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Original Research Article

Comparative Clinical Analysis of Conservative and Surgical Treatment of Distal Radius Fractures in Adults

Waybase Hanumant Ashok[1], Sagar Shriram Maslekar[2], Anand Balajirao Anerao[3], Madhusudhan Kale[4]

[1]Assistant professor, Department of Orthopaedics, Parbhani Medical College and RP Hospital, Parbhani, India

[2]Assistant professor, Department of Orthopaedics, Parbhani Medical College and RP Hospital, Parbhani, India

[3]Assistant professor, Department of Orthopaedics, Parbhani Medical College and RP Hospital, Parbhani, India

[4]HOD, Department of Orthopaedics, Parbhani Medical College and RP Hospital, Parbhani, India

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Corresponding Author: Dr. Anand Balajirao Anerao

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Abstract:

Background: Distal radius fractures (DRFs) are among the most common orthopedic injuries, particularly in elderly patients, and are often associated with osteoporosis and increased fall risk. Both conservative casting and surgical intervention are widely used treatment options, but the optimal approach remains debated.

Aim: To compare the clinical outcomes, functional recovery, quality of life, and complication rates of conservative versus surgical management of DRFs in adults.

Methodology: This prospective comparative study enrolled 60 adult patients with DRFs treated either conservatively (closed reduction and casting) or surgically (open reduction and internal fixation or percutaneous pinning). Outcomes assessed at 3 and 6 months included pain (VAS), ROM (range of motion), DASH (Disabilities of the Arm, Shoulder, and Hand) score, and SF-36 quality-of-life scores. Complications were documented and statistically analyzed.

Results: Surgical management demonstrated substantially reduced DASH scores across both 3 months (62.45 ± 9.12 vs. 69.10 ± 13.85; p=0.038) and 6 months (52.80 ± 8.75 vs. 59.45 ± 14.62; p=0.019). VAS pain scores and ROM were consistently superior among the surgery cohort ($p<0.05$). Malunion was more frequent with casting (53.3% vs. 23.3%), whereas surgical site infections (10.0%) and radial nerve injuries (13.3%) occurred only in surgical patients. The SF-36 ratings indicated no substantial difference between the groups.

Conclusion: Surgical management of DRFs offers faster functional recovery, improved pain control, and reduced malunion risk, though it carries procedure-specific complications. Casting remains viable for low-demand patients or those unfit for surgery. Individualized treatment selection is essential.

Keywords: Distal radius fracture, surgical management, conservative treatment, DASH score, functional outcome, complication rate.

Introduction

Distal radius fractures are among the most prevalent orthopaedic injuries, with more than 640,000 instances documented in the United States in 2001. This fracture type constitutes up to 18% of all fractures in the elderly population. Epidemiological studies indicate that the highest rates occur in youngsters and the elderly, with individuals over 65 years old constituting over 50% of all DRF cases in the population [1]. The incidence adjusted by age in extensive studies varies from 73 to 202 per 100,000 in men and from 309 to 767 per 100,000 in women among individuals aged over 50 years.

A peripheral low-energy fracture is a significant indicator of osteoporosis. Individuals with a distal radius fracture exhibit a twofold increased risk of subsequent hip fracture. In older adults, particularly females, fractures occur due to moderate trauma or low energy, such as falling from a standing position. Studies indicate a heightened propensity for falls in patients aged over 65 years [2]. This suggests that heightened bone fragility due to osteoporosis and osteopenia, coupled with an increased propensity for falls, constitutes significant risk factors for distal radius fractures, alongside additional factors such as previous vertebral fractures, cigarette smoking,

reduction in body height, and medical procedures for specific conditions like rheumatoid arthritis [3].

Multiple surgical alternatives exist for this type of damage, each presenting distinct benefits and dangers. The American Academy of Orthopaedic Surgeons is now unwilling to approve any form of therapy, whether conventional or surgical. In this case, they additionally do not endorse the most appropriate surgical technique [4]. The selection of treatment is contingent upon numerous aspects, factors to consider include the patient's age, lifestyle, comorbidities, adherence, functional requirements, limb dominance, fracture type, severity, alignment, soft tissue condition, and consecutive fractures.

