European Journal of Molecular & Clinical Medicine (EJMCM)
ISSN: 2515-8260 Volume 07, Issue 11, 2020

Original research article

Fixation of diaphyseal fracture of radius using modifiedlateral approach and lateral platting method

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Abstract

Aim: to determine the diaphyseal fracture of radius fixation using modified lateral approach and lateral platting.

Materials and Methods: This retrospective observational study was carried out in the Department of Orthopaedics, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India, for 13 months. Total 30 Patients with Fracture of both bone forearm and isolated fracture of radius, who underwent radial fixation using modified lateral approach, were included in the study. Preoperative evaluation includes routine musculoskeletal examination with more focus on radial pulse, muscles supplied by PIN and sensation in dorsum of hand. Anteroposterior and lateral radiographs of forearm were obtained to evaluate fracture characteristics. The Active range of motion (ROM) of contralateral forearm and wrist were recorded by physiotherapist. Surgery was done under regional block and tourniquet.

Results: Out of 30 patients 20 were male and 10 were female underwent ORIF of radius using modified lateral approach. Of which 24 patients had both bone forearm fracture and 6 had isolated radius fracture. The average age at the time of the procedure was 35.5 years (range 17 to 55 years). 19 patients had involvement of right forearm and 11 on left forearm. The average duration of time since injury to surgery is 2.8 days (ranging from 1- 6 days). Average tourniquet time for radius fixation using lateral approach was 33 minutes (range from 23 to 53 minutes). All ulna fracture and all but 2 radius fracture were united at six months post op. One radius went for delayed union and united at 9 months follow up. Fracture union rate is 100% at one year in our study. At one year follow up arc of forearm rotation was 141.30 (89.8% compared to normal side) and arc of wrist motion was 141.80 (93.5% compared to normal side).

Conclusion: The direct lateral approach less traumatic as the surgical plane is devoid of vital neurovascular structure. The clinical and radiological results were comparable to studies which used standard volar and dorsal approaches.

Keywords: lateral approach, radius, fracture, platting

Introduction

Distal Radius Fractures [DRFs], which are coined to the term (pilon radiale), are the most common upper extremity fractures constituting 17-18% of all emergency fractures. The intra-articular variant stands for 50% of DRFs.[1] Unfortunately, DRFs are usually associated with other bony or soft tissue injuries in variable percentages according to the magnitude of

trauma and the bone quality. For example, ulnarstyloid fracture is associated with DRFs in 50-70% of cases.[2] In addition, it has been estimated that DRFs could be associated with capsular tears [2.4%], Triangular Fibro Cartilage Complex [TFCC] tears [40-60%], Scapho-Lunate Ligament Injuries [SLLI] [2-40%], Luno-Triquetral Ligament Injuries [LTLI] [20-68%] and cartilage lesions [2-30%].[3-5] DRFs show trimodal pattern of occurrence being common at young adults (high energy trauma), after 60 years, and in postmenopausal osteoporotic women (low energy trauma).[6] The clinical objectives of treatment of DRFs include: restoration of distal radius configuration through anatomic stable reduction, restoration of articular congruity of the radiocarpal and distal radioulnar articulations, maintenance of reduction through stable fixation, and finally allowing early active rehabilitation. Early active motion initiates some potential benefits comprising: minimizing stiffness, negating osteopenia of the distal fracture fragment, and enhancing cartilage repair. In addition there are radiological objectives aiming at restoration of distal radius alignment including: radial height loss < 5 mm, radial inclination > 15°, radiocarpal and radioulnar articular step-off < 2mm, maintaining sagittal tilt of the distal radial articular surface between 20° volar and 15° dorsal tilt.[7] Some authors have shown that articular surface step-off by > 1-2 mm will result in deleterious radiocarpal arthritic changes in 90% of patients within a follow-up period of 6-7 years.[8] Other authors suggest that the ability of intra-articular fracture remodeling becomes very limited when the joint step-off exceeds the thickness of the articular cartilage.[6] On the other hand, it is well established that coronal displacement of the DRFs will negatively affect the Distal Radioulnar Joint [DRUJ] function particularly in pronation/supination. Similarly, radial collapse will result in ulnocarpal impaction. Accordingly, DRFs with complex fragmentation patterns, extensive articular comminution, and meta-diaphyseal bone loss pose unique challenges.[7,9] Cast immobilization has been used satisfactorily in cases of undisplaced fractures or displaced stable fractures aft er reduction. In addition, it represents an appealing treatment option for elderly, unfit, and low demand patients. However, in the young, active, or high demand patients who have high expectations of regaining their normal activities, surgery might be mandatory to achieve the previously mentioned clinical and radiological objectives. Various surgical techniques have been proposed for such fractures including: Closed reduction and percutaneous k-wires fixation whether intra-focal.[10] inter-focal, combined, or intra-focal cross-pinning .

