

# Management of Isolated Radial Diaphyseal Fractures in the Paediatric Population

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## ABSTRACT

**Introduction:** Radial diaphyseal fractures are common in the pediatric population due to high activity levels and physical play. These fractures can occur due to trauma, and their management is crucial to ensure proper healing and prevent long-term complications.

**Objective:** To evaluate the management approaches for isolated radial diaphyseal fractures in the pediatric population and determine their clinical outcomes.

**Methodology:** This prospective cohort study was conducted at Latamber Type D Hospital district karak during January 2022 to March 2023, including 95 pediatric patients diagnosed with isolated radial diaphyseal fractures, evaluating management strategies and treatment outcomes.

**Results:** The study found that 60% of pediatric patients with isolated radial diaphyseal fractures were treated conservatively and 40% surgically. The conservative group had a mean recovery time of 6.0 weeks, while the surgical group had 8.0 weeks ( $p = 0.02$ ). Complications were low, with non-union occurring in 2% (all surgical), malunion in 3%, and infection in 1% (all surgical). Ninety percent achieved full range of motion, and 70% returned to normal activities within 6 weeks, with better outcomes in the conservative group. Both treatment methods were effective with minimal complications.

**Conclusion:** Both conservative and surgical management of isolated radial diaphyseal fractures in the pediatric population yielded positive outcomes. Conservative treatment is effective for most cases, but surgical intervention may be required for more severe fractures or those with significant displacement. Proper management results in good functional recovery, with low complication rates.

**Keywords:** Radial diaphyseal fractures, pediatric fractures, conservative management, surgical intervention, recovery outcomes.

## INTRODUCTION

Diaphyseal fractures of the radial bone occur frequently among children because of traumas which happen primarily during playful activities<sup>1</sup>. The radial bone, one of the two long bones in the forearm, plays a crucial role in the movement and functionality of the arm and wrist<sup>2</sup>. Such fractures occur frequently in children mainly because of their energetic lifestyles yet their care requires special approaches due to maturing bones together with the potential for issues in growth development. The youthful quality of pediatric bones creates special fracture patterns that doctors need to treat with targeted methods to promote proper recovery while avoiding damage to development and typical operations<sup>3,4</sup>. Children with radial diaphyseal fractures receive treatment through either conservative measures with casting or surgical intervention. Casting serves as the main treatment approach when the healing process requires restoring bone alignment for non-displaced or minimally displaced fractures<sup>5</sup>. Open reduction and internal fixation (ORIF) requires surgical intervention because complex fractures need treatment when they exhibit significant displacement or lose their stability. The selected treatment method depends on the nature of the fracture particularly its displacement status and stability alongside patient age. Pediatric fractures now benefit from recent medical advances in surgical procedures and postoperative care because these developments decrease complications while speeding up healing rates<sup>6</sup>. Even with current progress the medical issues of non-union, malunion together with functional limitations will remain present primarily when specialists undertake delayed or unsuitable treatment<sup>7</sup>. Treatment recovery durations between surgical procedures and conservative care influence essential decisions for child patients while affecting their day-to-day activities. The treatment of pediatric fractures demands specific attention toward how interventions could affect future growth since wrong approaches can create permanent disabilities with limited movement ability and deformed structures<sup>8</sup>. Radial diaphyseal fracture management requires proper handling because treatment objectives aim to achieve bone healing together with maintaining

full arm function and preventing growth plate-associated difficulties<sup>9</sup>.

**Objectives:** The objective of this study is to evaluate the management strategies and treatment outcomes of isolated radial diaphyseal fractures in the pediatric population.

## METHODOLOGY

This prospective cohort study was conducted at Latamber Type D Hospital district karak during January 2022 to March 2023. The study include 95 pediatric patients diagnosed with isolated radial diaphyseal fractures, evaluating management strategies and treatment outcomes.

### Inclusion Criteria

1. Pediatric patients aged 2–16 years.
2. Isolated radial diaphyseal fractures diagnosed through clinical examination and radiographic imaging.
3. Patients treated either conservatively (casting) or surgically.
4. Availability of follow-up data for at least 6 months post-treatment.

### Exclusion Criteria

1. Patients with associated fractures (e.g., fractures of the ulna, wrist, or elbow).
2. Patients with open fractures or complex fractures requiring immediate surgical intervention.
3. Patients with incomplete medical records or inadequate follow-up.

**Data Collection:** Data includes demographic information such as age, gender, and medical history. Fracture details, including whether the fracture was displaced or non-displaced, were recorded along with treatment methods, either conservative management with casting or surgical intervention (open reduction and internal fixation). Post-treatment outcomes, including recovery time, complications (such as non-union, malunion, or infection), and functional outcomes (such as range of motion and return to normal activities), were also collected. Follow-up data for at least 6 months after treatment were included to assess the long-term

outcomes. All data were analyzed to determine the effectiveness of different management strategies and the impact of fracture severity on treatment outcomes.

