

## Original Research Article

# Clinical efficacy of the radius bone plates for the fixation of radius bone fractures

Tarun Kumar<sup>1\*</sup>, Mridul Beriwal<sup>1</sup>, Bhawana Chawale<sup>2</sup>, Mohit Kumar<sup>1</sup>, Gaurav Luthra<sup>1</sup>

<sup>1</sup>Regulatory Department, <sup>2</sup>Clinical Research Department, Auxein Medical Private Limited, Sonipat, Haryana, India

**Received:** 13 September 2022

**Revised:** 07 October 2022

**Accepted:** 12 October 2022

### \*Correspondence:

Tarun Kumar,

E-mail: [t.kumar@auxein.com](mailto:t.kumar@auxein.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## ABSTRACT

**Background:** The purpose of this study was to evaluate the clinical efficacy of the radius bone plates fixation for treating radius bone fracture.

**Methods:** Forty-Five patients with fracture of the radius involving the distal part were treated with fixed angle plate fixation approach. This was a retrospective study in which 45 patients (39M, 6F) were treated at different hospitals and countries between August 2020 to October 2021 with a mean follow up of year (1month, 3months, 6months and 12months). All patients were followed using radiographs, physical examination, ASA and VAS score.

**Results:** All patients with radius fracture treated with specific fixation of plate system were enrolled and received continuous physiotherapy by physiotherapists, which helped in early healing. The clinical treatment results showed decline in the VAS score percentage after 1 year follow up. About 91.1% patients were satisfied with no pain and 8.8% patients were unsatisfied due to mild pain. A successful surgical outcome was reported without any complications related to implant breakage, loosening, corrosion or other factors.

**Conclusions:** The radius plate system results in more efficient, stable fixation and better subjective results early in the postoperative period. It has minimal complications requiring reoperation and risks.

**Keywords:** Radius fracture, Extra-articular fracture, Distal radius, Management, Treatment

## INTRODUCTION

The radius, being one of the two bones that form the human ante-brachium permits the forearm and your hand to pronate, supinate, and flex.<sup>1</sup> Some of the most common direct, low energy trauma such as a car crash can be held accountable for radial fractures.<sup>2</sup> Around 8% to 15% of the adults report injury to the radial area. It is considered to be second to the hip fractures, which is the most common fracture bone in the elderly.<sup>3</sup> Most accounted cases of the radius fractures are based on a fall onto an outstretched arm.<sup>4</sup> The older adults with osteoporosis become very fragile and are more prone to such fractures.

Medical studies have reported that even a relatively minor fall from a standing position can result in a broken wrist. Therefore, age and bone disorders play an important role in determining the cause of such injuries. It's easy to identify the fracture in the radial area due to the immediate pain, tenderness, and swelling. Deformity or numbness in the adjoining areas (especially fingers) can also help one identify the urgency of the injury.<sup>5</sup> The treatments are always considered based on the location, anatomy and dissemination of the surrounding structures. Radius fractures account for 17% of the fractures in the upper extremities treatment.<sup>6</sup> There are two methods of treatment that are generally considered for radius bone

fractures, i.e. operative and non-operative methods for proximal, shaft and distal radius fractures. Non-operative or non-surgical treatment involves a cast that may be used to hold the bones which are in a better position until the bone heals. If the bone is out of place, then a reduction process is carried out to align the broken bone fragments. A splint of a cast can then be applied over the aligned bones to improve the healing process. The replacement period for the casts often remains 4-6 weeks at a time, followed by an X-ray examination. Therapy sessions often help and catalyze the healing period.<sup>7</sup> Operative treatment takes over when the closed reduction treatment fails to position the bone correctly. In order to prevent the healing of the fracture in a wrong alignment, surgery is performed.<sup>8</sup> This generally includes incisions for access to the broken bone while protecting the arteries, tissues, tendons, etc. This method of open reduction makes use of casts, metal pins, plates, screws and sometimes external fixators, or any combination of the same.<sup>9</sup> The aim of this retrospective study is to measure the safety and efficacy of the Auxein medical pvt. ltd. bone plates for fractures (2R3A1, 2R3A2.1, 2R3B1.1, 2R3B1.3) pertaining to the Radius bone.

