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Original Research Article **Ortho Surgery**

Evaluation of Fixation of Fracture Shaft of Radius Ulna without Tourniquet

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Abstract

Background: Plate fixation is the mainstay of care for distal forearm shaft fractures in adults. By and large, volar or dorsal plating is used for radial shaft fractures. The radius's lateral surface offers an equal and constantly curved region for inserting a plate. The radial bow may be readily evaluated and restored after surgery. A prospective investigation was performed to examine the result of lateral plating of radius shaft fractures. ***Objective*:** In this study our main goal is to evaluate the treatment outcome of fixation of fracture shaft of radius ulna. ***Method*:** The research was conducted at tertiary medical hospital and district general hospital, Dinajpur included 100 patients. Several of them had broken both of their forearm bones, while others had broken only the radial shaft. Within 36 hours of damage, all patients were fixed with a 3.5 mm restricted contact dynamic compression plate or locking compression plate on the lateral surface of the radius. Typical procedure was used to repair the ulna. ***Results*:** During the study, majority were belong to 32-40 years age group, 36%. Followed by 20% were belong to 41-50 years age group, 11% belong to 20-31 years age group. In addition to that, 80% were male. 75% had fractured both of their forearm bones. Followed by 70% had closed fractured type, 35% had motor vehicle accident and lastly 85% had middle third radial shaft. Union was assessed by gradual disappearance of the fracture line and/or development of bridging callus at the fracture site. After getting treatment, 89% patients had excellent results, 8% had satisfactory and 1% had unsatisfactory result. There was 1% failure (nonunion). ***Conclusion*:** As compared to conventional methods, radial lateral plating holds promise as a viable option. Longitudinal studies with larger patient groups and study criteria are needed to confirm the potential advantages and validate our results.

Keywords: Fracture shaft, radius ulna, forearm fracture.

INTRODUCTION

An estimated one percent of all adult fractures are forearm fractures, making them a common orthopaedic injury [1]. The significant deforming muscle loads make non-operative methods of preserving adequate alignment in these fractures exceedingly difficult to implement [2-4]. Thus, internal fixation, preferably with plates, is the optimal treatment for all displaced, unstable adult radius and ulna fractures [5-9]. Traditionally, plating on the radius was performed either on the dorsal (Thompson) or volar (Henry) surface [10-13].

Forearm shaft fractures are examples of damage to the articular cartilage. Forearm stiffness or instability may come from non-anatomic reductions having an influence on the mechanics of the interosseus membrane (the third joint between the radius and ulna). As you rotate your body, your ulna stays relatively still while your radius spins around it. The radius is more noticeably curved than the ulna, which is straighter for easier rotation [14].

There is a significant amount of lateral and slight posterior bending of the radius. In 1959, Sage [15] stressed the need of keeping the radius curves, especially the lateral bow. Later, Schemitsch and Richards [16] backed up the concept, drawing the conclusion that a good functional outcome after treating a radius fracture was linked to reestablishing the typical volume and positioning of the lateral bow.

Unlike the volar and dorsal surfaces, which both have a varying contour and a curvature in the coronal plane, the lateral surface is consistently convex. Placing a straight plate on this curved anterior or posterior surface will cause the plate to be off the bone somewhat, as was discussed before. The typical Asian has a smaller radius than the average Westerner, therefore this is particularly true for them. We also saw that some malreduction and, hence, deformation of the radial bow is conceivable in the haste to seat the plate on the bone from the start.

Moreover, there is evidence that if the nutritive artery, which enters the radius anteriorly, is damaged, fracture healing is slowed or completely halted [17]. Hence, there may be some benefit to not applying the plates to the volar surface. However, whereas many texts and manuscripts focused on volar and dorsal plating of the radius, it was clear from examples with illustrations that the plate was placed on the lateral surface. Thus, it seems that sometimes, but unrecorded, lateral surface plating is performed. Hence, the seed for this investigation was planted. The clinical and radiologic results of plating lateral radial shaft fractures in adults piqued our curiosity [18-21].

OBJECTIVE

In this study our main goal is to evaluate the treatment outcome of fixation of fracture shaft of radius ulna.

METHODOLOGY

Between September 2021 and March 2022, a prospective case series was conducted at tertiary medical hospital and district general hospital, Dinajpur. Approval from the institution's ethics board was secured in advance. Patients with forearm fractures who were visiting the emergency room were solicited as subjects after receiving their informed permission. Patients under 18 years old, those with open fractures of grade 3 or more, those with preoperative neurovascular abnormalities, compartment syndrome, or those with significant ipsilateral upper limb injuries were not included.