In the last century, many distal radius fractures in adults were managed non-operatively, which included fracture reduction for displaced instances and stabilization with a plaster cast or other external brace. The outcomes of this kind of therapy, especially in senior patients with osteoporotic bone deterioration, are not consistently favorable [5]. Closed reduction and cast immobilization can be performed extensively, cost-effectively, and without hospitalization; however, this frequently results in suboptimal radiological outcomes and displacement, with rates potentially reaching 40%. This has led to efforts to devise surgical methods focused on achieving more precise reduction and enhanced stabilization [6].

A variety of surgical procedures for fractures of the distal radius has been identified, including intramuscular pinning with external fixation and plaster (closed reduction); however, Open Reduction Internal Fixation (ORIF) involving the volar locking plate method is the preferable approach, alongside ORIF with Herbert screw fixation and crif with k-wire. Percutaneous pinning involves the insertion of pins, which can be either threaded or wired, into the dermis [7]. External fixation, a minimally invasive procedure, entails the insertion of screws or metal pins by little dermal incisions into the bone tissue, after the drilling of holes adjacent to the fracture.

Managing a fracture of the distal radius involves a range of interventions, each characterized by varying degrees of invasiveness, stability, and recovery. Ordinarily, external methods of treatment for distal radius fractures use percutaneous pins that are fixed externally via plaster casting, or external fixator frames. These methods are less invasive than operations, in which we avoid making a wound (as we did with external fixation), and we do not disturb any of the soft tissues [8]. External approaches typically use closed reduction to restore the fracture fragments so that the benefits of the process are realized. Open and percutaneous fixation theoretically are less invasive procedures as they expose the surgery to the potential of infecting the area of soft tissue damage. Open fixation typically is mechanical fixation with the approach of surgical exposure of the fracture site so that the fracture fragments can be visualized and interfered upon.

Internal fixation was generally thought to be better suited for more serious/unstable injuries as the method was technical demanding and had a higher risk of complications, including infections and soft tissue compromise; however, use of internal fixation has been on the rise [9]. Meta-analytic data reveal that for unstable distal radius fractures, internal fixation produced fewer overall surgical complications, particularly pin-track infections, in addition to better results with respect to grip strength, pronation and supination, in the early postoperative period when compared to external fixation.

Among the internal fixation options, volar locking plate systems (VLPS) are becoming increasingly popular, particularly for osteoporotic bone or comminuted intra-articular fractures. The fixed-angle constructs provided by volar locking plates afford greater mechanical stability, and minimize loss of reduction due to screw toggling, and provide better restoration of volar tilt, radial inclination, and articular congruence. For intra-articular and complex fractures, complication rates are still not negligible; complications noted include misplaced screws, irritation of tendon, irritation of soft tissue, prominence of hardware, and sometimes hardware removal [10]. There are growing positive findings about outcomes, however, there is a lack of strong population-based evidence, and context-specific evidence from Iran about managing distal radius fractures, regarding the best fixation method, functional, and patient-reported outcomes, and complications, indicating a pressing need for context-specific evidence.

This investigation aimed to assess and compare the outcomes of two different therapies pathways for older patients with distal radius fractures cast immobilization versus surgical treatment by investigating and comparing their clinical outcomes such as pain, range of motion, complication rates, functional outcomes, including strength, ability to perform daily activities, wrist function, and quality of life as per stipulated follow-up times.

Methodology

Study Design: This study was designed as a prospective comparative study to assess and contrast the clinical outcomes of conservative treatment versus surgical management in adults with distal radius fractures.

Study Area: The investigation was carried out in the Department of Orthopaedics at Parbhani Medical College and RP Hospital, Parbhani, India.

Study Duration: The research was carried out over the duration of one year.

Inclusion and Exclusion Criteria

Inclusion Criteria

- Patients aged 18 years and older are diagnosed with distal radius fractures.
- Patients are presenting within one week of injury.
- Patients who granted consent for involvement in the trial and subsequent follow-up.