### Materials

Radius plates with screws manufactured by Auxein medical pvt. ltd. were used to treat patients with radius fractures. Implants used in treatment were made up of titanium as per ISO 5832-3 (Ti-6Al-4V ELI) and stainless steel (SS) alloy as per ISO 5832-1 (316L). Instruments and implants used were biocompatible in nature.

### METHODS

This study was a retrospective study directed from July 2020 to August 2021. The data of the patients were collected from different hospitals and countries treated with a radius plate system. There were 45 total patients (39M, 6F) out of which 13 patients were treated at M.O.H. Victoria hospital (Mauritius), 12 patients were treated at Clinica El Loa SA. (Chile), 5 patients were treated at Cruz Verde Ruiz Sanchez (Mexico-Guadalajara), 1 patient was treated at Hospital De Alta Especialidad Jardines (Mexico-Guadalajara), 4 patients were treated at Sanatorio Santa Isabel (Mexico-Guadalajara), 1 patient was treated at Cruz Verde Ruiz Sanchez (México-Guadalajara), 3 patients were treated at Mayoreo (México-Guadalajara), 1 Patient was treated at Salutaris (Mexico-Guadalajara) and 5 patients were treated at Hospital Echauri (Mexico/Manzanillo). The informative data collected from all the patients after surgery includes: name, date of surgery, sex, age, implant name and fracture type according to AO fracture classification system.

### Inclusion and exclusion criteria

Skeletally mature patients above 20 years and having the radius bone fracture were included in the evaluation. The

subjects were excluded from the study if any of the following condition exist: below 20 years, suffering from any chronic disease, not associated with the radius fracture, abuse to drugs/alcohol, neurodegenerative disease, deviation in blood pressure, CVS disease, osteopenia and allergic history with metal can cause uncontrollable risk during fixation of plates.

### Statistical analysis

Primary outcomes were measured using visual analog scale with mean, standard deviation, median minimum and maximum with 95% significance level. Visual analog scale from baseline to each visit was analysed using paired t test at 5% level of significance. All statistical analysis was performed using minitab 19.

### Treatment

An imaging test was performed by a physician to see the nature of the fracture which helped to decide how much reduction (the resetting or realigning of bones) is required and choose the best way to maintain the reduction while the fracture heals. Any fracture that is unstable or has extensive fragmentation needs to be treated surgically because simple casting is less likely to keep the fracture aligned. For the surgical treatments, plates with screws of the same material are given the first choice of standard to treat fracture. The treating surgeon chooses the surgical strategy. 45 patients with distal radius fractures were reported and treated with a specific choice of implant based on the type of fracture according to AO fracture classification. Patients were treated with following implants: 2.4 mm variable angle two-column volar distal radius plate (narrow), 2.4 mm variable angle two-column volar distal radius plate (wide), 2.4 mm variable angle two-column volar distal radius plate (standard), 2.4 mm wise-lock volar column distal radius plate (Figure 1). After surgery patients were followed up for 1 month, 3 months, 6 months and 12 months to check the bone healing by radiographic examination.

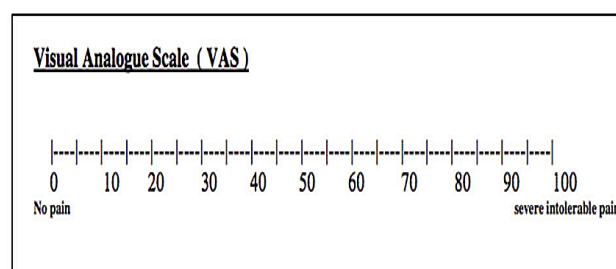


Figure 1: VAS scoring.

