

"Comparison of the Surgical Outcomes of Variable-Angle Locking Compression Plating and Ligamentotaxis for Intra-Articular Distal Radius Fractures: A Retrospective Study at a Rural Teaching Hospital in India."

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“Comparison of the Surgical Outcomes of Variable-Angle Locking Compression Plating and Ligamentotaxis for Intra-articular Distal Radius Fractures: A Retrospective Study at a Rural Teaching Hospital in India.”

Abstract

Background: Distal radius fractures are quite common, with an aging population (due to osteoporosis) and an increase in outdoor activity (higher energy fractures) being possible reasons for the increasing frequency of such injuries. Although many distal radius fractures are treated conservatively, around 20 percent of cases require surgery. The surgical management of distal radius fractures has changed over the last 30 years from the use of cast immobilization to various surgical techniques, some of which involve volar locking devices and external fixation.

Aim: To compare the efficacies of ligamentotaxis and variable-angle locking compression plating for the treatment of intra-articular distal radius fractures.

Methodology: A hospital-based retrospective study was conducted among 40 patients who had undergone elective ligamentotaxis (group A, which consisted of 20 patients) or variable-angle locking compression plating (group B, which also consisted of 20 patients) for intra-articular distal radius fractures at the Department of Orthopaedics, R.L. Jalappa Hospital, Tamaka, Kolar, Karnataka, India.

Results: Males outnumbered females in both groups. There was a statistically significant difference between the considered variable scores 6 months after surgery. Patients in group A (patients who had undergone elective ligamentotaxis) exhibited better outcomes compared to those in group B (patients who had undergone variable-angle locking compression plating).

Conclusion: For comminuted intra-articular and unstable extra-articular wrist injuries, external fixation and ligamentotaxis yield superior functional and anatomical outcomes. The functional outcome of treating distal radius fractures depends on the concomitant soft tissue injuries and articular damage, as well as the degree to which an anatomical repair of the articular surface is successful.

Keywords: Intra-articular distal radius fractures, surgical outcome, angle locking compression plate, ligamentotaxis.

Introduction

Compared to unstable extra-articular fractures, intra-articular distal radius fractures present a more significant treatment challenge [1]. Distal radioulnar joint anatomical restoration serves as the basis for surgical treatment. Most studies have found a negative association between radiographic arthrosis and outcomes, whereas some reports have reported none [2]. In logical treatment planning, it is important to carefully evaluate the degree of articular surface displacement and disruption; the stability and reducibility of the fracture; and any concurrent injury to surrounding nerves, tendons and/or carpal structures [2,3].

The proximal radioulnar bones, the forearm bones, and the interosseous membrane constitute the complex articulation known as the proximal radioulnar joint, which permits the forearm to pronate and supinate. The joint is physically and physiologically related to "the ulnocarpal joint." Although they can occur in isolation, distal radius fractures are frequently linked to ulnar nerve entrapment and distal radial artery damage. Acute or chronic instability and severe distal radioulnar joint arthritis are possible presentations. Both clinical examination and an understanding of anatomy are necessary for the diagnosis and treatment of these conditions [4].

Because the wrist joint transmits loads, it is crucial to preserve its anatomical structure throughout surgical treatment. Accurate restoration of the skeletal structure by means of closed or open treatment, the identification and repair of related injuries, and closely monitored rehabilitation by licensed therapists are the goals of optimal care [5,6]. Clinical consequences of distal radius fractures, such as decreased range of motion, diminished grip strength, and radiographic abnormalities, may not always correspond to the pain and disability of the injured wrist [7]. The two most used surgical approaches, namely variable-angle locking compression plating and ligamentotaxis, as well as their respective postoperative rehabilitation regimens, differ significantly. Currently, the literature does not provide sufficient data to determine whether external fixation or volar locked plating produces better results; hence, the current study was conducted [8]. This study aimed to compare the efficacies of ligamentotaxis and variable-angle locking compression plating treatment strategies for the treatment of intra-articular distal radius fractures.

Methodology

A hospital-based retrospective study was conducted among 40 patients who had undergone treatment for intra-articular distal radius fractures at the Department of Orthopaedics, R.L. Jalappa Hospital, Tamaka, Kolar, Karnataka, India. These patients were divided into two groups: Those in Group A (20 individuals) underwent elective ligamentotaxis, whereas those in Group B (20 individuals) were treated by means of variable-angle locking compression plate.