Materials and Methods

This retrospective observational study was carried out in the Department of Orthopaedics, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India, for 13 months. after taking the approval of the protocol review committee and institutional ethics committee.

Methodology

Total 30 Patients with Fracture of both bone forearm and isolated fracture of radius, who underwent radial fixation using modified lateral approach, were included in the study. Patients with neurovascular injury, open fracture, bilateral fracture, more than five days old fracture and patient who had previous history of trauma and immobilization of either upper limb were excluded from this study. Preoperative evaluation includes routine musculoskeletal examination with more focus on radial pulse, muscles supplied by PIN and sensation in dorsum of hand. Antero-posterior and lateral radiographs of forearm were obtained to evaluate fracture characteristics. The Active range of motion (ROM) of contra-lateral forearm and wrist were recorded by physiotherapist. All the surgeries were done by single surgeon. Surgery was done under regional block and tourniquet. Patient is supine with forearm on arm board in mid prone position. Tourniquet was used in radius fixation and the ulna fixation done without tourniquet. Skin incision centered over the radial fracture along a line which is drawn from a lateral epicondyle to radial styloid. Subcutaneous tissue and facia incised along

the skin incision. Branches of antebrachial cutaneus nerve in the proximal part to be identified and preserved. ECRL was identified by its relatively short muscle belly and long tendon. The plane between ECRL and ECRB is identified and retracted. Flexion of elbow to relaxes the ECRL aids in retraction. This will expose the whole length of diaphysis with supinator in proximal third, PT in middle third and distal third lateral suface is free from any muscle attachment but it is crossed by tendons of Abductor policis longus (APL) and Extensor policis brevis(EPB). Pronator teres insertion is not disturbed and the plate applied over its insertion. For distal fracture the tendons of APB and EPL retracted dorsaly or the plate may be glided underneath the tendons. The plate is applied on lateral surface and the radial bow is maintained by pre-contouring the plate using a template. Ulna is fixed using posterior approach. Fixation both ulna and radius was done using a 3.5 mm limited contact dynamic compression plate (LC-DCP) or dynamic compression plate (DCP). Mobilisation started on first post op day as tolerated by the patient under the direction of a physical therapist. ROM advanced incrementally as fracture site healing progressed, with a goal of full ROM by three weeks. Postoperative evaluation included clinical and radiographic evaluation at three, six, nine and twelve months. Clinical evaluation focused on measurement of ROM (forearm and wrist) by physiotherapist. The postoperative radiographs included biplanar views of forearm, which were evaluated for progression of healing. Healing was assessed by disappearance of fracture line and bridging callus formation.

Results

Out of 30 patients 20 were male and 10 were female underwent ORIF of radius using modified lateral approach. Of which 24 patients had both bone forearm fracture and 6 had isolated radius fracture. The average age at the time of the procedure was 35.5 years (range 17 to 55 years). 19 patients had involvement of right forearm and 11 on left forearm. The average duration of time since injury to surgery is 2.8 days (ranging from 1- 6 days). Average tourniquet time for radius fixation using lateral approach was 33 minutes (range from 23 to 53 minutes). All ulna fracture and all but 2 radius fracture were united at six months post op. One radius went for delayed union and united at 9 months follow up. Fracture union rate is 100% at one year in our study. At one year follow up (Table 2) arc of forearm rotation was 141.30 (89.8% compared to normal side) and arc of wrist motion was 141.80 (93.5% compared to normal side).