Exclusion Criteria

- Open fractures of the distal radius.
- Pathological fractures or fractures associated with bone tumors.
- Patients with multiple injuries or polytrauma.
- Patients with previous surgery or deformity of the affected wrist.
- Patients are unwilling or unable to comply with follow-up requirements.

Sample Size: 60 patients who carried out the inclusion and exclusion criteria were determined in the clinical study.

Procedure: Eligible patients were clinically examined and evaluated with radiographs to confirm the diagnosis and classify the fractures. After obtaining informed consent, patients were allocated into two groups: conservative management (closed reduction and immobilization with a plaster cast) and surgical management (open reduction and internal fixation with volar plating or percutaneous pinning, as indicated by fracture pattern). Preoperative preparation and standard surgical protocols were followed for patients undergoing surgery. Post-intervention, patients in both groups underwent a structured rehabilitation program including physiotherapy and regular follow-up visits at 2, 6, 12, and 24 weeks. At each follow-up, clinical outcomes were assessed using parameters such as pain, wrist amplitude of movement, grip strength, and functional outcomes using the Disabilities of the Arm, Shoulder, and Hand (DASH) score. Radiological union was also documented.

Statistical Analysis: All gathered data were input into Microsoft Excel and analyzed utilizing SPSS version 27. Continuous variables were expressed as mean ± standard deviation, whereas categorical parameters were represented as frequencies and percentages. Assessments between the two groups were conducted utilizing the chi-square test for categories of variables and the independent t-test for constant variables. A significant p value was defined as one that was less than 0.05."

Result

Table 1 compares functional results and quality of existence between patients treated with casting versus surgery for distal radius fractures at 3 and 6 months. Patients in the surgery group demonstrated significantly better functional recovery, as indicated by lower DASH scores at both 3 months (62.45 ± 9.12 vs. 69.10 ± 13.85, p = 0.038) and 6 months (52.80 ± 8.75 vs. 59.45 ± 14.62, p = 0.019), suggesting less disability in the upper limb. Although the SF-36 scores, reflecting overall quality of life, were slightly higher in the surgery group at both time points (65.05 ± 11.90 vs. 63.10 ± 9.95 at 3 months and 77.25 ± 11.85 vs. 71.40 ± 10.20 at 6 months), The variations were not statistically relevant (p > 0.05). Overall, surgical management appears to provide superior functional outcomes, the enhancements in quality of life were comparable among the two groups.

Table 1: Functional and Quality of Life Outcomes between Casting and Surgery Groups at 3 and 6 Months (n = 60)

Outcomes	Casting Group (n = 30)	Surgery Group (n = 30)	P value
DASH			
3 months	69.10 ± 13.85	62.45 ± 9.12	0.038
6 months	59.45 ± 14.62	52.80 ± 8.75	0.019
SF-36			
3 months	63.10 ± 9.95	65.05 ± 11.90	0.142
6 months	71.40 ± 10.20	77.25 ± 11.85	0.281

Table 2 compares the quality of life and functional outcomes between the Casting and Surgery groups at 3- and 6-month post-intervention. At both points, the Surgery group demonstrated significantly lower pain intensity, with mean VAS scores of 3.05 ± 1.00 versus 3.62 ± 1.05 at 3 months (p = 0.011) and 1.95 ± 0.85 versus 2.40 ± 0.90 at 6 months (p = 0.029), indicating better pain relief after surgery. Similarly, the ROM (Range of Motion) was consistently higher in the Surgery group, measuring 130.10 ± 12.50° compared to 122.45 ± 15.20° at 3 months (p = 0.014) and 146.50 ± 13.30° versus 138.50 ± 13.00° at 6 months (p = 0.005), reflecting superior functional recovery. Overall, these results suggest that surgical management provides more favorable outcomes in both pain reduction and joint mobility compared to cast immobilization over a six-month period.