The majority of the 100 patients who had surgery did so within the first 36 hours after their injuries. In most situations, the radius was reached before anything else. Henry was the only one of the three examples where the radius wasn't reached dorsally, but rather from the volar side (Thompson, 2 cases). From there, we figured out how to get a straight lateral access to the radius by using the space between the brachioradialis and the extensor carpi radialis longus, and we've been employing that method ever since. Care was taken to elevate the supinator to avoid damaging the posterior interosseus nerve in cases of proximal fractures. Depending on the plating method, a 3.5 mm limited contact dynamic compression plate (LC-DCP) or a locking compression plate (LCP) was used for fixation. When the radius was shortened, the lateral bow was measured using a template, and the plate was then shaped to fit the new surface. In a further step,[3] bicortical screws were inserted on each side of the fracture for a standard fixation. Injuries of the Galeazzi kind were evaluated for damage to the distal radioulnar joint (DRUJ), and treatment was provided if necessary. Patients with comminuted radius had their ulna repaired first. The closing was completed as usual.

RESULTS

Table-1 shows demographic status of the patients where majority were belong to 32-40 years age group, 36%. Followed by 20% were belong to 41-50 years age group, 11% belong to 20-31 years age group. In addition to that, 80% were male.

Table-1: Demographic status of the patients

Age distribution	**Percentage (%)**
20-31	11%
32-40	36%
41-50	20%
51-60	33%
Gender	**Percentage (%)**
Male	80%
Female	20%

Table-2 reveals injury status of the patients where 75% had fractured both of their forearm bones. Followed by 70% had closed fractured type, 35% had motor vehicle accident and lastly 85% had middle third radial shaft.

Table-2: Injury status of the patients

Injury	**Percentage (%)**
Fractures of both the forearm bones	75%
Isolated radial shaft fracture	25%
Fracture type	
Closed	70%
Open	20%
Mode of trauma	
Motor vehicle accident	35%
Fall on the hand	32%
Assault	20%
Torsional injury	13%
Affected level of radial shaft	
Upper third	15%
Middle third	85%

Table-3 shows functional outcome of the patients where union was assessed by gradual disappearance of the fracture line and/or development of bridging callus at the fracture site. After getting treatment, 89% patients had excellent results, 8% had satisfactory and 1% had unsatisfactory result. There was 1% failure (nonunion).

Table-3: Functional outcome of the patients

Result	%	Union	Flexion/extension at wrist	Supination/pronation
Excellent	89%	Present	<10° loss	<25% loss
Satisfactory	8%	Present	<20° loss	<50% loss
Unsatisfactory	1%	Present	<30° loss	>50% loss
Failure	1%	Nonunion with or without loss of motion		

Figure-1 shows preoperative radiograph, and immediate postoperative AP and oblique radiographs. The radius was approached dorsally, and the plate placed laterally after a lag screw. B: Follow-up AP, lateral and oblique radiographs at 4 months showing healed fractures.

Figure-1: Preoperative radiograph, and immediate postoperative AP and oblique radiographs

In Figure-2 reveals preoperative radiograph showing radial shaft fracture in the proximal third where immediate post operative AP and lateral radiographs after compression plating of the radius on the lateral surface. The approach used here was a direct lateral. C: Follow up radiographs showing union by primary fracture healing (no callus).

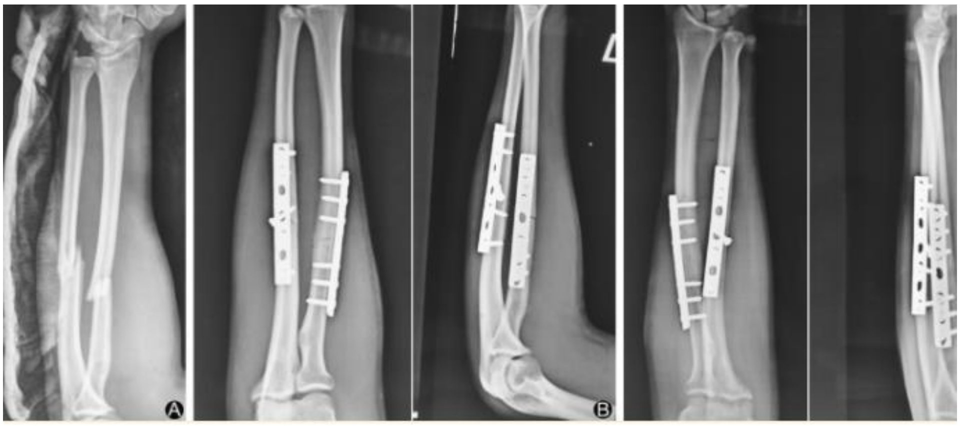

Figure-2: Preoperative radiograph showing radial shaft fracture in the proximal third

Discussion

Which side of the radius to plate depends almost entirely on the procedure used to fix the fracture. As a result, plates are fixed to the dorsal surface of the radius by surgeons who prefer the dorsal approach, while the volar surface of the radius is used by surgeons who favor the volar method. The most contentious topics have always included the suggested method [22-24], and the material being used (dorsal or volar). It has been hypothesized that a third, unplated surface exists and is easily accessible.

