

Evaluating the Effectiveness of Radius Bone Plates in Fracture RepairDipak Suthar¹, Ayush Vaishav²¹Associate Professor, Department of Orthopedics, Gujarat Adani Institute of Medical Science, Bhuj, Kutch, Gujarat, India²Resident, Department of Orthopedics, GMERS Medical College, Dharpur, Patan, Gujarat, India

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Abstract:**Background and Aim:** Clinically, resection and reduction-based palmar internal fixation using locking plates is commonly utilized to address AO-C type distal radius fractures. This study seeks to evaluate the safety and effectiveness of radius bone plates in the fixation of fractures associated with the radius bone.**Material and Methods:** This research took place within an Orthopedics Department in India, examining a cohort of 80 patients over the span of one year. In cases of fractures that exhibit instability or significant fragmentation, surgical intervention becomes essential, as relying solely on casting may prove inadequate in preserving the proper alignment of the fracture. All patients underwent monitoring through radiographs, physical examinations, and assessments using the ASA and VAS scoring systems.**Results:** The findings indicate that at each follow-up, there was a noticeable difference in the VAS score, with a consistent reduction in pain intensity suggesting improved outcomes for radius fractures treated with radius plates. Patients undergoing postoperative care were recommended to engage in rehabilitation exercises during the initial six months, followed by physiotherapy sessions. Assessing the advancements at each follow-up revealed positive post-operative outcomes throughout the first year of the follow-up period.**Conclusion:** Employing radius plates for the management of unstable distal end radius fractures demonstrates a strong correlation with favourable functional results and a low incidence of complications.**Keywords:** Fracture, Internal Fixation, Locking Plate, Radius Plate.

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Introduction

The radius is a crucial bone in the human antebrachium, facilitating essential movements such as pronation, supination, and flexion of the forearm and hand. [1] Radial fractures frequently result from typical direct, low-energy trauma, including incidents like car crashes. [2] Between 8% and 15% of adults report experiencing injuries in the radial region. It ranks just behind hip fractures, which are the most prevalent type of bone fracture among the elderly population. [3] The majority of radius fracture cases are attributed to falls onto an outstretched arm. [4] Older adults diagnosed with osteoporosis experience increased fragility, making them more susceptible to fractures. Research indicates that even a seemingly insignificant fall from a standing position can lead to a fractured wrist. Consequently, factors such as age and bone disorders significantly influence the underlying causes of these injuries. The fracture in the radial area is readily identifiable, characterized by immediate pain, tenderness, and swelling. The presence of deformity or numbness in nearby regions, particularly in the fingers, can serve as a crucial indicator of the injury's urgency. [5]

Resection and reduction. The use of palmar internal fixation with locking plates is a common clinical practice for addressing AO-C type distal radius fractures. However, the conventional approach necessitates an incision through the pronator quadratus and extensive dissection of the adjacent soft tissues. This technique carries a significant risk of compromising the blood supply to the fracture site, which can adversely affect the healing process. [6,7] In recent years, there has been a significant emphasis on the application of minimally invasive techniques in trauma orthopedics, particularly in the management of AO-C type distal radius fractures. [8] Non-operative or non-surgical treatment typically includes the application of a cast, which serves to stabilize the bones in an optimal position while the healing process takes place. When a bone is misaligned, a reduction procedure is performed to properly align the fractured bone segments. Applying a splint or cast over the properly aligned bones can significantly enhance the healing process. The duration for which casts are typically replaced is generally between 4 to 6 weeks, after which an X-ray

examination is conducted. Therapy sessions frequently play a crucial role in facilitating the healing process. [9] When closed reduction treatment fails to adequately align the bone, operative intervention becomes necessary. Surgery is conducted to ensure that the fracture heals correctly and does not align improperly. [10] This approach to open reduction involves the utilization of casts, metal pins, plates, screws, and occasionally external fixators, or a combination of these elements. [11] This study seeks to evaluate the safety and effectiveness of radius bone plate fixation in treating fractures of the radius bone.

Material and Methods

This study was conducted at a Department of Orthopedics in India, focusing on 80 patients over a period of 1 year.

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.

In cases of fractures that exhibit instability or significant fragmentation, surgical intervention becomes essential, as relying solely on casting may prove inadequate in preserving the proper alignment of the fracture. In the realm of surgical interventions, plates equipped with screws crafted from identical materials are generally regarded as the premier option for addressing fractures. The approach to surgery is dictated by the surgeon responsible for the patient's care.

A total of 80 patients with distal radius fractures were identified and treated with a meticulously chosen implant, selected according to the AO fracture classification system that categorizes the type of fracture. The patients underwent treatment involving a range of implants, which included narrow, wide, and standard 2.4 mm variable angle two-column volar distal radius plates, along with a 2.4 mm wise-lock volar column distal radius plate. Individuals who had surgery were observed at consistent intervals of 1 month, 3 months, 6 months, and 12 months to evaluate the advancement of bone healing via radiographic assessment.