Table 2: Quality of Life and Functional Outcomes in Casting and Surgery Groups at 3 and 6 Months (n = 60)			
Outcomes	**Casting Group (n = 30)**	**Surgery Group (n = 30)**	**P value**
Pain intensity (VAS)			
3 months	3.62 ± 1.05	3.05 ± 1.00	0.011
6 months	2.40 ± 0.90	1.95 ± 0.85	0.029
Range of Motion (ROM)			
3 months	122.45 ± 15.20	130.10 ± 12.50	0.014
6 months	138.50 ± 13.00	146.50 ± 13.30	0.005

"Table 3 demonstrates a comparative analysis of complications between patients treated with casting and those undergoing surgery for distal radius fractures. Mal-union was significantly higher in the casting group (53.3%) compared to the surgery group (23.3%) with a p-value of 0.021, indicating a statistically significant difference. Conversely, surgical site infections (10.0%) and superficial radial nerve injuries (13.3%) were observed exclusively in the surgery group, both showing statistical significance ($p = 0.05$ and 0.026, respectively). Rates of non-union (6.6% vs. 10.0%) and the need for reoperation (20.0% vs. 16.6%) did not differ significantly among the two groups. Overall, the total the rate of complications was slightly higher in the casting group (80.0%) compared to the surgery group (73.3%), reaching borderline statistical relevant ($p = 0.05$), suggesting that while surgery reduces mal-union risk, it carries its own procedure-related complications.

Table 3: Complications Observed in Casting and Surgery Group Patients (n=60)			
Complications	**Casting Group (n = 30)**	**Surgery Group (n = 30)**	**P-value**
Mal-union	16 (53.3%)	7 (23.3%)	0.021
Surgical site infection	0 (0.0%)	3 (10.0%)	0.05
Superficial radial nerve injury	0 (0.0%)	4 (13.3%)	0.026
Non-union	2 (6.6%)	3 (10.0%)	0.214
Need for reoperation	6 (20.0%)	5 (16.6%)	0.321
Total complications	24 (80.0%)	22 (73.3%)	0.05

Discussion

The present study assessed the relative clinical outcomes, functional recovery, quality of life, and complications of conservative (casting) and surgical management of distal radius fractures in adults over a six-month follow-up period. Our results suggest that surgical management provides better functional outcomes, improved pain control, and improved range of motion, but both treatment options had similar improvements in quality of life.

The functional assessment utilizing the Disability of the Arm, Shoulder, and Hand (DASH) score revealed favorable outcomes in the surgery group compared to the casting group. At 3 months, the mean DASH score in the surgery group was 62.45 ± 9.12, while the mean score in the casting group was higher at 69.10 ± 13.85 ($p = 0.038$). At 6 months, even though the mean DASH score had improved in the surgery group 52.80 ± 8.75 lower than the casting group 59.45 ± 14.62 ($p = 0.019$). Taking together our results suggest that surgical stabilization may allow for earlier and more optimal return of upper limb function by achieving anatomical reduction and stable fixation to allow for early mobilization. Similar studies have also reported that open reduction and internal fixation (ORIF) promote decreased impairment after fracture and accelerates functional recovery compared to non-operative management, particularly in patients with displaced or unstable fractures. Testa et al., (2019) [11] examined 91 patients aged older than 65 with distal radius fractures, divided into two groups and assessed at 1, 3, 6 and 12 months post-intervention using methods like his research, and found no significant therapeutic distinctions among both the surgical and casting groups."

Assessment of quality of life through the SF-36 instrument indicated modestly higher scores in the surgery group at both 3 months (65.05 ± 11.90 vs. 63.10 ± 9.95) and 6 months (77.25 ± 11.85 vs. 71.40 ± 10.20), however, this difference did not reach statistical relevant ($p > 0.05$). This implies that while surgery demonstrated a benefit compared to baseline in objective functional metrics, there may not be an overall difference in subjective health and quality of life metrics compared to non-surgical interventions in the short-to-intermediate term. It is possible that expectations, adherence to rehabilitation, and psychosocial support affect quality of life in ways not directly related to the treatment type. Arora et al., (2009) [12] reached a similar outcome, identifying no significant difference between the two strategies of treatment for DRF.

