

The Clinical Efficacy of the Radius Bone Plates in the Treatment of Radius Bone Fractures

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Abstract

Background and Aim: Distal radius intraarticular fractures can have a significant impact on clinical outcomes. Treatment of intraarticular fractures is a topic of debate in the medical community, with varying outcomes reported in the literature. Our study aimed to assess the effectiveness of radius bone plate fixation in the treatment of radius bone fractures.

Material and Methods: A group of fifty patients who had fractures in the distal part of their radius underwent treatment using the fixed angle plate fixation method. Patients were monitored through radiographs, physical examination, ASA and VAS score.

Results: Among the 50 patients, 30% (15) were found to have 2R3A1, while 22% (11) were found to have 2R3B1. Out of the total number of patients, 20% (10) were found to have 2R3B1. Out of the 28 patients, 14 were diagnosed with 2R3A2.1 types of fracture based on the AO fracture classification. According to this retrospective study, fractures were found to occur more frequently on the left side of the radius (56%) compared to the right side (44%). Based on data from the American Society of Anaesthesiologists (ASA), the majority of patients (84%) were classified as grade 1, indicating that they were normal and healthy. A smaller percentage of patients (16%) were classified as grade 2, indicating that they had mild systemic disease.

Conclusion: The utilization of radius plates in the treatment of unstable distal end radius fractures has been found to result in favorable functional outcomes and few complications.

Keywords: American Society of Anaesthesiologists, Radius Intraarticular Fracture, Plate Fixation, VAS Score.

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Introduction

One of the bones that make up the human ante-brachium is the radius, which allows for the pronation, supination, and flexion of the forearm and hand. [1] Radial fractures can often be attributed to common direct, low energy trauma, such as a car crash. [2] Distal radius fractures in younger patients typically result from high-energy trauma, while in the elderly, these fractures are commonly caused by low to moderate-energy trauma, often occurring against a backdrop of osteopenia or osteoporosis. Comminuted or intraarticular fractures are commonly associated with high-energy trauma, while metaphyseal fractures are more often seen in cases of low to moderate-energy trauma. [3,4]

Radius fractures are commonly caused by falls onto an outstretched arm, according to experts. [5] Elderly individuals diagnosed with osteoporosis are at a higher risk of experiencing fractures due to

their increased fragility. According to medical studies, a seemingly harmless fall from standing can lead to a wrist fracture. Age and bone disorders are significant factors in determining the cause of these injuries. Identifying a fracture in the radial area is quite straightforward, as it is accompanied by immediate pain, tenderness, and swelling. Noticing any deformity or numbness in the surrounding areas, particularly the fingers, can provide important clues about the severity of the injury. [6]

There are several factors that come into play when determining the treatment for distal radius fractures. Several factors, including the type and stability of the fracture, the patient's age, hand dominance, and any existing medical conditions, are commonly considered when determining the appropriate treatment. There are two commonly used methods for treating radius bone fractures:

operative and non-operative. These methods are used for proximal, shaft, and distal radius fractures. During non-operative or non-surgical treatment, a cast is utilized to maintain the proper alignment of the bones while they heal. When a bone is misaligned, a reduction process is performed to realign the broken bone fragments. To enhance the healing process, a splint or cast can be applied over the aligned bones.

The casts typically need to be replaced every 4-6 weeks, and an X-ray examination is done afterwards. Therapy sessions can be incredibly beneficial and accelerate the healing process. [7] When closed reduction treatment is unsuccessful in properly aligning the bone, operative treatment becomes necessary.

Surgery is performed to ensure that the fracture heals in the correct alignment and prevents any complications. [8] Typically, incisions are made to access the broken bone while ensuring the safety of surrounding arteries, tissues, tendons, and other structures. This technique of open reduction utilizes casts, metal pins, plates, screws, and occasionally external fixators, or a combination of these devices. [9]

Our study aimed to assess the effectiveness of radius bone plate fixation in the treatment of radius bone fractures.

Material and Methods

This study was conducted at a prestigious Department of Orthopedics in India, focusing on 50 patients over a period of 1 year.

Patients over the age of 20 with a fracture in the radius bone were included in the evaluation.

Participants who met any of the following criteria were not included in the study: being under 20 years old, having a chronic disease, not having a radius fracture, substance abuse, neurodegenerative disease, abnormal blood pressure, cardiovascular disease, osteopenia, or a history of metal allergies that could pose a significant risk during plate fixation.

For fractures that are unstable or have extensive fragmentation, surgical treatment is necessary as simple casting may not effectively maintain the alignment of the fracture. When it comes to surgical treatments, plates with screws made of the same material are typically considered the top choice for treating fractures. The surgical strategy is determined by the treating surgeon.

A total of 50 patients suffering from distal radius fractures were identified and subsequently treated using a carefully selected implant that was specifically chosen based on the type of fracture, as per the AO fracture classification. The patients

received various implants for their treatment, including narrow, wide, and standard 2.4 mm variable angle two-column volar distal radius plates, as well as a 2.4 mm wise-lock volar column distal radius plate. Patients who underwent surgery were monitored at regular intervals of 1 month, 3 months, 6 months, and 12 months to assess the progress of bone healing through radiographic examination.

Statistical Analysis

The data was compiled and entered into a spreadsheet computer program (Microsoft Excel 2019) and then exported to the data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). The quantitative variables were described using either means and standard deviations or median and interquartile range, depending on their distribution. The qualitative variables were displayed as counts and percentages. Confidence level and level of significance were set at 95% and 5% respectively for all tests.

