A COMPARITIVE STUDY OF FUNCTIONAL OUTCOME OF DISPLACED ULNAR STYLOID FRACTURES TREATED CONSERVATIVELY VS OPERATIVELY ASSOCIATED WITH DISTAL END RADIUS FRACTURES TRETAED SURGICALLY

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KEYWORDS

ULNAR STYLOID, fracture, TFCC, Surgical.

ABSTRACT

Introduction: Ulnar styloid fractures, a common injury associated with distal radius fractures, are often a subject of debate regarding their optimal management. The ulnar styloid process, situated at the distal end of the ulna, plays a significant role in the stability and function of the wrist joint, particularly influencing the function of the triangular fibrocartilage complex (TFCC). Surgical repair and conservative treatment are two major management strategies widely adopted in ulnar styloid fracture patients, but the consensus of the optimal treatment strategy is still debated. **Aim and objective:** The aim of this study is to assess potential differences in clinical and radiological outcomes between surgical and conservative management of ulnar styloid fractures that occur alongside distal radius fractures treated with volar plating. This evaluation will focus on the duration of fracture union and the PRWE (Patient-Rated Wrist Evaluation) score. **Materials and Methods:** Group A underwent conservative management and Group B underwent surgical management for ulnar styloid fracture while distal end radius fracture was operated with volar plating for both the groups.Each group has 20 patients of distal end radius fracture with ulnar styloid fracture. Patient follow up was carried at 1.5 months , 3 months and 6 months and were clinically and radiologically assessed and outcomes were graded according to PRWE Score. **Results**: A significant difference was observed in non-union between 2 groups with non union occurring in 45% of conservative cases, compared to 15% in the operative group .Functional outcome assessed using mean changes in the PRWE score which was 27.96 ± 10.90 for rotella type 1, 22.21 ± 7.10 for type 2, 30.77 ± 8.19 for type 3 in Group A while 20.28 ± 12.13in rotella type 1, 14.73 ± 7.64 in type 2, 22.36 ± 8.40 in rotella type 3 in Group B at 6 months follow up. **Conclusion**: Patients who underwent operative treatment for ulnar styloid fractures showed a statistically significant improvement in functional outcomes using PRWE Score compared to those who were treated conservatively. The incidence of complications like non-union was higher in the conservative treatment group. Radiological union of the ulnar styloid fracture was achieved more consistently and predictably in the operative group.

Introduction:

Ulnar styloid fractures, a common injury associated with distal radius fractures, are often a subject of debate regarding their optimal management. The ulnar styloid process, situated at the distal end of the ulna, plays a significant role in the stability and function of the wrist joint, particularly influencing the function of the triangular fibrocartilage complex (TFCC). Displaced fractures of the ulnar styloid are particularly concerning due to their potential effect on wrist biomechanics and the risk of associated TFCC injuries**.** Ulnar styloid fractures are commonly associated with distal radius fractures, representing a significant portion of wrist injuries worldwide. These fractures occur in approximately 50% of distal radius fractures, making them a frequent concern in orthopaedic practice. According to some previous studies, ulnar styloid fractures in adults have been identified as a significant predictive factor for poorer functional outcomes in cases of distal radius fractures. Studies suggest that the presence of an ulnar styloid fracture can lead to complications such as increased pain, reduced range of motion, decreased grip strength, and overall impairment in wrist function. These adverse effects highlight the importance of addressing ulnar styloid fractures to ensure optimal recovery and patient satisfaction. In orthopaedic practice, ulnar styloid fractures are often treated conservatively with immobilization using casts or splints, particularly when these fractures occur with distal radius fractures. This method is favored because it allows for natural healing and maintains wrist function without the risks of surgery. The conservative approach is generally effective for many ulnar styloid fractures, especially those without major displacement.However, a recent study by Robles C. et al. has challenged this perspective. The research indicates that surgical treatment for ulnar styloid fractures results in a 2.76 times higher rate of bone union compared to conservative management. Despite this significant improvement in bone union rates with surgery, there were no notable differences in patient-reported outcomes, such as DASH scores and pain levels, between the surgical and conservative treatment groups.

AIM:

The aim of this study is to assess potential differences in clinical and radiological outcomes between surgical and conservative management of ulnar styloid fractures that occur alongside distal radius fractures treated with volar plating.

OBJECTIVES:

1. To evaluate duration of fracture union in both groups.
2. To evaluate functional outcome of wrist in both the groups using PRWE Score

MATERIAL AND METHOD

Source of data: This was a hospital based cross sectional study and carried out at the Department of Orthopaedics and casualty at a Krishna Institute of Medical Sciences and Hospital, Karad. This study was carried out over a period from May 2022 to May 2024.