Sample size

The sample size was calculated using Open-Epi software (confidence interval = 95%, power = 80%), and ratio of patients treated with the use of variable-angle locking compression plate to those who underwent ligamentotaxis to be 40. The patients were classified into two groups: Group A (20) received ligamentotaxis, while group B (20) was treated with variable-angle locking compression plating for intra-articular distal radius fractures.

After obtaining information from patient medical records, all patients who had undergone elective ligamentotaxis or variable-angle locking compression plating for intra-articular distal radius fractures were retrospectively evaluated. Following surgery, all patients were monitored for 6 months, during which time their level of discomfort, grip strength, wrist range of motion, and activity were repeatedly measured. The patients were then graded using the Green and O'Brien ratings system. A score of less than 65 was regarded as low, while scores between 65 and 79, 80 and 89, and 90 and 100 were regarded as fair, good, and excellent, respectively. Before the study began, the Institutional Ethical Committee (IEC no 527) gave its approval. We obtained written informed consent from every research participant.

Microsoft Excel was used for data entry, and the Statistical Package for the Social Sciences version 26 was used for analysis. Mean and SD were used to summarize all continuous variables. Fractions and percentages were used to summarize categorical variables. A *t*-test was used to compare quantitative variables between study groups, and using the chi-square test, qualitative factors were compared between the research groups. A *p* value of less than 0.05 was deemed statistically significant.

Results

Most of the study participants fell into the age group 41–50 years. Only one patient in each group was less than 20 years old (Figure 1).

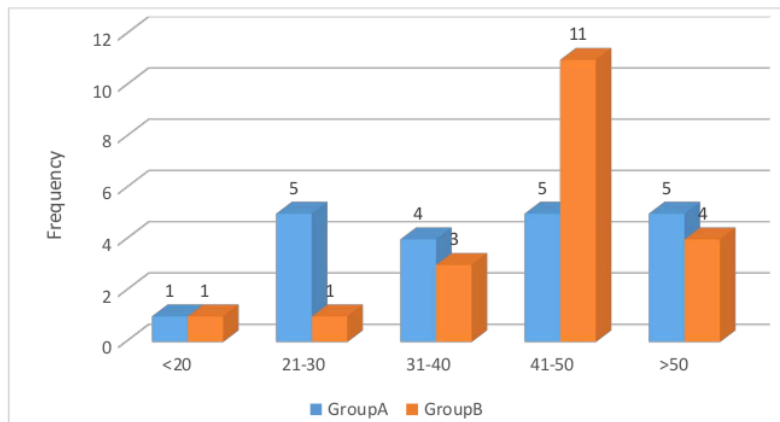


Figure 1: Age group-wise distribution

The mean age of the participants in group A was 39.45 years, whereas that of the participants in group B was 43.4 years. In both groups, males outnumbered females. Overall, 29 participants were male and 11 females. No statistically significant difference was identified between the two groups in terms of mean age or gender distribution. (Table 1).

Table 1. Comparison of sociodemographic information

Variables	Group A	Group B	P value
Age (Mean $\pm$ SD)	39.45 $\pm$ 13.8	43.4 $\pm$ 9.9	0.345
Male	15	14	0.219
Female	5	6	

The mean pain score before surgery was 13.65 for group A and 13.5 for group B. The mean Grip score before surgery was 15.4 in group A and 16.1 in group B. The mean ROM score before surgery was 17.4 for group A and 18.6 for group B. The mean activity score before surgery was 18.5 for group A and 17.1 for group B.

Finally, the mean total score before surgery was 54.05 for group A and 55.4 for group B. No statistically significant differences were identified between the scores for the investigated variables for both groups prior to surgery (Table 2).

Table 2. Comparison of Green and O'Brien scores before surgery among both groups

Variables	Group A (Mean±SD)	Group B (Mean±SD)	P value
Pain	13.65 ±2.5	13.5 ±2.2	0.841
Grip	15.4 ±2.1	16.1 ±2.3	0.321
ROM	17.4 ±5.7	18.6 ±6.9	0.552
Activity	18.5 ±3.8	17.1 ±4.7	0.274
Total Score	54.05 ±4.1	55.4 ±5.9	0.406

Six months post-surgery, the mean pain score for group A was 20.65, whereas that for group B was 18.6. The mean grip score for group A was 22.6, whereas that for group B was 17.1. The mean ROM score for group A was 27.4, whereas that for group B was 23.4. The mean activity score for group A was 28.1, whereas that for group B was 25.4. Finally, the mean total score for group A was 79.25, whereas that for group B was 75.4. Statistically significant differences were identified between different variable scores for both groups of 6 months post-surgery. Patients in group A achieved better outcomes than those in group B (Table 3).

