Satisfactory	Union <20	<50
Unsatisfactory	Union >30	50
Failure	Non-union with/without loss of motion	

Results

Functional results by Anderson's Scoring system in both groups are presented in Table 2. We can see that excellent results in the plating group were 87% vs. 68% in the nailing group. Satisfactory results were found in 13% of plating group vs. nailing group. We found unsatisfactory and failure in 9% of nailing group only.

Table 2: Functional results by Anderson's Scoring system in both groups (plating and nailing)

Anderson's Scoring	No. of cases plating	%	No. of cases nailing	%
Excellent	20	87	15	68
Satisfactory	3	13	3	13.6
Unsatisfactory	0	0	2	9
Failure	0	0	2	9

Radiological findings are shown in Table 3: United results were found in 100% of plating group vs. 86% in the nailing group. Delayed and non-union results were found in 9% of the nailing group only. Average time to union in weeks was 9.4 weeks in the plating group vs. 10.2 weeks in the nailing group.

Table 3: Radiological Results of both groups

No.	Plating	%	Nailing	%
United	23	100	20	86
Delayed	0	0	2	9
Non union	0	0	2	9
Average time to union in weeks	9.4		10.2	

Complications were more associated with nailing group of which 2 cases had delayed union (2.2%), 2 cases developed non-union (2.2%), 1 case of malunion (1.1%), but in plating group only one patient developed superficial infection (2.2%), which was controlled with appropriate IV antibiotics after culture and sensitivity.



Figure 1: A- Pre-operative radiographic image. B,C and D- post-operative radiographic images after plating

Discussion

Fractures of both radius and ulna are one of the common fractures in adults in upper extremity [4]. Healing occurs relatively after closed treatment but mal-union with resultant decreased rotation of the forearm is common and has been associated with poor outcomes. Loss of rotation impedes the function

of the upper limb and activities of daily living [5].

The treatment of displaced fractures of shafts of radius and ulna is primarily operative [6]. The closed reduction and cast immobilisation for the displaced fractures should only be taken if there is a specific contraindication to operative treatment [7].



Figure 2: Postoperative results after plating

Open reduction and compression plate fixation have become the treatment of choice for diaphyseal fractures of forearm bones in adults. Compression-plate fixation gives a high rate of union, low rate of complications and the satisfactory return of rotation of the forearm. Thus excellent results of this mode of treatment have been reported in many series [8].



Figure 3: Postoperative results after plating

The AO- group has reported the successful use of compression plate and screws in the forearm shaft fractures. Since then it is one of the widely used and well-established methods of treating forearm bone fractures [8, 9].

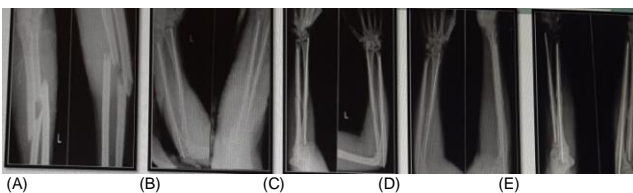


Figure 4: A Preoperative radiographic image. B, C, D and E, Postoperative radiographic images after using intramedullary nail

The advantages of the plate and screw fixation are that the reduction is done under direct vision; the plates are applied so that there is compression at the fracture site. Bone grafting can be done if needed. The fixation is rigid, so postoperative immobilisation in a cast is not needed. The disadvantages being, the risks of any open surgical fixation, that is increased the chance of infection, disturbance of the soft tissues, periosteal stripping, and evacuation of fracture hematoma [10].



Figure 5: Postoperative results after using intramedullary nail

One important disadvantage is the risk of refracture after removal of the compression plate, which necessitates the forearm being protected in a splint for 6 weeks and from severe stress for 6 months [11].

Mechanically intramedullary nails offer several advantages over the plate and screw fixation. Intramedullary nails are subjected to smaller bending loads than plates and are least likely to fail by fatigue. The reason is that they are closed to the mechanical axis than usual plate position on the external surface of the bone [12].

Closed intramedullary nailing definitely has an advantage over the other modalities of treatment. It is minimally invasive procedure requiring shorter operating time. The biology of the fracture healing is not disturbed. Bone grafting is usually not needed. The risk of infection is minimal [13]. Intramedullary nails act as a load sharing devices in fractures with cortical contact. Stress shielding with resultant osteopenia commonly seen with plate and screws is minimised with intramedullary nails.