Place of study: Krishna Hospital and Research Centre, Krishna Institute of Medical Sciences, Karad.

Sample size: 40 cases (20 cases in each group).

Design of study**:** Prospective comparative study

Sample technique: The patients to be divided in 2 groups for Conservative treatment or surgical treatment of Ulna Styloid Fracture was by randomized technique.

All participants were given both oral and written explanations regarding the purpose and procedures of the study and provided their written informed consent.

INCLUSION CRITERIA**:**

1. Patients with distal radius fractures associated with ulnar styloid fractures, classified according to the Frykman Classification as types 2, 4, 6, or 8 (for distal radius fractures with ulnar styloid fractures) and Rottela Classification as types 1, 2, or 3 (for ulnar styloid fractures).
2. Age group: 18 and above and who underwent ORIF for distal end radius fractures with volar plates
3. Patients of both sexes
4. Patient medically fit for surgery
5. Patient willing to participate in study.

EXCLUSION CRITERIA:

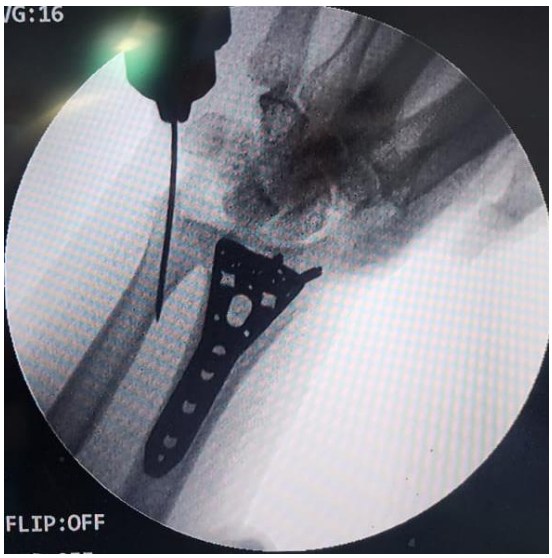
1. Age group: Below 18
2. Pathological Fracture
3. Compound Fracture
4. Patient requiring revision surgery for distal end radius fracture
5. Patient with distal neurovascular deficit

This prospective comparative study, conducted over two years from May 2022 to May 2024, investigated ulnar styloid fractures associated with distal radius fractures. Participants were selected based on predefined inclusion and exclusion criteria. The study involved 40 patients, all of whom had ulnar styloid fractures treated either conservatively (Group I) or surgically (Group II) using Kirschner wires (K-wires) and tension band wiring (TBW). Distal radius fractures were classified using the Frykman classification, while ulnar styloid fractures were categorized according to Rotella's classification, which includes tip, proximal, and base fractures.

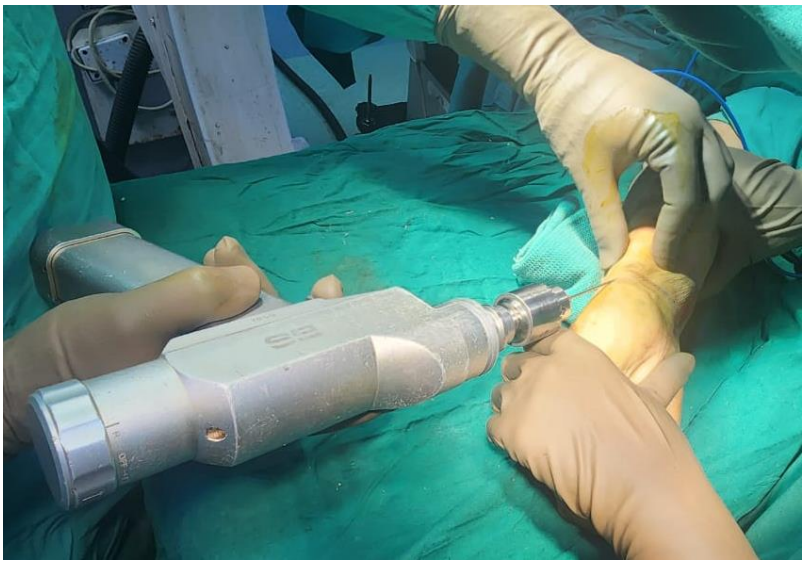
PROCEDURE:

In conservative group, distal end radius fractures were operated with volar plating using modified henry approach while ulnar styloid fracture was conserved while in Operative group distal end radius fractue were operated with volar plating with modified henry’s approach while ulnar styloid fracture were operated with K wiring and tension band wiring.

