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Outcome of Volar Plate in Patients with Intra Articular Distal Radius Fracture

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ABSTRACT

Background: Intra-articular variations of distal radius fractures, which are common orthopedic injuries, might make it difficult to achieve anatomical reduction and functional rehabilitation. Because of its durability, capacity to restore joint congruity, and ability to facilitate early mobilization, volar plate fixation is the recommended technique. **Objective:** The purpose of this study is to assess the radiological, functional, and clinical results of volar plate fixation in intra-articular fractures of the distal radius. **Methodology:** At a Quetta tertiary care hospital, a cross-sectional study was carried out between August 2022 and August 2024. Included were 55 adult patients who had displaced intra-articular fractures of the distal radius. The AO system was used to classify the fractures, and volar locking plates were used to cure them. The Modified Mayo Wrist Score was used to measure functional outcomes, and follow-ups at two, six, three, and six months were used to gauge union time and complications. **Results:** The most prevalent fracture type (41.8%) was AO type 23-C2, and the mean age was 37.2 ± 10.05 years. With a mean duration of 11.98 ± 1.64 weeks, union was attained in 98.2% of patients. With 67.2% reporting good results and 27.2% reporting very good results, the functional outcomes were positive. There were just a few complications, such as median nerve neuropathy (1.8%), wound dehiscence (3.6%), and superficial infections (11%). **Conclusion:** volar plate fixation is a successful treatment for intra-articular distal radius fractures because it has minimal complication rates, good union rates, and functional results..

INTRODUCTION

According to MacIntyre NJ (2016), out of the total number of forearm fractures, distal radius fractures make up about 74.5 percent and 16% of all fractures evaluated in emergency departments. A complex pattern involving the joint is seen in around 25% of those injuries (Shauver MJ, Yin H, on the other Banerjee M, among others, 2011). Osteoporosis causes it to be more common in the elderly, although outdoor activities & high-velocity accidents lead it to be more common in younger people (Phadnis J, 2012). Precise reduction & stability owing to the intraarticular breakage of the distal radius remain challenges for these complicated injuries, notwithstanding the arguments surrounding their treatment and rehabilitation (Koval K, 2014).

The most important factors to consider when deciding how to treat the fracture are the following: radial inclination, intraarticular step-off, ulnar variation, and volar/dorsal tilt.

Willis AA et al. (2006), Gondusky JS, he J, Erpenbach J, et al. (2011), and Bentohami A et al. (2014) all note that using volar locking plates has several benefits, including direct reduction of fracture fragments, stable fixation, and quick following surgery. physiotherapy aimed at encouraging an early return to normal levels of motion and work.

Volar locking plates are less likely to have issues than dorsal plating (Ruch DS, et al., 2006). According to biomechanical analysis, the volar, a locking plate is more

stable than non-locking structures and can even hold the component that has been moved dorsally. (Kandemir U, et al., 2008; Osada D, et al.,2003).

A break that affects the wrist's joint surface is called an intra-articular distal radius fracture. If left untreated, these fractures not only jeopardize the integrity of the joint but also increase the likelihood of malalignment, post-traumatic arthritis, and loss of function. To guarantee anatomical reduction of the articular surface and restore wrist biomechanics, these injuries need to be carefully managed. Since the distal radius is crucial in the formation of the wrist joint, precise reduction and stability are essential to getting the best results. Conservative care with casts or splints and surgical techniques including external fixation, dorsal plating, and volar plating are two treatment options for intra-articular distal radius fractures. Because of its capacity to preserve reduction while permitting early mobilization, volar plate fixing has been the method of choice among these alternatives. The volar locking plate provides better fixation for both simple and complex fracture patterns by stabilizing fracture fragments on the volar face of the distal radius. This method improves functional recovery, lowers the risk of post-traumatic arthritis, and makes it easier to align the joint surface precisely. Volar plate fixation has drawbacks despite its benefits. Although they have been documented, complications like infection, hardware prominence, and tendon irritation are uncommon as compared to other surgical techniques. Furthermore, it can be difficult to achieve and sustain anatomical reduction in situations of severe osteoporosis or comminution. Patient-specific variables including age, bone quality, and adherence to postoperative rehabilitation guidelines also affect how effective this approach is.

