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Original Research Article

Functional Outcome of Rush nail in Unstable Fractures of Both Bone Forearm in Children

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Abstract;

Background: Unstable diaphyseal fractures of both bone forearm in children are challenging to manage due to the need to restore anatomical alignment and preserve function. The Rush nail technique, a relatively newer surgical approach, has shown promise in stabilizing such fractures with minimal complications.

Objective: To evaluate the functional outcomes, efficacy, and safety of Rush nail technique in the management of unstable fractures of both bone forearm in children.

Methods: A prospective observational study was conducted on 30 pediatric patients aged 5–15 years with unstable diaphyseal fractures of the radius and ulna, managed using the Rush nail method. Patients were followed up over 6 months for radiological union, range of motion, complications, and functional recovery using the Price criteria.

Results: All patients achieved radiological union within 6–10 weeks. Functional outcomes were excellent in 24 (80%), good in 5 (16.6%), and fair in 1 (3.4%) patient. No major complications were noted. Minor issues included superficial infection (6.6%) and transient nerve irritation (3.3%).

Conclusion: The Rush nail technique is a safe and effective method for managing unstable both bone forearm fractures in children, with excellent functional outcomes and minimal complications.

Introduction;

Forearm fractures constitute approximately 40% of all pediatric fractures, with both bone diaphyseal fractures being particularly common due to falls on an outstretched hand. While many cases are treated conservatively, unstable fractures—especially those with complete displacement, segmental involvement, or failed closed reduction—require surgical intervention.

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Restoration of forearm rotation, growth potential, and avoidance of long-term deformity are critical goals in pediatric fracture management. Traditional methods include intramedullary nailing or plating. The Rush nail technique has gained attention for providing adequate rotational control with minimal soft tissue dissection.

This study aims to analyze the functional outcomes and assess the safety and efficacy of Rush nail in the treatment of unstable both bone forearm fractures in children.

Aims and objectives;

Primary Objective:

- To assess the functional outcome of the Rush nail technique in unstable diaphyseal fractures of both bone forearm in children.

Secondary Objectives:

- To evaluate the rate of fracture union.
- To identify any procedure-related complications.
- To assess the safety and efficacy of the implant.

Materials and Methods;

Study Design: Prospective observational study

Study Period: [e.g., January 2014 to January 2016]

Sample Size: 30 patients

Inclusion Criteria:

- Age between 5–15 years
- Radiologically confirmed unstable diaphyseal fractures of both radius and ulna
- Presented within 7 days of injury

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Exclusion Criteria:

- Open fractures (Gustilo Grade ≥ II)
- Pathological fractures
- Previous surgery on the same limb

Surgical Technique:

Under general anesthesia or brachial block anesthesia, under c-arm guidance,

1. Patient Positioning:

The patient is positioned supine, with the affected arm on side table, prepared and draped. Closed reduction of fracture done by traction and pressure & assessed under c-arm.

2. Nail Selection:

Rush nails of appropriate size and length are chosen based on the patient's anatomy and the fracture characteristics.

3. Incision and Access:

Small incisions are made near the olecranon tip for the ulna and for radial nail a small incisions are made ulnar to radial styloid or Lister's tubercle, sparing epiphysis/metaphysic of bone.

4. Nail Insertion:

The ulnar nail is inserted in an antegrade fashion (from proximal to distal), while the radial nail is inserted in a retrograde fashion (from distal to proximal).

The nails are advanced through the medullary canal, negotiating the fracture site under fluoroscopic (C-arm) guidance.

The nails are typically inserted until they are reached up to the other end of bone with the nail end part remains outside the entry point.

5. Reduction and Stability:

The slight bend in nail tip help to align the fractured bone fragments, and their inherent flexibility allows for some degree of motion and remodeling.

6. Closure:

Once the nails are properly positioned & confirmed under c-arm in both AP & Lateral view, the incisions are closed with 3/0 ethilon and above elbow slab applied for immobilization.

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Postoperative Protocol:

- Limb immobilized for 3–4 weeks
- Early mobilization encouraged after splint removal, followed by progressive strengthening exercises as tolerated.
- Regular follow-up of patient done at 2, 6, 12, and 24 weeks to monitor fracture healing and implant stability.

Implant Removal:

Implant removal is typically considered after the fracture has healed, usually 6-12 months after surgery.

Advantages of Rush Nails:

1)Minimally Invasive: Rush nails can be inserted through small incisions, minimizing soft tissue damage.

2)Cost-Effective: Rush nails are relatively inexpensive compared to other fixation methods, such as plates and screws.

3)Good Outcomes: Rush nail fixation has been shown to provide good to excellent results in many cases of forearm fractures, especially in children and adolescents.

Potential Complications:

1)Infection: As with any surgical procedure, there is a risk of infection.

2)Delayed Union or Nonunion: The fracture may not heal within the expected timeframe.

3)Malunion: The fracture may heal in a malaligned position.

4)Refracture: The bone may refracture after the implant is removed.

5)Implant Problems: The nail may break, migrate, or cause irritation.

Outcome Measures:

- Union assessed radiologically
- Functional outcome assessed using Price et al. criteria
- Complications recorded

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Results;

Table 1: Patient Demographics and Data Collection Parameters

Parameter	Value / Range
Number of Patients	30
Age Range	5–15 years
Mean Age	10.2 ± 2.5 years
Gender	21 Males, 9 Females
Fracture Side	Right: 18, Left: 12
Mechanism of Injury	Fall from height: 20 RTA: 7 Sports injury: 3
Fracture Pattern	Midshaft transverse: 14 Oblique: 10 Segmental: 6
Time from Injury to Surgery	<48 hours for all patients
Follow-up Duration	6 months

Table 2: Outcomes and Complications (n = 30)

Outcome/Complication	Number of Patients	Percentage (%)
Radiological Union (within 10 weeks)	30	100%
Functional Outcome (Price Criteria)		
– Excellent	24	80%
– Good	5	16.6%
– Fair	1	3.4%
– Poor	0	0%
Superficial Infection	2	6.6%
Transient Radial Nerve Palsy	1	3.3%
Implant Failure / Malunion / Refracture	0	0%

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Discussion;

In unstable forearm fractures in children, achieving good fixation without compromising growth plates or soft tissue is essential. Conventional techniques like plating, though effective, require extensive dissection and carry risks like refracture after implant removal.

The Rush nail technique, being minimally invasive, preserves periosteal blood supply and growth potential. Our results align with prior studies indicating high union rates and favorable outcomes.

A notable benefit is reduced infection risk due to minimal exposure. Functional recovery was rapid due to early mobilization. The few minor complications observed were manageable and resolved without long-term effects.

Compared to other nails Rush nails showed better result in our study and fewer implant-related issues in our experience.

Conclusion;

The Rush nail technique offers a reliable, safe, and effective option for the management of unstable diaphyseal fractures of both bones of the forearm in children. It has the advantages of intramedullary fixation, resulting in excellent functional outcomes and minimal complications.

It can be considered a superior alternative to other options in selected pediatric populations.

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