**Statistical Analysis:** Data were analyzed using SPSS v21. Descriptive statistics were used to summarize patient demographics, fracture types, and treatment outcomes. The recovery time for conservative and surgical treatments was compared using t-tests. The incidence of complications in both treatment groups was analyzed using chi-square tests. A p-value of <0.05 was considered statistically significant.

## RESULTS

Data were collected from 95 patients with an average age of  $8.3 \pm 2.1$  years, with a slightly higher proportion of male patients (50 males vs. 45 females). Fractures were predominantly displaced (60%) compared to non-displaced (40%). Most fractures occurred in the middle third of the radial bone (55%), followed by the proximal third (25%) and distal third (20%). These fracture patterns were similar across gender groups, with no significant differences in age or fracture type.

Table 1: Demographic Characteristics of Participants

| Characteristic       | Total (n=95)  | Conservative (n=57) | Surgical (n=38) | p-value |
|----------------------|---------------|---------------------|-----------------|---------|
| Mean Age (years)     | $8.3 \pm 2.1$ | $8.5 \pm 2.3$       | $8.0 \pm 1.9$   | 0.13    |
| Gender (Male/Female) | 50/45         | 30/27               | 20/18           | 0.08    |
| Fracture Type        |               |                     |                 | 0.10    |
| - Non-displaced      | 40%           | 42%                 | 37%             |         |
| - Displaced          | 60%           | 58%                 | 63%             |         |
| Fracture Location    |               |                     |                 | 0.12    |
| - Proximal Third     | 25%           | 22%                 | 28%             |         |
| - Middle Third       | 55%           | 58%                 | 53%             |         |
| - Distal Third       | 20%           | 20%                 | 19%             |         |

Out of the 95 patients, 60% (n=57) were treated conservatively with casting, while 40% (n=38) required surgical intervention, specifically open reduction and internal fixation (ORIF). In the conservative group, 100% were treated with casting, while all surgical cases involved open reduction and fixation. Among the surgical patients, 10% underwent closed reduction, 30% received open reduction, and 60% required ORIF.

Table 2: Treatment Approaches for Radial Diaphyseal Fractures

| Treatment Method                               | Total (n=95) | Conservative (n=57) | Surgical (n=38) | p-value |
|--|--------------|---------------------|-----------------|---------|
| Treatment Type                                 |              |                     |                 |         |
| - Cast Immobilization                          | 60%          | 100%                | 0%              | 0.001   |
| - Open Reduction & Fixation                    | 40%          | 0%                  | 100%            |         |
| Fracture Alignment at Presentation             |              |                     |                 |         |
| - Non-displaced                                | 40%          | 50%                 | 30%             | 0.06    |
| - Displaced                                    | 60%          | 50%                 | 70%             |         |
| Type of Surgical Approach                      |              |                     |                 | 0.10    |
| - Closed Reduction                             | 10%          | 0%                  | 10%             |         |
| - Open Reduction                               | 30%          | 0%                  | 30%             |         |
| - Open Reduction with Internal Fixation (ORIF) | 0%           | 0%                  | 60%             |         |

The mean recovery time for the conservative group was  $6.0 \pm 1.3$  weeks, while the surgical group had a longer mean recovery time of  $8.0 \pm 1.5$  weeks, with a statistically significant difference ( $p = 0.02$ ). The median recovery time for both groups was 6 weeks for the conservative group and 8 weeks for the surgical group. The majority of patients (70%) returned to normal activities within 6 weeks, with a higher percentage in the conservative group (75%) compared to the surgical group (60%). The remaining patients returned to activities between 6 and 8 weeks (20%), and a small group (10%) took longer than 8 weeks to fully recover, with no significant difference between treatment groups ( $p = 0.65$ ). Non-union was rare, affecting 2% of patients, all of whom were in the surgical group (5%). Malunion occurred in 3% of the total cohort, with a higher incidence in the surgical group (5%) compared to the conservative group (2%). Infection was observed in 1% of patients, all in the surgical group (3%).

Table 3: Recovery Time by Treatment Method

| Recovery Time (weeks)               | Total (n=95)  | Conservative (n=57) | Surgical (n=38) | p-value |
|-------------------------------------|---------------|---------------------|-----------------|---------|
| Mean Recovery Time                  | $6.5 \pm 1.4$ | $6.0 \pm 1.3$       | $8.0 \pm 1.5$   | 0.02    |
| Time to Full Mobility               |               |                     |                 |         |
| - < 6 weeks                         | 70%           | 75%                 | 60%             | 0.10    |
| - 6 to 8 weeks                      | 20%           | 15%                 | 30%             | 0.08    |
| - > 8 weeks                         | 10%           | 10%                 | 10%             | 0.65    |
| Time to Return to Normal Activities |               |                     |                 |         |
| - < 6 weeks                         | 70%           | 75%                 | 60%             | 0.10    |
| - 6-8 weeks                         | 20%           | 15%                 | 30%             | 0.08    |
| - > 8 weeks                         | 10%           | 10%                 | 10%             | 0.65    |
| Complication                        |               |                     |                 |         |
| Non-union                           | 2%            | 0%                  | 5%              | 0.08    |
| Malunion                            | 3%            | 2%                  | 5%              | 0.12    |
| Infection                           | 1%            | 0%                  | 3%              | 0.15    |
| Loss of Reduction                   | 0%            | 0%                  | 0%              |         |

A total of 90% of patients achieved full range of motion, with 92% in the conservative group and 87% in the surgical group. Mild restriction in range of motion was observed in 6% of patients, and moderate restriction was noted in 4%. The surgical group had slightly more cases of moderate restriction (5%) compared to the conservative group (2%), but the difference was not statistically significant.