LITERATURE REVIEW

Distal radius fractures are among the most common orthopaedic injuries, accounting for about 17% of all adult fractures. Intra articular fractures (also known as, fractures involving joint surfaces) are complicated because they affect the joint surface and, if left untreated could lead to long term functional damage. Anatomical alignment and joint congruity must be restored for the best functional results and to minimize post traumatic arthritis.

The Development of Medicine

In past and traditional approaches of distal radius fractures, conservative measures like closed reduction and casting were used. But employing these techniques was not easy to maintain reduction, and as a consequence the results were usually substandard, particularly in the intraarticular fractures. With the advent of surgical fixation techniques, the treatment of these injuries has seen major change: these techniques offer improved alignment, stability and early mobilization.

Volar plate fixation benefits and indications.

The volar locking plate system is an increasingly common option for surgical treatment of intra articular distal radius fractures. This approach has various benefits, such as:

Through stable attachment of metaphyseal, and articular fragments.

The biomechanical approach is superior to other approaches, especially for the osteoporotic bones.

To avoid stiffness, early range of motion is promoted.

It has fewer issues, like irritation of the extensor tendon, than with dorsal plating.

Numerous trials have proven that the use of a volar plate fixation method has functional and radiological results. For example, Arora et al. (2011) showed that patients treated with volar plating had better wrist motion and grip strength than with other methods.

Difficulties and Obstacles

Although volar plate fixation has shown largely positive results, tendon irritation, hardware prominence and intraoperative hazards are causes for worry. The severity of the fracture, patient's age, and compliance to post operative rehabilitation are all factors which affect the result. Studies by Orbay and Fernandez highlighted the importance of exact surgical technique and that hardware related problems can occur when plates are placed incorrectly. (2002).

Long-TermResults

Long term research has indicated that volar plate fixation may reduce post traumatic arthritis following anatomical reduction. This validation of the use of volar plates to treat intraarticular fractures is further corroborated by favorable correlation between radiographic parameters, for example, radial inclination, volar tilt, and ulnar variance, and functional outcome.

RESEARCH OBJECTIVE

The purpose of this study is to determine clinical, functional, and radiological outcome in the treatment of intra articular distal radius fractures using volar plate fixation. This surgical method is to be studied to determine its effectiveness and safety by examining its radiographic parameters, grip strength, range of motion, and post operative healing. It also seeks to quantify how common tendon irritation or hardware failure might occur and to provide evidence-based suggestions for the application of this device. Our results may aid orthopaedic surgeons in managing these complex fractures by optimizing treatment plans.

METHODOLOGY

In this cross-sectional study is being conducted at a Quetta tertiary care hospital from August 2022 to August 2024. Fifty-five adult patients with displaced intra-articular distal radius fractures were recruited into this study using non-probability consecutive sampling strategy. Patients ages more than 20, in good health and willing to provide their informed consent were found to be eligible patients. Exclusion criteria were open fractures, ipsilateral limb injuries, polytrauma, pathological fractures and neurovascular injuries. A trial was conducted, and ethical approval was obtained from the ethical review board of the hospital prior to commencing this trial. Fractures were classified using the AO Classification system. In the volar approach surgical technique, we use a volar locking plate to fix fractures. Postoperative rehabilitation followed and upon four weeks depending upon the patient's pain threshold active assisted makes then passively under a physiotherapist started. Follow up appointments were set at two weeks, six weeks, three months, and at six months to track improvement. Fracture unit was clinically and radiologically evaluated six weeks after the surgery. Functional outcomes were measured by the Modified Mayo Wrist Score at six months' follow up.

The data was collected using prepared proformas followed by thematic analysis of the data. Clinical observations, functional results and patient reactions were coded and clustered into themes in line with the goals of the study. Recurring patterns were found to find out if the volar locking plate is efficacious for fracture healing and functional recovery. The results were reported narratively using an emphasis on patient reported outcomes, and their congruence with clinical and radiological findings. The qualitative insights enabled a precise understanding of functional and recuperation results that are tied with the application of volar locking plates in intra articular distal radius fracture.