### RESULTS

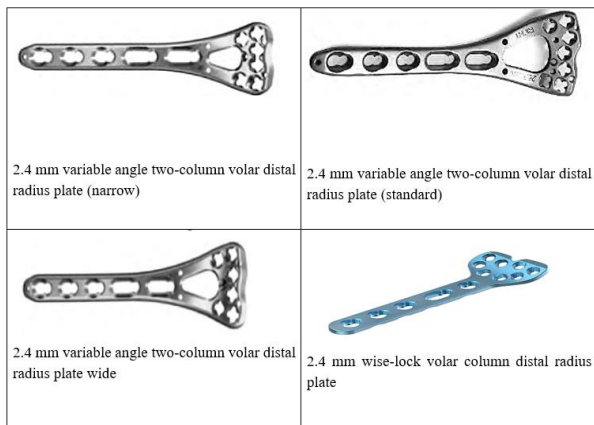
There were forty-five patients (39M and 6F) with the age range of 27-71 years (mean 45.2 years) operated with radius plate system (Table 1). Out of 45 patients, 31.1% patients (14) were reported 2R3A1, 20% patients (9)

were reported 2R3B1.1, 26.6% patients (12) were reported 2R3B1.3, 22.2% patients (10) were reported 2R3A2.1 types of fracture according to AO fracture classification (Table 2).

**Table 1: Demographic data.**

Demographics	N	%
<b>Mean age in years</b>	45.2	-
<b>Sex</b>		
Male	39	86.6
Female	6	13.3
<b>Dominant side</b>		
Left side radius	23	55.5
Right side radius	20	44.4
<b>Mode of injury</b>		
Fall on ground	14	31.1
Sports injury	10	22.2
Road traffic incident	21	46.6
<b>ASA</b>		
Grade I	38	84.4
Grade II	7	15.5
Grade III	0	0
Grade IV	0	0
Grade V	0	0
<b>Types of fractures</b>		
Distal fracture	45	100

The surgery was initiated by an expert orthopaedic surgeon and was completed in 75 minutes. In this retrospective study, the left side of the radius had a 55.5% rate of occurrence and right side of the radius had a 44.4% rate of occurrence of fracture. According to the American Society of Anaesthesiologists (ASA), 84.4% patients (38) were classified as grade 1, indicating a normal healthy patient, while 15.5% patients (7) were classified as grade 2, indicating mild systemic disease. Patients classified as grade 3 by the American society of anesthesiologists (ASA) were not included in the study. The VAS score was used for determination of the pain intensity after the surgery by a follow up period of 1 month, 3 months, 6 months and 12 months (Figure 2).



**Figure 2: Implants.**

**Table 2: Fracture classification.**

Fracture type (AO Classification)	N (%)
<b>2R3A1</b>	14 (31.1)
<b>2R3A2.1</b>	10 (22.2)
<b>2R3B1.1</b>	9 (20)
<b>2R3B1.3</b>	12 (26.6)

The difference in the VAS score at every follow up was observed and continuous decline in the pain intensity shows better outcomes for radius fracture treated with radius plates (Table 3).

**Table 3: VAS Scoring.**

Follow up time	VAS score %
<b>1</b>	51
<b>3</b>	30
<b>6</b>	13
<b>12</b>	2

Initial 6 months for postoperative care patients were advised rehabilitation exercises followed by physiotherapy. Examining the progress at every follow up showed good post-operative results to the end of the first year of the follow up period. A successful surgical outcome was reported without any problems or reoperational indications. It did not contain any instances of infection, non-union, or fixture failure.