Statistical analysis

The collected data was organized and input into a spreadsheet application (Microsoft Excel 2019) before being exported to the data editor interface of SPSS version 19 (SPSS Inc., Chicago, Illinois, USA). Quantitative variables were characterized using means and standard deviations or medians and interquartile ranges, depending on their distribution patterns. Qualitative variables were reported in terms of counts and percentages. The confidence level for all tests was established at 95%, while the level of significance was determined to be 5%.

Results

A total of eighty patients underwent surgical procedures utilizing the radius plate system. The study population included 71 males and 9 females, with ages spanning from 25 to 75 years, resulting in a mean age of 45 years (Table 1). In a study involving 80 patients, 24 individuals, accounting for 30% of the total cohort, received a diagnosis of 2R3A1, whereas 18 patients were identified with 2R3B1.

The findings of this study reveal that fractures occurred in 55.5% of cases on the left side of the radius, while the right side exhibited a 46.25% occurrence rate. The American Society of Anaesthesiologists (ASA) reports that 87.5% of patients (70) were categorized as grade 1, signifying they are normal healthy individuals. In contrast, 12.5% of patients (10) fell into grade 2, which denotes the presence of mild systemic disease. The VAS score was utilized to assess pain intensity following surgery during follow-up periods at 1 month, 3 months, 6 months, and 12 months. Observations of the VAS score at each follow-up indicated a consistent decline in pain intensity, suggesting improved outcomes for radius fractures treated with radius plates (Table 2).

For the first six months post-surgery, patients were recommended to engage in rehabilitation exercises, which would be complemented by physiotherapy sessions. Assessing the advancements at each follow-up revealed positive post-operative outcomes throughout the first year of the follow-up period. The surgical procedure yielded a successful outcome, with no complications or indications for reoperation reported. The study reported no occurrences of infection, non-union, or fixture failure.

Table 1: Demographic data of study participants

Variables	Number	Percentage (%)
Gender		
Male	71	88.75
female	9	11.25
ASA		
Grade I	70	87.5
Grade II	10	12.5
Dominant side		
Left side radius	37	46.25
Right side radius	43	53.75
Mode of injury		
Fall on ground	18	22.5
Sports injury	14	17.5
Road traffic incident	48	60

Table 2: VAS Scoring %

Follow up time	VAS score (%)
1	55
3	28
6	14
12	3

Table 3: Evaluation parameter

Evaluation parameter	Satisfied N (%)	Not satisfied N (%)
Pain (N=80)	38	47.5
Aesthetic appearance (N=80)	42	52.5

Statistically significance at $p \leq 0.05$

Discussion

The use of radius plating has emerged as a highly effective method for the surgical management of unstable radial fractures. The plating system has typically yielded results that align with both functional and radiographic criteria.

The results among the various plating systems continue to be consistent. Subjective measures of outcomes can be assessed using tools such as the Visual Analog Scale (VAS), Mayo wrist scores, and QuickDASH scores. A study conducted by Satake et al involved the surgical treatment of 824 patients. Complications were reported in approximately 7.5% of patients, including nerve palsy, tendon rupture, trigger digit, and carpal tunnel syndrome. [12] No results were identified in the radius plates from Auxein Medical Pvt. Ltd. A recent study by Galle et al. examined a consecutive series of 61 patients who experienced distal radius fractures and underwent surgical intervention. At the final follow-up, complications such as hardware sensitivity and wrist stiffness were reported. [13]

Fractures of the distal radius, whether accompanied by ulnar involvement or not, are frequently encountered in emergency departments, especially in individuals presenting with upper extremity injuries. Distal radius fractures (DRF) are often the result of high-energy trauma in younger individuals, whereas in older adults, these fractures

are more frequently associated with low to moderate-energy trauma. [14,15] Younger adults exhibiting elevated energy-related DRF may encounter greater joint involvement and increased bone fragmentation. Distal radius fractures resulting from high-energy trauma are more commonly observed in men. Notably, the incidence of DRF is higher among women than men. With advancing age, the probability of encountering comminuted intraarticular fractures increases significantly. External fixation, whether utilized alone or in conjunction with K wires, serves to maintain proper alignment of fractures and avert any shifting or angling in cases of distal radius fractures. Research indicates that younger patients suffering from a comminuted intraarticular fracture experience improved radiographic and functional outcomes when treated with external fixation rather than a plaster cast. [16]

No complications associated with the hardware were reported; however, 9% of patients experienced mild pain, and 4.5% expressed dissatisfaction with the aesthetic appearance. In a retrospective analysis, Figl et al examined a cohort of 85 patients who received surgical intervention involving variable angle volar plating fixation for unstable fractures of the distal radius. Research revealed that 75% of the patients maintained their radial height, with none experiencing a loss of acceptable reduction. The findings of this study

indicate improved immobilization of bone union, achieved without any complications. [17] The findings of this study indicate that fractures can achieve improved clinical outcomes when immobilization is kept to a limited duration, resulting in no pain, in contrast to our analysis. The limitations of our study include a small sample size and a follow-up duration of just 12 months.

Conclusion

The application of radius plates for managing unstable distal end radius fractures demonstrates promising functional results, often characterized by minimal complications.

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