- The percutaneous K-wire fixation of ulnar styloid was performed with the patient in a supine position, preferably under regional anesthesia (e.g., a brachial plexus block) or general anesthesia, depending on the patient's condition and the surgeon's preference. The fluoroscopy unit (C-arm) was positioned accordingly. Sterile scrubbing, painting, and draping were conducted. Maintaining the reduction, a single 1.5 mm smooth K-wire was inserted into the detached styloid fragment percutaneously and used as a joystick to achieve reduction under direct vision. The wire was inserted using a T-handle. Once reduction was satisfactory, the K-wire was advanced until it just engaged the radial cortex of the distal ulnar metaphysis. The K-wire was left protruding through the skin, bent, and cut. The skin was then protected with sterile padding prior to the application of a splint.

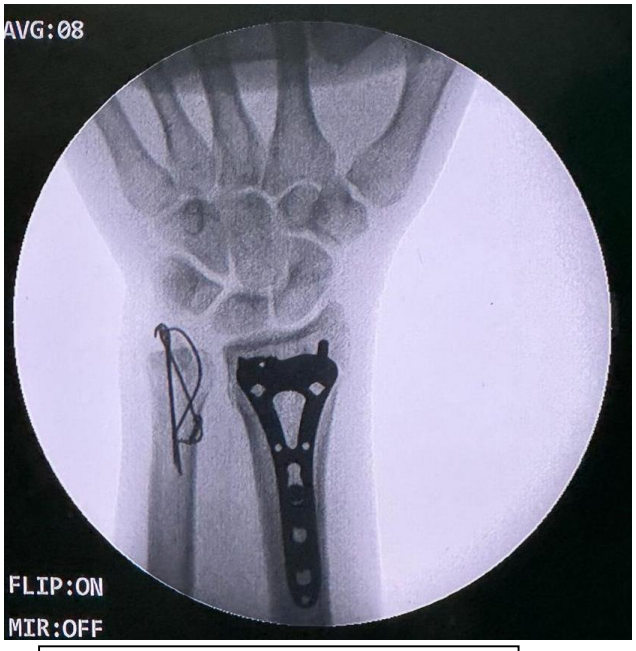


C ARM IMAGE OF ULNAR STYLOID K WIRING



INTRA OP IMAGE OF ULNAR STYLOID K WIRING

- Tension band wiring of ulnar styloid was performed with open reduction and internal fixation. Patients were anesthetized using general anesthesia and then positioned supine. The limb was exsanguinated, and a tourniquet was applied. A longitudinal incision was made over the ulnar styloid, extending distally from the ulnar head. Careful dissection through the subcutaneous tissue was performed, ensuring the



C ARM IMAGE OF ULNAR STYLOID TENSION BAND WIRING

INTRA OP IMAGE OF ULNAR STYLOID TENSION BAND WIRING

protection of the dorsal sensory branch of the ulnar nerve. The fracture site was identified and exposed. Anatomical reduction of the ulnar styloid fragment was achieved, and confirmed with fluoroscopy. Two parallel Kirschner wires (K-wires) were drilled across the fracture site, anchoring into the distal fragment. An 18-gauge stainless steel wire was inserted through a predrilled hole in the ulnar styloid fragment and looped around the K-wires. The wire was tightened in a figure-of-eight configuration, converting tensile forces into compressive forces at the fracture site. Stability of the fixation was ensured by manipulating the wrist, confirming no displacement occurred at the fracture site with fluoroscopy. The ends of the K-wires were cut, bent, and buried beneath the skin to prevent irritation. The wound was cleansed with a saline solution, the subcutaneous layer was sutured with absorbable stitches, and the skin was sealed with either non-absorbable sutures or staples.

FOLLOW UP PROTOCOL:

In cases where ulnar styloid fractures were treated operatively with K-wire fixation, the K-wire was typically removed at four weeks post-operatively. Subsequently, the plaster slab was removed, and a crepe bandage was applied, allowing for the initiation of active wrist movements. Follow-up was done at 1.5 months, 3month and 6 months post- operatively. At each follow-up clinical examination of operated limb was done and radiographs were taken. PRWE score was calculated at each follow up. Complications were noted if any.