Pain control and joint mobility are essential considerations in the healing process following fracture management. The pain intensity, as assessed by the

visual analogue scale (VAS), was markedly reduced in those that underwent surgery for 3 months (3.05 ± 1.00 vs. 3.62 ± 1.05, p = 0.011) as well as at 6 months (1.95 ± 0.85 vs. 2.40 ± 0.90, p = 0.029). In addition, Range of Motion (ROM) for surgically treated patients was either equal to or greater than those patients treated nonoperatively at 3 months (130.10 ± 12.50° vs. 122.45 ± 15.20°, p = 0.014) and 6 months (146.50 ± 13.30° vs. 138.50 ± 13.00°, p = 0.005). These results corroborate other studies suggesting that internal fixation allows for early mobilization of the wrist and, therefore, better pain control and recovery of wrist motion compared to delaying motion with a cast. Ju et al., (2015) [13] performed a meta-analysis of eight studies analogous to ours, evaluating cast immobilization (449 patients) versus surgical intervention (440 patients), and identified no statistically significant differences in VAS pain score, DASH score, ulnar deviation, wrist extension, grip strength, supination, or pronation among the cohorts.

There were differences in the complication profiles for each treatment group. There was a significantly greater risk of mal-union in the casting group (53.3%) contrasted to the surgery group (23.3%, p = 0.021), which demonstrates the surgical stabilization provides greater protection from mal-union and provides anatomical alignment. There were surgery-specific complications related to surgery including surgical site infection (10.0%) and superficial radial nerve injury (13.3%) that did not occur in the casting group. No substantial changes were observed in the diagnosis of non-unions and no clinically meaningful difference in reoperation rates. Although the overall complication rates were slightly higher in the casting group (80.0%) versus the surgery group (73.3%), this marginally met significance (p = 0.05). While there is risk in both treatment options, the difference illustrated above should be viewed in the context of the risks and benefits of surgical versus conservative intervention. Bruce et al., (2016) [14] investigated the lack of an integrative approach to treating DRFs and the impact on therapy variability on care quality and cost, emphasizing the need for more clinical trials or implemented evidence-based recommendations to better manage this common fracture.

It appears that surgical intervention for distal radius fractures provides definite advantages regarding functional recovery, pain relief, and joint range of motion within the first six months of sustaining the injury. The risk of procedure-related complications, as well as patient selection, needs to be considered. Casting remains an option for selecting low-demand patients or patients with comorbidities that preclude them from surgery will be able to return to a satisfactory level of function and quality of life.

In summary, our study's results align with the increasing body of evidence advocating for surgical management of distal radius fractures when functional recovery is most important to the patient. While both surgical and conservative management result in similarly improved quality of life benefit, surgery achieves better functional outcomes, reduces pain, and improves joint range of motion. For best individualized outcomes, current optimal management of distal radius fractures should factor in fracture type, patient activity level, comorbidities, and patient risk tolerance for surgical outcomes. Subsequent research with extended follow-up durations may better clarify the long-term functional and radiographic benefits of surgical management of distal radius fractures versus conservative management.

Conclusion

This study demonstrates that surgical management of distal radius fractures provides significant advantages over conservative casting in terms of functional recovery, pain control, and joint mobility, particularly within the first six months post-injury. Patients treated surgically showed consistently lower DASH scores, greater range of motion, and reduced pain intensity, reflecting faster and more effective restoration of upper limb function. However, surgical intervention carries risks, including surgical site infections and nerve injuries, while casting is associated with a higher incidence of malunion. Quality-of-life improvements, as measured by SF-36 scores, were comparable between the two groups, suggesting that both methods can achieve satisfactory overall outcomes depending on patient factors. These findings highlight the importance of individualized treatment planning, where surgical stabilization is favored for patients with unstable or displaced fractures and higher functional demands, whereas casting remains a reasonable option for low-demand or high-risk surgical candidates. Longer-term studies are recommended to evaluate sustained functional benefits and complication rates.

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