RESULTS

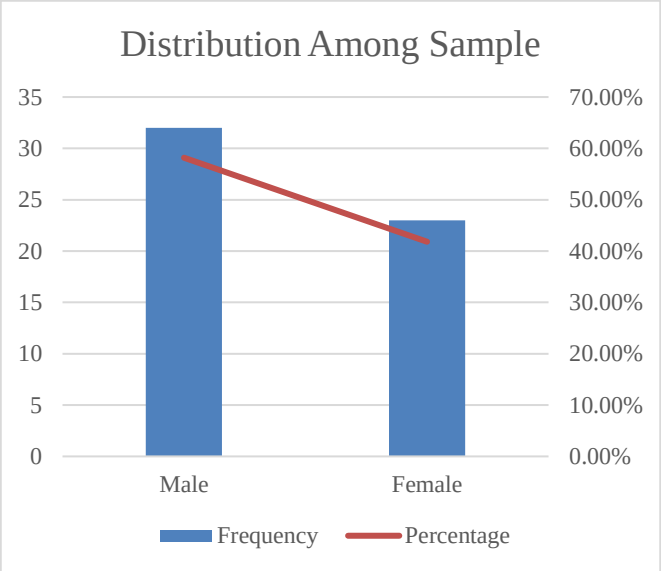
In this cross-sectional study conducted at a tertiary care hospital in Quetta from August 2022 to August 2024, 55 adult patients with displaced intra-articular distal radius fractures were assessed for surgical outcomes using the volar locking plate technique. The mean age of participants was 37.20 ± 10.05 years, with a majority being male (58.18%). Fractures were classified using the AO system, with 41.8% of cases falling under the 23-C2 type. The mean duration of union was 11.98 ± 1.64 weeks. Functional outcomes, assessed using the Modified Mayo Wrist Score, showed that 94.4% of patients had very good to good results. Postoperative complications were minimal, with 83.6% of patients experiencing no complications. These findings underscore the efficacy of the volar locking plate in promoting fracture healing and functional recovery.

Table 1

Distribution Among Sample

Gender	Frequency	Percentage
Male	32	58.18%
Female	23	41.82%

Figure 1



Mean Age ± SD: 37.20 ± 10.05

Among the sample of 55 patients, 32(58.18%) out of 55 patients were males, 23 (41.82%) were females.

Table 2

Descriptive Statistics

Mean age	37.20 ± 10.05
Duration of injury	2.43 ± 1.768 days.
Type of fracture (AO classification)	23-C1 12(27.2%) 23-C2 23 (41.8%) 23-C3 16 (31%) 23-B3 4 (8.2%)
Union Time (weeks)	11.98 ± 1.64

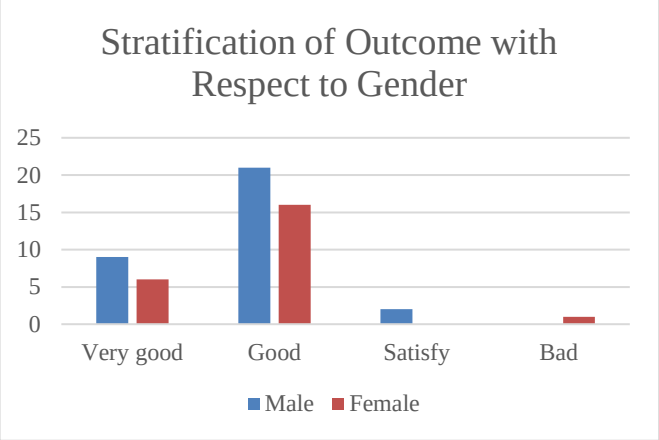
Among the sample of 55 patients, mean age of patients is 37.20± 1.768 years. The mean duration of injury was 2.43 ± 1.768 days. Most of the patients, or 23 patients, had fracture patterns of type 23-C2, 16 patients had fractures of AO type 23-C3, 4 patients (8.2%) had fractures of AO type 23-B3, and 12 patients had fractures of AO type 23-C1. Except for one instance, which became non-union despite the sufficient initial reduction, union was attained in nearly all fractures. The mean duration of union was 11.98 ± 1.64 weeks, with a range of at least 10 weeks and up to 20 weeks.