OUTCOME MEASURES:

The functional outcomes of both operative and conservative treatments were assessed using validated scoring systems such as, the Patient-Rated Wrist Evaluation (PRWE) as represented as follows:

Patient Rated Wrist Evaluation score (PRWE)

There are 3 steps to score PRWE

Step 1: Measure the pain score of all 5 items (Pain over wrist on ulnar styloid/ulnar aspect wrist pain)

1. PAIN		
Rate the **average** amount of pain in your wrist over the past week by circling the number that best describes your pain on a scale from 0-10. A zero **(0)** means that you **did not** have any pain and a **ten (10)** means that you had the **worst pain you have ever experienced** or that **you could not do the activity because of pain.**		
RATE YOUR PAIN: Sample Scale ☞	0 1 2 3 4 5 6 7 8 9 10 No Pain Worst Ever	
At rest	0 1 2 3 4 5 6 7 8 9 10	
When doing a task with a repeated wrist movement	0 1 2 3 4 5 6 7 8 9 10	
When lifting a heavy object	0 1 2 3 4 5 6 7 8 9 10	
When it is at its worst	0 1 2 3 4 5 6 7 8 9 10	
How often do you have pain?	0 1 2 3 4 5 6 7 8 9 10 Never Always	

Step 2: Measure the function score of all the 10 items and divide it by 2

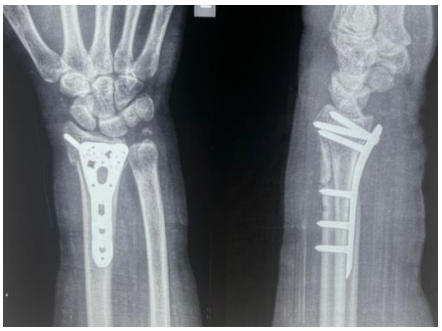
2. FUNCTION											
A. SPECIFIC ACTIVITIES *Rate the **amount of difficulty** you experienced performing each of the items listed below - over the past week, by circling the number that describes your difficulty on a scale of 0-10. A **zero** (0) means you did not experience any difficulty and a **ten** (10) means it was so difficult you were unable to do it at all.*											
Sample scale →	0 No Difficulty	1	2	3	4	5	6	7	8	9	10 Unable To Do
Turn a door knob using my affected hand	0	1	2	3	4	5	6	7	8	9	10
Cut meat using a knife in my affected hand	0	1	2	3	4	5	6	7	8	9	10
Fasten buttons on my shirt	0	1	2	3	4	5	6	7	8	9	10
Use my affected hand to push up from a chair	0	1	2	3	4	5	6	7	8	9	10
Carry a 10lb object in my affected hand	0	1	2	3	4	5	6	7	8	9	10
Use bathroom tissue with my affected hand	0	1	2	3	4	5	6	7	8	9	10
B. USUAL ACTIVITIES *Rate the **amount of difficulty** you experienced performing your **usual** activities in each of the areas listed below, over the past week, by circling the number that best describes your difficulty on a scale of 0-10. By "usual activities", we mean the activities you performed **before** you started having a problem with your wrist. A **zero** (0) means that you did not experience any difficulty and a **ten** (10) means it was so difficult you were unable to do any of your usual activities.*											
Personal care activities (dressing, washing)	0	1	2	3	4	5	6	7	8	9	10
Household work (cleaning, maintenance)	0	1	2	3	4	5	6	7	8	9	10
Work (your job or usual everyday work)	0	1	2	3	4	5	6	7	8	9	10
Recreational activities	0	1	2	3	4	5	6	7	8	9	10

Step 3: Add pain and function score.
Total Score = Sum of pain+ function scores (Best Score = 0, Worst Score = 100)
Less score = better outcome