Table 3. Comparison of Green and O'Brien scores 6 months after surgery among both groups

Variables	Group A (Mean±SD)	Group B (Mean±SD)	P value
Pain	20.65 ±3.5	18.6 ±2.1	0.0306
Grip	22.6 ±2.1	17.1 ±5.4	0.0001
ROM	27.4 ±4.2	23.4 ±3.7	0.0028
Activity	28.1 ±4.9	25.4 ±6.1	0.013
Total Score	79.25 ±3.3	75.4 ±4.6	0.004

Discussion

Distal intra-

articular radial fractures, which are significantly more common than unstable extra-articular fractures, present a therapeutic challenge, and the optimal course of treatment remains unclear. The evaluation technique employed may have an impact on patient outcomes. To effectively treat these fractures, medical care beyond physical impairment and radiographic analysis is required since the prognosis may also depend on post-fracture rehabilitation [9].

The operative management of distal radius fractures with open reduction and internal fixation has significantly improved since the introduction of volar locking plates. In cases of extra-articular and simple intra-articular fractures that may be lessened by closed manipulation, restoration of anatomy, joint congruity, and stability allows for early functional mobilization. Nevertheless, recent randomized controlled studies have questioned whether there are clear functional benefits over more conservative approaches [10, 11].

In a randomized prospective study, McQueen et al. [8] compared the effectiveness of nonbridging and bridging external fixators in restoring normal anatomy, carpal alignment, and hand function for the treatment of intra-articular distal radial fractures. Both during the first analysis and at one-year follow-up, the authors found that the pain outcome metrics for the bridging and nonbridging fixators were comparable. At the final follow-up, there were no statistically significant differences in carpal discomfort between the two groups.

Evidence-

based medicine indicates that until the end of the first year post-surgery, there is no appreciable difference in pain levels between patients treated with external fixation and those treated with closed reduction and casting [12]. There is still disagreement over which approach (bridging or nonbridging) is preferable for treating distal radial fractures using an external fixator.

Atroshi et al. [13] determined that nonbridging external fixation was more effective in preserving radial length but had no clinically significant benefit over wrist-bridging fixation. In their research, Huan et al. [14] treated 70 cases of intra-articular distal radius fractures with closed reduction and external fixation using extremely small AO external fixators. The authors proposed that bridging external fixation is a more suitable and reliable method than nonbridging fixation for the treatment of intra-articular distal radial fractures. They concluded that the rigorous fixation and cautious

reduction achieved through treatment using a small AO external fixator were primarily responsible for the good final clinical outcomes observed in their trial.

Through prospective cohort research, Grewa et al. [15] aimed to determine the association between pain and age, gender, comorbidity, educational attainment, and compensation claims. This study also investigated the correlation between radiological and clinical results. The authors found no evidence of a significant relationship between baseline patient characteristics and extra-

articular distal radial fracture injuries or the likelihood of pain and impairment one year after surgery.

Rosental et al. [16] compared the final outcomes of percutaneous K-wire fixation with those of unstable comminuted distal radial fractures treated by open reduction and internal fixation using volar plates. The authors found no appreciable variation in the results based on the scores for disabilities of the arm, shoulder and hand. However, they concluded that volar plates could hasten the healing process for distal intra-articular radial fractures in patients who require a rapid return to function after injury.

Limitations

The present study focused on a small group of patients. Therefore, a multicentric longitudinal study would be required to allow for generalizable findings. In the present study, no follow-up was done, so the long-term complications of the investigated treatments and patient prognosis remain unknown.

Conclusion

Superior functional and anatomical outcomes can be achieved with ligamentotaxis and external fixation for comminuted intra-articular and unstable extra-articular wrist injuries. In addition to the anatomical restoration of the articular surface, the functional result of treating distal radius fractures depends on concurrent soft tissue injuries and articular damage. At 6-month follow-up, ligamentotaxis outperformed volar-locked plating procedures once all patients undergone adequate radiological reduction.

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