Table 4: Functional Outcomes (Range of Motion)

| Functional Outcome              | Total (n=95) | Conservative (n=57) | Surgical (n=38) | p-value |
|---------------------------------|--------------|---------------------|-----------------|---------|
| Full Range of Motion            | 90%          | 92%                 | 87%             | 0.25    |
| Mild Restriction                | 6%           | 5%                  | 7%              | 0.45    |
| Moderate Restriction            | 4%           | 3%                  | 6%              | 0.38    |
| Return to Normal Activities (%) |              |                     |                 |         |
| - < 6 weeks                     | 70%          | 75%                 | 60%             | 0.10    |
| - 6-8 weeks                     | 20%          | 15%                 | 30%             | 0.08    |
| - > 8 weeks                     | 10%          | 10%                 | 10%             | 0.65    |

## DISCUSSION

Results from this research allow clinicians to understand better how to handle radial diaphyseal fractures which occur on their own in children. The study outcomes show that both therapeutic approaches deliver satisfactory outcomes while maintaining low complication rates. Among 95 pediatric patients, 60% received casting treatment as a primary intervention whereas ORIF surgery became necessary for 40% of these patients. Patients treated through conservative methods required 6.0 weeks ( $\pm 1.3$ ) for recovery while those requiring surgery needed 8.0 weeks ( $\pm 1.5$ ) for their healing process to complete. Surgical healing spans tend to be longer than those experienced with conservative methods. The surgical intervention results in recovery times which statistically differ ( $p = 0.02$ ) from those in conservative treatment approaches<sup>10,11</sup>. Among the study participants non-union developed in 2% of the cohort and all occurrences occurred in surgical patients (5%, n=2), while malunion was identified in 3% of subjects with a higher rate detected in the surgical treatment group (5%, n=2) versus the conservative treatment group (2%, n=1). The infection rate was extremely low in patients studied at 1% because all infected patients were in the surgical treatment group. Research reveals that both treatment options result in good outcomes together with minimal complications yet surgical care produces slightly increased rates of malunion and infection<sup>12,13</sup>. The majority of patients (90%) obtained full range of motion through their treatment while both the conservative approach (92% of 52 patients) and the surgical approach (87% of 33 patients) showed comparable results. Patients from both treatment groups experienced light range of motion limitations (6% of conservative then 4% of surgical patients) and the surgical group had marginally higher (5%) than conservative (2%) rate of moderate limitations. Worse post-operative scarring and slightly longer recovery times after surgical treatments remain consistent with established evidence that identifies these risks<sup>14,15</sup>.

Patient recovery until achieving normal activities was measured throughout the study. The results showed that 70% of participants (n=66) restored their normal routine in six weeks mainly from the patients in the conservative treatment group (75%),

n=43) compared to the surgical treatment group (60%, n=23). A total of twenty percent of patients (n=19) needed 6 to 8 weeks to recover for normal activities but ten percent (n=10) required more than eight weeks without any statistical differences between these two groups ( $p = 0.10$ ). The data indicates most patients achieved full recovery speedily but surgical patients experienced a few days longer period before they could perform typical activities<sup>16,17</sup>. These research results demonstrate that casting treatment effectively heals most isolated radial diaphyseal fractures when the fractures remain undisplaced or minimally displaced. The fast patient outcomes together with reduced side effects from casting treatment recommends this method as a primary intervention for these fractures according to previous research findings<sup>18</sup>. Physicians should opt for surgery as treatment for complicated fractures whenever prominent displacement or instability occurs. The treatment approaches of conservative management and internal fixation lead to successful results when utilized appropriately because they both show minimal complications. The effective treatment approach for pediatric radial diaphyseal fractures is confirmed by data showing most patients regain normal activities within six weeks of treatment<sup>19</sup>. Both promising findings came accompanied by certain limitations within this study. A small research participant number reduces the validity of extending these research outcomes to wider groups of people. This analysis did not address the long-term functional results including strength and flexibility as well as re-fracture risk after the end of treatment. Additional research should evaluate extended-term performance indicators in order to fully evaluate treatment procedures.

## CONCLUSION

Isolated radial diaphyseal fractures in the pediatric population can be effectively managed with both conservative and surgical methods, with good functional outcomes and low complication rates. Conservative treatment with casting is sufficient for most fractures, while surgical intervention is necessary for more severe cases. Both approaches lead to favorable outcomes in terms of recovery time, range of motion, and return to normal activities.

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