CASE ILLUSTRATION

GROUP A

PRE OP



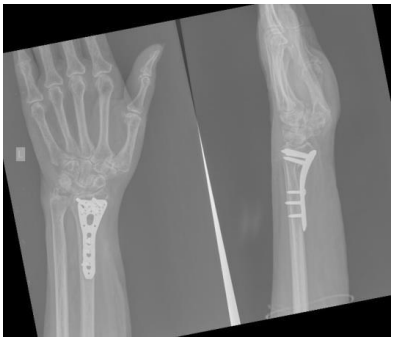
POST OP

GROUP B

PRE OP

POST OP

POD 1.5 MONTHS AFTER K WIRE REMOVAL

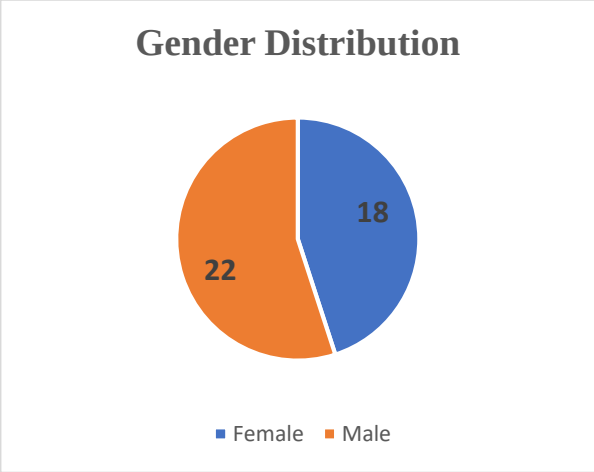


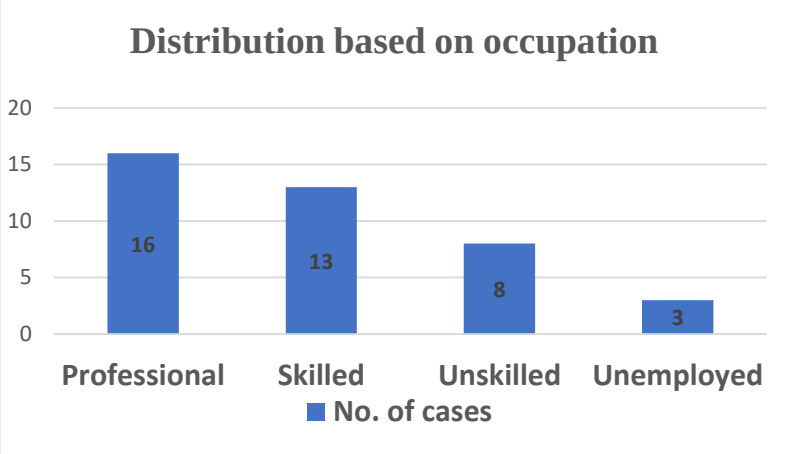
POD 6 MONTHS

RESULTS

The demographic characteristics of the study group revealed a mean age of 47.48 years with a standard deviation of 10.19 years. The gender distribution showed 55.00% male and 45.00% female participants. In terms of occupation, professionals constituted 40.00%, skilled workers 32.5%, unskilled workers 20.00%, and unemployed individuals 7.5%.

Age (Mean ± SD)	47.48 ± 10.19	
	No of cases	**Percentage**
Gender		
Female	18	45.00%
Male	22	55.00%
Occupation		
Professional	16	40.00%
Skilled	13	32.5%
Unskilled	8	20.00%
Unemployed	3	7.5%



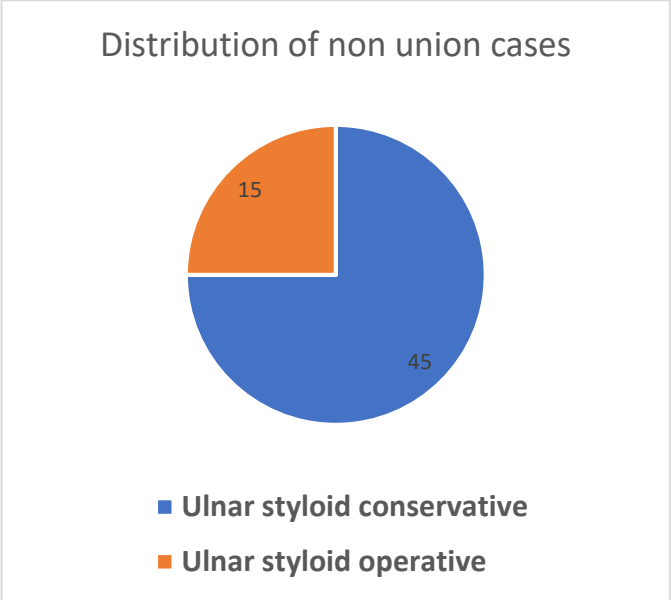


The distribution of cases in the study cohort was evenly divided, with 50.00% of the cases involving ulnar styloid fractures treated conservatively and 50.00% treated surgically. Specifically, the study included 20 cases of ulnar styloid fractures managed conservatively and 20 cases treated surgically, out of a total of 40 cases.

Among the cases reviewed, 95% of ulnar styloid fractue were treated with K-wire fixation in operative group making it the most commonly used approach. Additionally, 5% of cases were managed with tension band wiring (TBW).

Among those treated conservatively, 45% experienced non-union, whereas in the operative group, the rate was 15%. Statistical analysis using chi-square testing yielded a p-value of 0.08, indicating a trend towards significance but not reaching conventional levels .