In conclusion, open reduction and internal fixation with compression plates with strict adherence to surgical technique is the gold standard method of treatment in both bones forearm fractures with excellent results than closed reduction, internal fixation with "Talwarkar" square nails which is also again a simple method with better results than conservative methods.

References

- Andruszkow H, Pfeifer R, Horst K, Hildebrand F, Pape HC. External fixation in the elderly. *Injury*. 2015;46(Suppl 3):S7-S12. [https://doi.org/10.1016/S0020-1383\(15\)30004-8](https://doi.org/10.1016/S0020-1383(15)30004-8)
- Schmitt KU, Zürich PF, Muser MH, Walz F. *Trauma Biomechanics: Accidental injury in traffic and sports*. Springer Science & Business Media, 2009.

3. Saikia K, Bhuyan S, Bhattacharya T, Borgohain M, Jitesh P, Ahmed F. Internal fixation of fractures of both bones forearm: Comparison of locked compression and limited contact dynamic compression plate. *Indian Journal of Orthopaedics*. 2011;45(5):417-421. <https://doi.org/10.4103/0019-5413.83762> PMID:21886922 PMCID:PMC3162677
4. Alffram PA, Bauer GC. Epidemiology of fractures of the forearm. *J Bone Joint Surg Am*. 1962;44(1):105-14. <https://doi.org/10.2106/0004623-196244010-00009>
5. Court-Brown CM, Caesar B. Epidemiology of adult fractures: a review. *Injury*. 2006;37(8):691-7. <https://doi.org/10.1016/j.injury.2006.04.130> PMID:16814787
6. Anderson LD, Sisk D, Tooms RE, Park WI. Compression-plate fixation in acute diaphyseal fractures of the radius and ulna. *J Bone Joint Surg Am*. 1975;57(3):287. <https://doi.org/10.2106/0004623-197557030-00001> PMID:1091653
7. Kapoor H, Agarwal A, Dhaon BK. Displaced intra-articular fractures of distal radius: a comparative evaluation of results following closed reduction, external fixation and open reduction with internal fixation. *Injury*. 2000;31(2):75-9. [https://doi.org/10.1016/S0020-1383\(99\)00207-7](https://doi.org/10.1016/S0020-1383(99)00207-7)
8. Müller ME, Allgöwer M, Perren SM. Manual of internal fixation: techniques recommended by the AO-ASIF group. Springer Science & Business Media, 1991. <https://doi.org/10.1007/978-3-662-02695-3>
9. Vander Griend RO, Tomasin J, Ward EF. Open reduction and internal fixation of humeral shaft fractures. Results using AO plating techniques. *J Bone Joint Surg Am*. 1986;68(3):430-3. <https://doi.org/10.2106/0004623-198668030-00018> PMID:3949838
10. Arora R, Lutz M, Hennerbichler A, Krappinger D, Espen D, Gabl M. Complications following internal fixation of unstable distal radius fracture with a palmar locking-plate. *Journal of orthopaedic trauma*. 2007;21(5):316-22. <https://doi.org/10.1097/BOT.0b013e318059b993> PMID:17485996
11. Deluca PA, Lindsey RW, Ruwe PA. Refracture of bones of the forearm after the removal of compression plates. *J Bone Joint Surg Am*. 1988;70(9):1372-6. <https://doi.org/10.2106/0004623-198870090-00015> PMID:3182889
12. Lee YH, Lee SK, Chung MS, Baek GH, Gong HS, Kim KH. Interlocking contoured intramedullary nail fixation for selected diaphyseal fractures of the forearm in adults. *J Bone Joint Surg Am*. 2008;90(9):1891-8. <https://doi.org/10.2106/JBJS.G.01636> PMID:18762649
13. Amit Y, Salai M, Chechik A, Blankstein A, Horoszowski H. Closing intramedullary nailing for the treatment of diaphyseal forearm fractures in adolescence: a preliminary report. *Journal of Pediatric Orthopaedics*. 1985;5(2):143. <https://doi.org/10.1097/01241398-198505020-00003> PMID:3988914