The proximal third of the radius's volar surface is convex, with an average apex anterior curvature of 13.1°, whereas the distal third is concave, with a curvature of 6.4° [15]. This is a reference to the symmetry present between the opposite curves of the dorsal surface. As there is already a natural radial bow in the radius to account for, we now have to deal with two plane curvatures using a single straight plate, which increases the risk of error and malreduction. On postoperative anteroposterior radiographs, the plate might also get in the way of a clear assessment of the radial bow.

Mekhail *et al*., [25] presented a volar approach to lateral plating because to concerns that a high volar plate might impinge on the biceps tendon. The nutritive artery of the radius is another potential site of injury during volar-surface plating. Located in the second proximal quadrant of the diaphysis, the nourishment artery enters the radius from anterior to medial [26]. Many authors have argued that even if the periosteal and metaphyseal veins sustain blood supply to the bone after a lesion to a nutritional artery, this is not enough to avoid delays in fracture recovery [27-29]. The nutritive foramen never penetrates the dorsolateral surface of the radius, as stated by Giebel *et al*., [17]. This makes this area an ideal one for plating.

Lateral plating is not a completely original idea. As was said up above, there are examples of radiography that serve as examples in the literature. We are unaware of any published data on the effects of lateral surface plating. Our show intended to fill this need. We found that our results were quite similar to those seen in the existing literature on dorsal and volar plating. The average unionization rate in our data was 94.73 percent. Eighteen of the last 19 instances.

The union rate was 90% according to Chapman *et al*., [30], 98% according to Anderson *et al*., [6], and 97% according to Hadden *et al*., [31]. While Leung and Chow [8] reported 20 weeks and Saikia *et al*., [18] reported 16.2 weeks, the mean time to union for our patients was 17.44 weeks. The average arc of rotation for the forearm was 129.6 degrees, whereas the arcs of flexion/extension at the elbow and wrist were 136.7 and 140.1 degrees, respectively. These measurements are in line with those reported by Goldfarb *et al*., [32], who measured 140.1° of wrist arc and 150° of rotation. Goldfarb *et al*., [32] reported a pronation of 85° and 90° in their sample, while the range of rotation in the contralateral normal forearm was 150°-160° in our patients.

In comparison to the 86% excellent and 92% satisfied outcomes given by others in the same series, we achieved 89% excellent and 8% satisfactory overall [6, 30, 31].

As a result, the overall outcome of our patients is on line with what has been seen in the literature. In 1% of patients, we encountered a nonunion; the patient was advised for a second treatment but declined; and at the most recent follow-up (14 months), he was able to move his affected limb pain-free and with full range of motion. No cases of nerve damage or infection were found in our cohort. Nonunion occurred in 2% of his patients, and infection occurred in 2.3%, as described by Chapman *et al*., [30]. Three percent of Hadden's 111 surgical forearms failed to union, five percent developed infection, and six percent had nerve damage, according to the study.

Eglseder et aldescription.'s of lateral surface plating was a helpful find throughout our investigation [33]. Nevertheless, they performed an ex-vivo biomechanical study and found no significant biomechanical differences between anterior and lateral plating of the distal radial shaft. They also claimed that volar plates were easier to apply, but we find that the lateral approach we've explained makes plating just as simple, if not simpler, than volar plating.

The strengths of this method outweigh the limitations of our investigation. There has been no investigation into how lateral plating could alter the delicate posterior curvature of the radius. We did not operate on any patients to remove the plate, thus we do not know what happens when a lateral plate is removed. Several patients' distal radial plates could be palpated, but none reported any discomfort. Theoretically, hardware issues may manifest much later. In addition, our sample size is quite limited, therefore the therapeutic relevance of this method has to be shown in bigger, ideally randomized, investigations. Our work may be seen as an early report on the outcomes of lateral plating of the radial shaft.

CONCLUSION

If conventional methods fail, radial lateral plating may be used as a viable alternative. Longitudinal investigations are needed to confirm the potential advantages and validate our results, using larger patient groups and stricter study criteria.

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