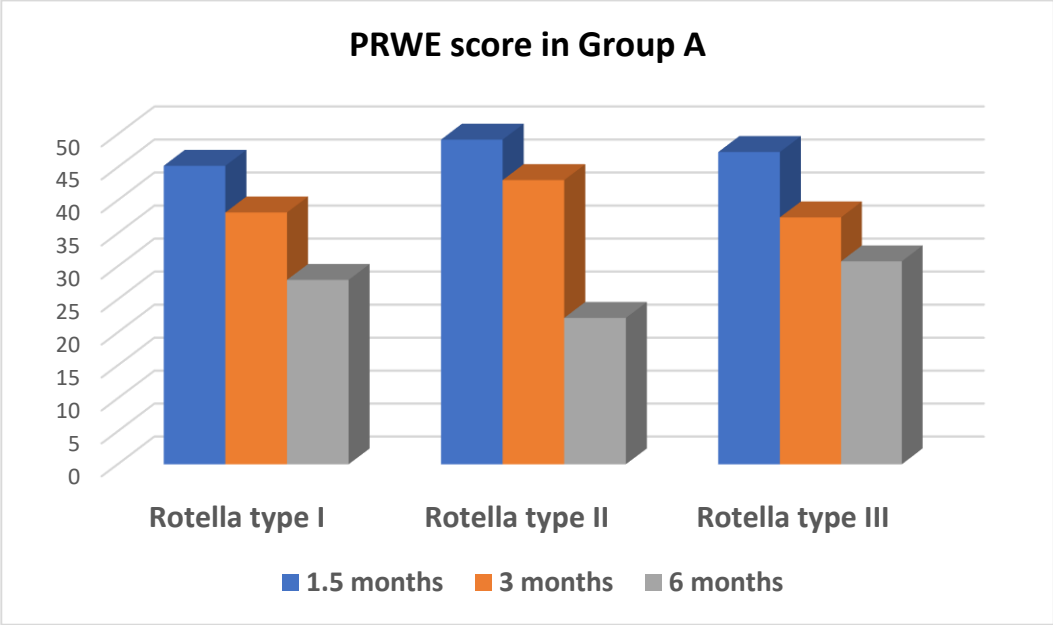
complications	**Ulnar styloid conservative**		**Ulnar styloid operative**		**Chi-square**	**P-value**
	No of cases	**Percentage**	**No of cases**	**Percentage**		
Non-union	9	45.00%	3	15.00%	3.00	0.08



While calculating PRWE score for both the groups, In group A For Rotella type I fractures, mean values were 45.24 ± 8.12 at 1.5 MONTHS, 38.17 ± 7.45 at 3 months, and 27.96 ± 10.90 at 6 months. ANOVA testing revealed highly significant differences across these time points ($p < 0.0001$), indicating variability in outcomes throughout the recovery process. Similarly, for Rotella type II fractures, mean values were 49.20 ± 8.08 at 1.5 MONTHS, 43.07 ± 9.11 at 3 months, and 22.21 ± 7.10 at 6 months, with significant differences observed ($p < 0.0001$). For Rotella type III fractures, mean values were 47.32 ± 11.28 at 1.5 MONTHS, 37.43 ± 10.44 at 3 months, and 30.77 ± 8.19 at 6 months, with significant differences observed ($p < 0.0001$).

Follow up	**1.5 MONTHS**	**3 Months**	**6 Months**	**ANOVA**	**P-value**
Rotella type I	45.24 ± 8.12	38.17 ± 7.45	27.96 ± 10.90	18.85	<0.0001
Rotella type II	49.20 ± 8.08	43.07 ± 9.11	22.21 ± 7.10	60.46	<0.0001
Rotella type III	47.32 ± 11.28	37.43 ± 10.44	30.77 ± 8.19	13.72	<0.0001

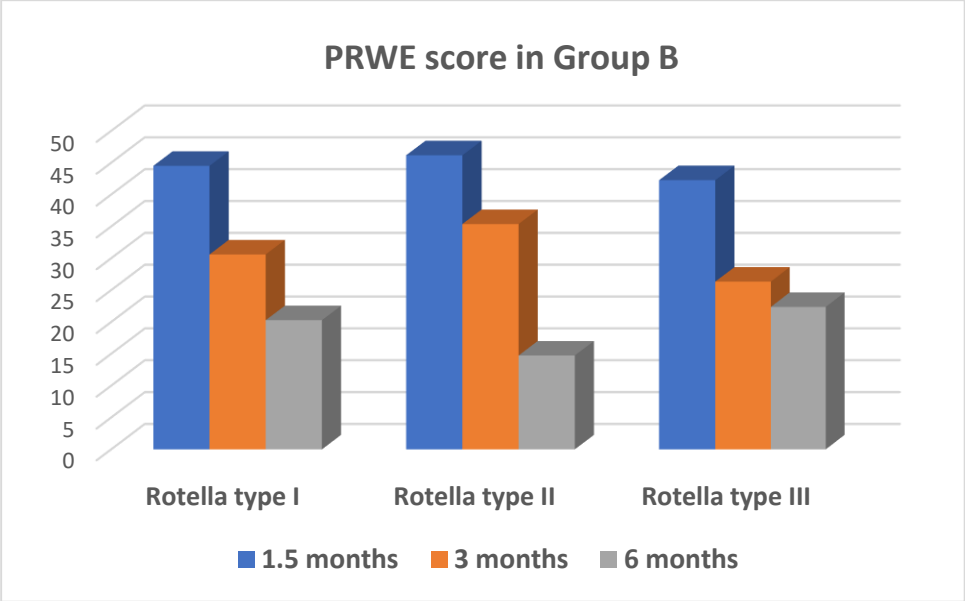
Distribution according to PRWE Score in Group A on consecutive follow up