Table 3

Stratification of Outcome with Respect to Gender

Description	Male	Female
Very good	9	6
Good	21	16
Satisfy	2	
Bad	0	1

Figure 2



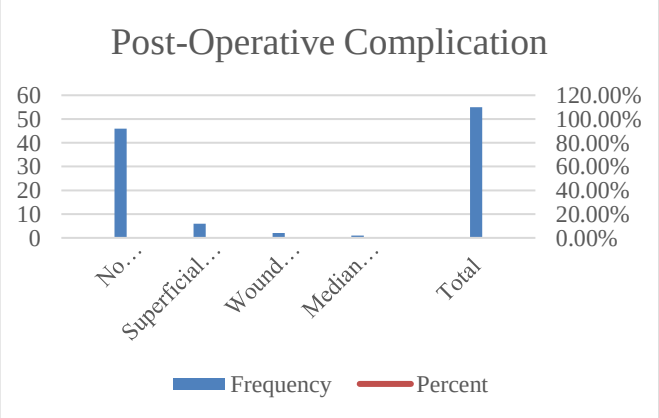
Regarding the outcome stratification, 15 patients (27.2%) and 37 patients (67.2%) had very good and good functional outcomes, respectively; two patients (3.6%) had satisfactory outcomes, and one patient had a poor outcome where union was not attained and went into non-union.

Table 4

Post-Operative Complication

Complication	Frequency	Percent
No complication	46	83.6%
Superficial infection	6	11%
Wound Dehiscence	2	3.6%
Median nerve neuropathy	1	1.8%
Total	55	100%

Figure 3



Among the sample, regarding the complication of surgery, no complication was found in 46(83.6%) patients. A superficial infection developed in 6(11%) patients. A wound dehiscence and median nerve neuropathy occurred in 2(3.6%) and 1(1.8%) patients respectively.

DISCUSSION

Emergency departments see the greatest number of cases with fractures affecting the outermost portion of the radius. Although it is more prevalent in the elderly due to osteoporosis, high-velocity injuries are the main reason of its increased prevalence in young individuals (Phadnis J, 2012). When it comes to treating distal radial fractures, opinions vary on whether to use open reduction & internal fixation, which is more aggressive, or the more cautious closed decrease and cast application, which is less invasive (Costa ML et al., 2011). The most complex injuries, distal radius intraarticular fractures, need the use of many types of implants in their treatment. Compared to fixation from a dorsal plate, or conventional non-locking volar plates, locking volar plates provide a relatively robust structure and allow for excellent, stable alignment of the metaphysis and diaphysis (Levin SM et al., 2008). Volar engaging plates have shown superior performance in biomechanical testing compared to non-locking volar and axial planes (Leung F et al., 2003).

The difference from earlier research regarding a union rate of close to 98.2% over 11.98 ± 1.64 weeks confirms the voltar locking plate's accuracy and stability in anatomical reduction. The majority (94.4%) of patients had good or very good functional results according to the Modified Mayo Wrist Score. This coincides with data showing that volar plates facilitate early mobilization and improved wrist biomechanics. They underscore the advantages in relationship to such more conventional tactics as casting or external fixation which often do not preserve reduction and are unable to allow early motion. This distribution of fracture types in this study reflects the complexity of cases handled, with AO type 23-C2 fracture dominating. Adaptability and biomechanical excellence of the volar locking plate is demonstrated by the ability to manage such a wide range of fracture patterns especially in osteoporotic and comminuted fractures. The bimodal pattern for distal radius fractures—high velocity injury in younger patients and the frequency of fragility fractures in older patients—is also supported by age (33.2 years). This trial was very well tolerated, and 83.6% of individuals had no issues in this trial of this antibody combination. Wound dehiscence (3.6%) and superficial infections (11%) were treated conservatively, but one instance of median nerve neuropathy (1.8%) emphasizes the need for surgical caution to prevent iatrogenic harm. The low complication rates correlate well with results in the literature because volar plates are less likely to cause extensor tendon irritation and hardware prominence than dorsal plating. While the one case of non union that did occur,hid the difficulties posed by patient specific factors such as severe comminution or postoperative noncompliance.

CONCLUSION

Volar locking plate fixation is a dependable and efficient technique for the treatment of intra articular distal radius fractures with good functional and radiological results. With a union rate of 98.2% and a good to very good functional rate, this method demonstrates excellent stability and allows early mobility, the best possible for

the best recovery. Its safety and biomechanical superiority over other techniques are highlighted by low complication rates. However, patient specific factors such as severe comminution and rehabilitation compliance still factor in success. This study indicates that the best treatment for complicated intra-articular fractures of the distal radius is volar plates.

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