Results

There were a total of fifty patients who underwent surgery using the radius plate system. The patients consisted of 43 males and 7 females, with ages ranging from 26 to 72 years and a mean age of 44.9 years (Table 1). Among the 50 patients, 15 individuals (30% of the total) were diagnosed with 2R3A1, while 11 patients (22%) were diagnosed with 2R3B1. Out of the total number of patients, 20% (10) were found to have 2R3B1. In the study, a total of 28 patients were observed, with 14 of them experiencing 2R3A2.1 types of fractures based on the AO fracture classification (Table 2).

The surgery was performed by a highly skilled orthopaedic surgeon and was successfully completed in just 75 minutes. According to this retrospective study, fractures were found to occur more frequently on the left side of the radius (56%) compared to the right side (44%). As per the American Society of Anaesthesiologists (ASA), the majority of patients (84%) were classified as grade 1, indicating a normal healthy patient, while a smaller percentage (16%) were classified as grade 2, indicating mild systemic disease.

Exclusion criteria for the study did not encompass patients classified as grade 3 by the American Society of Anesthesiologists (ASA). A follow-up period of 1 month, 3 months, 6 months, and 12 months was used to determine the pain intensity after the surgery, using the VAS score.

Observing the difference in the VAS score at each follow-up, it becomes evident that there is a consistent decline in pain intensity for radius fractures treated with radius plates. This continuous decline in pain intensity indicates positive

outcomes for patients. Patients undergoing postoperative care were recommended to engage in rehabilitation exercises and follow up with physiotherapy for the first 6 months. Observing the progress at each follow-up revealed positive post-

operative outcome throughout the first year of the follow-up period. A successful surgical outcome was reported without any complications or need for further surgery. No instances of infection, non-union, or fixture failure were found.

Table 1: Demographic data

Demographics	Number	Percentage (%)
Age (Mean±SD)	44.90±5.68	
Gender		
Male	43	86
female	7	14
Mode of injury		
Fall on ground	15	30
Sports injury	11	22
Road traffic incident	24	48
Dominant side		
Left side radius	28	56
Right side radius	22	44
ASA		
Grade I	42	84
Grade II	8	16

Table 2: Fracture classification

Fracture type (AO Classification)	Number	Percentage (%)
2R3A1	15	30
2R3A2.1	11	22
2R3B1.1	10	20
2R3B1.3	14	28

Table 3: VAS Scoring

Follow up time	VAS score %
1	50
3	30
6	14
12	2

Discussion

There are various treatment options available for comminuted, intraarticular fractures of the distal radius. When making a decision on the best approach, it is crucial to thoroughly analyze patient characteristics, activity demands, fracture stability, and displacement. [10-12]

Based on current observations, it has been noted that the most frequently used method for treating these fractures is open reduction and fixation using a volar approach. There are several ways to measure the subjective measures of the outcome, such as VAS, Mayo wrist scores, and quick dash scores. A study conducted by Satake et al involved the surgical treatment of 824 patients. [13] Complications were reported in approximately 7.5% of patients, including nerve palsy, tendon rupture, trigger digit, and carpal tunnel syndrome.10 In a recent study conducted by Galle et al, a group of 61 patients who had distal radius fractures underwent surgery. The study found that

some patients experienced complications such as hardware sensitivity and wrist stiffness during the final follow-up period. [14]

Distal radius fractures with or without ulnar involvement are commonly observed in the emergency department, particularly among patients with upper extremity injuries. Distal radius fractures (DRF) typically occur due to high-energy trauma in young adults, while in the elderly; distal radial fractures are more commonly caused by low to moderate-energy trauma. [15,16]

Younger adults with high energy-related DRF may experience more extensive joint involvement and bone fragmentation. High-energy trauma-related distal radius fractures tend to affect men more frequently. Interestingly, women experience a higher incidence of DRF compared to men. As individuals get older, the likelihood of experiencing comminuted intraarticular fractures tends to rise. External fixation, with or without the K wire combination, is used to keep fractures aligned and

prevent them from shifting or angling in distal radius fractures. For younger patients with a comminuted intraarticular fracture, studies have demonstrated that external fixation offers better radiographic and functional outcomes compared to a plaster cast. [17]

In previous reports on elderly patients, particularly those with osteoporotic bones, it was discovered that the use of external fixators was not as effective in maintaining radial length. The literature presents a variety of clinic and radiologic outcome results. [18,19] In a study conducted by Kreder et al., it was found that patients in the external fixator group experienced quicker return to function and pain relief compared to those who underwent open reduction surgery. [20]

There were no complications reported regarding the hardware, however, a small percentage of patients (8.8%) experienced mild pain and a slightly smaller percentage (4.4%) were not satisfied with the aesthetic appearance. In a recent study, Figl et al examined a group of 85 patients who had undergone surgery for unstable fractures in the distal radius.

The focus of the study was on the variable angle volar plating fixation technique. According to the findings, a significant majority of the patients (75%) maintained their radial height, and none of them experienced any loss in acceptable reduction. The study demonstrated improved bone union immobilization without any complications. [21] Our study was limited by a small sample size and a follow-up period of only 12 months.

Conclusion

Treating unstable distal end radius fractures with radius plates has been shown to result in excellent to good functional outcomes and minimal complications.

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