In Group B, For Rotella type I fractures, the mean values were 44.51 ± 9.48 at 1.5 MONTHS, 30.60 ± 8.16 at 3 months, and 20.28 ± 12.13 at 6 months. Statistical analysis using t-tests demonstrated highly significant differences across these time points ($p < 0.0001$), indicating varying outcomes over the recovery period. Similarly, for Rotella type II fractures, the mean values were 46.17 ± 8.09 at 1.5 MONTHS, 35.37 ± 9.17 at 3 months, and 14.73 ± 7.64 at 6 months, with significant differences observed ($p < 0.0001$). For Rotella type III fractures, the mean values were 42.26 ± 7.14 at 1.5 MONTHS, 26.33 ± 11.15 at 3 months, and 22.36 ± 8.40 at 6 months, with significant differences observed ($p < 0.0001$).

Follow up	**1.5 MONTHS**	**3 Months**	**6 Months**	**t-test**	**P-value**
Rotella type I	44.51 ± 9.48	30.60 ± 8.16	20.28 ±12.13	29.22	<0.0001
Rotella type II	46.17 ± 8.09	35.37 ± 9.17	14.73 ± 7.64	73.64	<0.0001
Rotella type III	42.26 ± 7.14	26.33 ± 11.15	22.36 ± 8.40	27.06	<0.0001

Distribution according to PRWE Score in Group B on consecutive follow up



While comparing according to PRWE Score between ulnar styloid conservative and ulnar styloid operative at 3 months follow up, For Rotella type I fractures, patients managed conservatively had an average PRWE score of 38.17 ± 7.45, whereas those treated operatively scored 30.60 ± 8.16, demonstrating a statistically significant difference ($t = -3.06$, $p = 0.004$). Similarly, for Rotella type II fractures, conservative management resulted in a mean PRWE score of 43.07 ± 9.11 compared to 35.37 ± 9.17 with operative treatment ($t = -2.67$, $p = 0.011$). The most substantial disparity was seen in Rotella type III fractures, where conservative management yielded a mean PRWE score of 37.43 ± 10.44 versus 26.33 ± 11.15 for operative treatment ($t = -3.25$, $p = 0.002$).

While comparing according to PRWE Score between ulnar styloid conservative and ulnar styloid operative at 6 months follow up, For Rotella type I fractures, patients treated conservatively had a mean PRWE score of 27.96 ± 10.90, which was significantly higher than the score of 20.28 ± 12.13 for those who underwent operative treatment ($t = -2.11$, $p = 0.042$). Similarly, for Rotella type II fractures, conservative management resulted in a mean PRWE score of 22.21 ± 7.10, compared to 14.73 ± 7.64 for operative treatment ($t = -2.31$, $p = 0.003$). For Rotella type III fractures, conservative treatment yielded a mean PRWE score of 30.77 ± 8.19, whereas operative treatment resulted in a lower score of 22.36 ± 8.40 ($t = -3.21$, $p = 0.002$).

DISCUSSION

Ulnar styloid fractures often occur alongside distal radius fractures, and the approach to managing these fractures can greatly influence patient outcomes. The primary treatment approaches for displaced ulnar styloid fractures include conservative management (immobilization) and surgical intervention (fixation). Our study compares the functional outcomes of these two approaches in patients who have undergone surgical treatment for distal radius fractures. This study aims to provide evidence on the functional outcomes of conservative versus operative treatment, including percutaneous K-wire, tension band wire of ulnar styloid fractures in this context, contributing to more informed clinical decision-making.