Table 1: Demographic profile of the patients

Gender	**Number of patients**	**Percentage**
Male	20	66.67
Female	10	33.33
Age		
Below 20	7	23.33
20-40	21	70
Above 40	2	6.67
involvement of forearm		
Right	19	63.33
Left	11	36.67
Delay in surgery	2.8days	
Mean stay in the hospital postoperatively	6.3 days	

Table 2: Clinical results at 12 months follow up

Average Active ROM	Fractured side	Normal side	Percentage
Forearm Supination	73.6^0	80.6^0	90.4%
Forearm Pronation	66.7^0	74.1^0	89.1%
Arc of forearm rotation	141.3^0	155.7	89.8%
Wrist flexion	66.4^0	69.8^0	94.2%
Wrist extension	74.4^0	79.3^0	92.9%
Arc of wrist motion	141.8^0	150.1^0	93.5%

Fig. 1: Superficial exposure

Fig. 2: Deep exposure

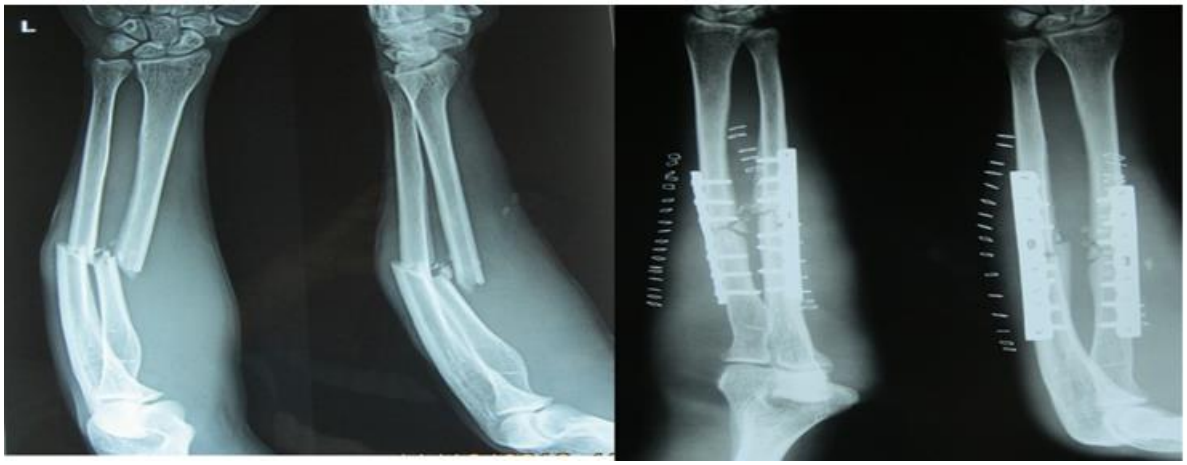

Fig. 3: Radiographic assessment

Discussion

There are very few studies on lateral approach to radius[11] and lateral platting of radius.[11] Most of the studies used either volar approach with volar plating or dorsal approach with dorsal plating. Average rate of union in our study is 100%, compared to 94.73% by Muhammad Haseeb et al, [11] 90% by Chapman et al,[12] 98% by Anderson et al[13] and 97% by Hadden et al.[14] The increased union rate in our study may be due less vascular insult with this approach or may be due to small sample size. We do not erase any muscle from bone for application of plate in this approach. The average arc of forearm rotation was 141.30 in our study compared to 129.60 by Muhammad Haseeb et al[11] and 1500 by Goldfarb et al.[15] The average arc of wrist motion is 141.80 in our study compared to 140.10 by Muhammad Haseeb et al[11] study. All but one radius fracture were unitted at the end of six months which is also unitted at 9 months without any intervention. No vascular or nerve injury in our study group No superficial or deep infection in our analysis. Hadden et al[14] reported nonunion in 3%, infection in 5.4%, and nerve injury in 6.3% in his study which included 111 patients. Chapman et al[12] reported nonunion in 2% and infection in 2.3% in his study. Functional and radiological outcome of our study results are comparable to the studies using the standard volar and dorsal approaches. Complication rates in our study are lesser as compared to other studies. Lateral approach is comparatively easier as the surgical plane is devoid of vital neurovascular structure. The modified lateral approach described by Backiaraj Devaraj et al [16] eliminates the theoretical risk of injury to superficial radial nerve by lateral approach.[17] Modified lateral approach with lateral plating of the radius is a viable alternative to the conventional techniques. But further long term prospective comparative studies with larger patient numbers are needed to confirm our results.

Conclusion

The direct lateral approach less traumatic as the surgical plane is devoid of vital neurovascular structure. The clinical and radiological results were comparable to studies which used standard volar and dorsal approaches. But its potential as an alternate to standard approaches has to be proved by randomized case control study in a large series of patients.

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Received: 02-09-2020 || Revised: 21-09-2020 || Accepted: 28-10-2020