**Table 4: Evaluation parameter.**

Evaluation parameter	Satisfied N (%)	Not satisfied N (%)
<b>Pain (N=45)</b>	41 (91.1)	4 (8.8)
<b>Aesthetic appearance (N=45)</b>	43 (95.5)	2 (4.4)



**Figure 3: Represents pre-operative and post-operative radiological images of distal radius fracture.**

## DISCUSSION

The radius plating (Auxein medical private limited) are considered to be highly effective for the operative treatment of unstable radial fractures. The plating system has generally produced an outcome based on functional and radiographic parameters. The outcomes amongst the different plating systems remain persistent. The subjective measures of the outcome can also be measured by (not limited to) VAS, Mayo wrist scores, and quick dash scores. According to the study conducted by Satake et al in which 824 patients were treated surgically. In about 7.5% patients complications was reported such as nerve palsy, tendon rupture, trigger digit and carpal tunnel syndrome.<sup>10</sup> No such results were found in the radius plates by Auxein Medical pvt. ltd. Another study conducted by Galle et al in which consecutive series of 61 patients who sustained distal radius fractures underwent surgery and complications such as Hardware sensitivity and wrist stiffness were reported at final follow up.<sup>11</sup> No complication related to hardware was reported but 8.8% patients experienced mild pain and 4.4% patients were not satisfied by aesthetic appearance (Table 4). Retrospectively Figl et al reviewed a sample of 85 patients who underwent a surgery pertaining to the variable angle volar plating fixation for unstable fractures in the distal radius. It was found out that 75% of the patients had a maintained radial height and none of the patients had lost acceptable reduction either. This study showed better immobilization of bone union without any complication.<sup>12</sup> This study concluded better outreach clinical results of a fracture healed with a limited time period of immobilization with no pain as compared to our analysis. The small sample size and 12-month follow-up period were the most significant limitations of our study. Despite these limitations, the outcomes were satisfactory, just as we had anticipated before beginning this clinical study.

## CONCLUSION

The use of radius plates in treating unstable distal end radius fractures is associated with excellent to good functional outcomes with minimal complications.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

## REFERENCES

1. Bair MM, Gondal AZ. Anatomy, shoulder and upper limb, forearm radius. USA: StatPearls Publishing; 2021.
2. Thakur S, Sharma S, Kumar M, Rawat P, Luthra G. Treatment of clavicle fracture using wise lock clavicle hook plate and wise lock superior anterior clavicle plate. Int J Res Orthopaed. 2019;5(5):796.
3. Vannabouathong C, Hussain N, Guerra-Farfan E, Bhandari M. Interventions for distal radius fractures: a network meta-analysis of randomized trials. J Am Acad Orthop Surg. 2019;27(13):e596-605.
4. Corsino CB, Reeves RA, Sieg RN. Radius fractures. USA: Stat Pearls Publishing; 2022.
5. Radius fractures. Available at: <https://orthoinfo.aaos.org/en/diseases-conditions/distal-radius-fractures-broken-wrist>. Accessed on 20 November 2021.
6. Gallo M, Morello S, Burgio V, Cigno LL. The current state of the art of angle-stable volar plating in the treatment of distal radial epiphysis fractures. Capsula Eburnea. 2011;6(18):23-9.
7. Eva AK, Tamara G, Vries R. Duration of cast immobilization in distal radial fractures: a systematic review. J Wrist Surg. 2019;8(5):430-8.
8. Chung KC, Mathews AL. Management of complications of distal radius fractures. HSS J Manu. 2015;31(2):205-15.
9. Hoare CP, Dickson DR, Armstrong DJ, Nuttall D, Watts AC. Internal fixation for treating distal radius fractures in adults. Cochrane Database Syst Rev. 2017;2017(9):CD011213.
10. Satake H, Hanaka N, Honma R, Watanabe T. Complications of distal radius fractures treated by volar locking plate fixation. Orthoped. 2016;39(5):e893-6.
11. Galle SE, Harness NG, Hacquebord JH, Burchette RJ, Brett P. Complications of radial column plating of the distal radius. Hand. 2013;2:23-9.
12. Figl M, Weninger P, Liska M, Hofbauer M, Leixnering M. Volar fixed-angle plate osteosynthesis of unstable distal radius fractures: 12 months results. Arch Orthop Trauma Surg. 2009;129(5):661-9.

**Cite this article as:** Kumar T, Beriwal M, Chawale B, Kumar M, Luthra G. Clinical efficacy of the radius bone plates for the fixation of radius bone fractures. Int J Res Orthop 2023;9:16-9.