- In this study, a total of 40 participants were enrolled with ulnar styloid fractures. Among them, the majority were male participants, accounting for 55% of the cohort, while the remaining 45% were female participants. The mean age of the participants was 47.48 ± 10.19 years. This distribution was consistent with the findings of **Sebaey AA et al. (2019),** who studied ten cases of ulnar styloid fractures and observed a similar gender distribution, with males accounting for 60% and females for 40% of the cases. Similarly, a study conducted by **Robles C, et al.,** in **2019** presented findings that were comparable to those of the present study. In **Robles'** study, the mean ages were reported as 49.38 years for Group I and 50.71 years for Group II, while our study reported a mean age of 47.48 years for Group I. Both studies found no significant differences in age between the treatment groups. However, **Robles' study** highlighted a significant difference in gender distribution between the groups ($p = 0.0435$), with a higher proportion of women in Group II. In contrast, the present study observed a slight male predominance, with 55.00% of the participants being male. This variation in gender distribution highlights an interesting aspect that requires further investigation.
- In this current investigation, out of the 40 cases examined, 20 cases were managed through conservative treatment methods, while the remaining 20 cases were managed using operative procedures. The findings of the present study closely comparable with study done by **Iglesias CR, et al., (2019).** On the other hand, **Robles C, et al., (2019)** observed a statistically significant disparity in the distribution of surgical cases between their study groups ($p = 0.0501$). Specifically, Group II exhibited a higher incidence of surgical interventions (42%) compared to Group I (28%).
- Our study revealed that, the complication of non-union was predominantly observed in the conservatively treated group compared to the operatively treated group. Specifically, among patients treated conservatively for ulnar styloid fractures, 9 cases (45%) exhibited non-union. On the other hand, in the operatively treated group, only 3 cases (15%) presented with non-union. In 2019, **Robles C, et al.,** reported a higher success rate in achieving bone union with surgical intervention (Group II: 68%) compared to conservative management (Group I: 48%). Similarly, the present study demonstrated a trend towards statistical significance towards operative management for achieving bone union ($p = 0.08$). Furthermore, **Sebaey AA, et al., (2019)** findings highlighted that in the operatively treated group, one case (10%) was complicated by non-union, another case (10%) developed an infection, two cases (20%) experienced injury to the dorsal cutaneous branch of the ulnar nerve, and one case (10%) resulted in dislocation of the distal radioulnar joint (DRUJ). These observations underscore the higher incidence of complications associated with conservative treatment, particularly non-union, compared to surgical intervention.
- Robles et al. in his study, evaluated functional outcomes using Disabilities of the Arm, Shoulder, and Hand (DASH) scores. The results revealed a lower mean score in Group II (3.67) compared to Group I (4.10) without statistical significant ($p = 0.276$). While the functional outcomes evaluated in our study using the Patient-Rated Wrist Evaluation (PRWE) scores. At the 3-month follow-up, patients with Rotella type I fractures treated conservatively had a PRWE score of 38.17 ± 7.45, whereas the group that underwent operative treatment scored 30.60 ± 8.16 ($t = -3.06$, $p = 0.004$). For Rotella type II fractures, conservative management resulted in scores of 43.07 ± 9.11, compared to 35.37 ± 9.17 with operative treatment ($t = -2.67$, $p = 0.011$). Rotella type III fractures exhibited scores of 37.43 ± 10.44 for conservative treatment and 26.33 ± 11.15 for operative treatment ($t = -3.25$, $p = 0.002$). At the 6-month follow-up, Rotella

type I fractures managed conservatively scored 27.96 ± 10.90, whereas operative treatment yielded a score of 20.28 ± 12.13 (t = -2.11, p = 0.041). For Rotella type II fractures, conservative management resulted in scores of 22.21 ± 7.10 compared to 14.73 ± 7.64 for operative treatment (t = -2.31, p = 0.003). Lastly, Rotella type III fractures showed scores of 30.77 ± 8.19 for conservative treatment and 22.36 ± 8.40 for operative treatment (t = -3.21, p = 0.002). These results revealed that, operative management were associated with better wrist function and reduced disability across all Rotella fracture types at both the 3-month and 6-month follow-up periods compared to conservative treatment approaches.

CONCLUSION

- Our study highlighted that, Patients who received operative treatment for ulnar styloid fractures demonstrated a statistically significant improvement in functional outcomes compared to those who were treated conservatively. This was evaluated using standardized scoring systems Patient-Rated Wrist Evaluation (PRWE) score.
- The incidence of complications like non-union was higher in the conservative treatment group. Radiological union of the ulnar styloid fracture was achieved more consistently and predictably in the operative group. Conservative treatment often resulted in delayed or incomplete union.
- Patient satisfaction scores were greater in the operative treatment group, suggesting improved perceived outcomes and functionality.
- Further research with a larger sample size and extended follow-up is needed to confirm these results.

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