

A Retrospective Analysis of Flexible Nailing of Paediatric Both Bone Forearm Fractures

Reece Travis¹, Ella Burwell¹, William H F King MRCS², Timothy P Davis MRCS²,
Khaleel Chilimi FRCS(T&O)², Sunil Bajaj FRCS(T&O)²

1. GKT School of Medical Education, King's College London
2. Department of Trauma & Orthopaedics, Queen Elizabeth Hospital, Lewisham and Greenwich NHS Trust, London

Introduction and Aims

- Forearm fractures account for 18% of paediatric bony injuries - around half of these affecting both the radius and ulna
- Surgical fixation has benefits over conservative management including shorter hospital stays with less psychological impact to the child
- Titanium elastic nails (TENs) are widely used for fixation of these fractures, offering minimally invasive stabilisation with favourable outcomes
- Guidance states that the optimum nail diameter is 2/3rd the diameter of the medullary canal
- Complication rates of TENs fixation vary across centres and UK based outcome data remains limited

Our aim was to report on the outcomes of TENs fixation in a UK district general hospital, particularly focusing on whether nail over or under sizing impacts functional outcomes.

Methods

- Retrospective analysis was conducted
- All patients under 16 years of age who underwent TENs fixation for a long bone fracture at our centre were identified from our EMR
- Between **01/01/2021 and 01/01/2025**
- Patient age, sex, side affected, date of injury, site of injury, time to surgery and time to removal of TENs, canal diameter, TENs diameter, complications and time to follow-up were collected
- Nail sizing was assessed using the recommended guideline of each nail being 66% (+/-10%) of the intramedullary canal diameter, and whether paired nails were of equal diameter was recorded

The flowchart below details the operative technique. Functional outcomes were assessed using the Flynn criteria.

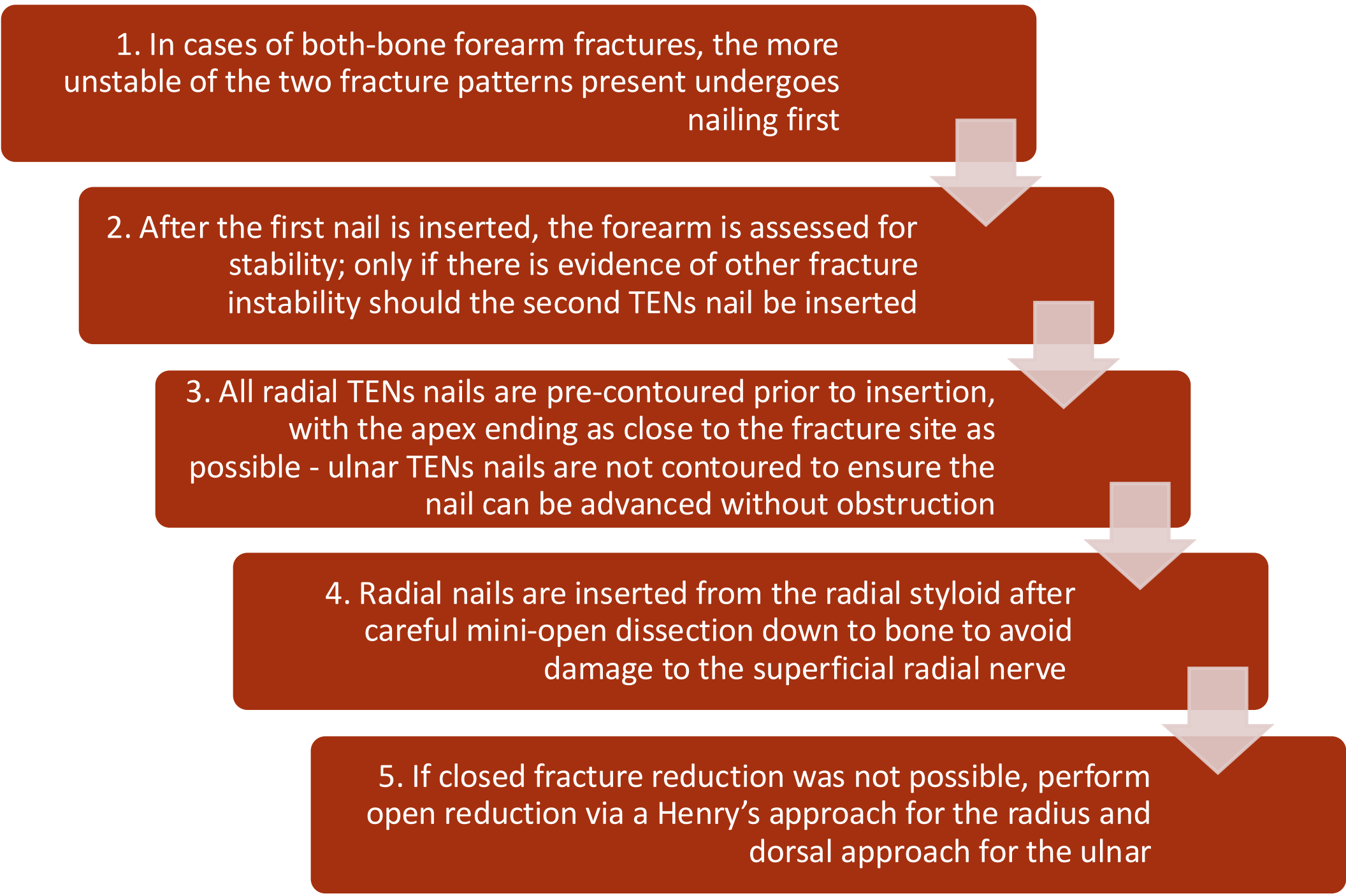


Figure 1: Flowchart detailing operative technique

Results

12 patients were included with a total of 19 TENs nails; 8 patients were male, 6 were female; there were 6 right sided fractures and 8 left sided fracture. The mean age at surgery was 8.5 years (range 4-15). Injuries were most frequent in the spring and summer months (64%). The median time to surgery was 1 day (range 1-12) as was the median hospital stay (range 0-1).

10/19 (53%) of nails were appropriately sized. The average canal fill of all nails was 58%; for under-sized nails, the average fill was 45%; over-sized 79%.

9/12 (75%) of patients had an excellent outcome with only one patient having a poor outcome due to loss of reduction at the fracture site requiring revision to ORIF. Stratifying outcomes based on nail size, 6/7 (85%) of correctly sized nails had an excellent outcome, with 3/5 (60%) of incorrectly sized nails having an excellent outcome.

Percentage of canal filled by nail

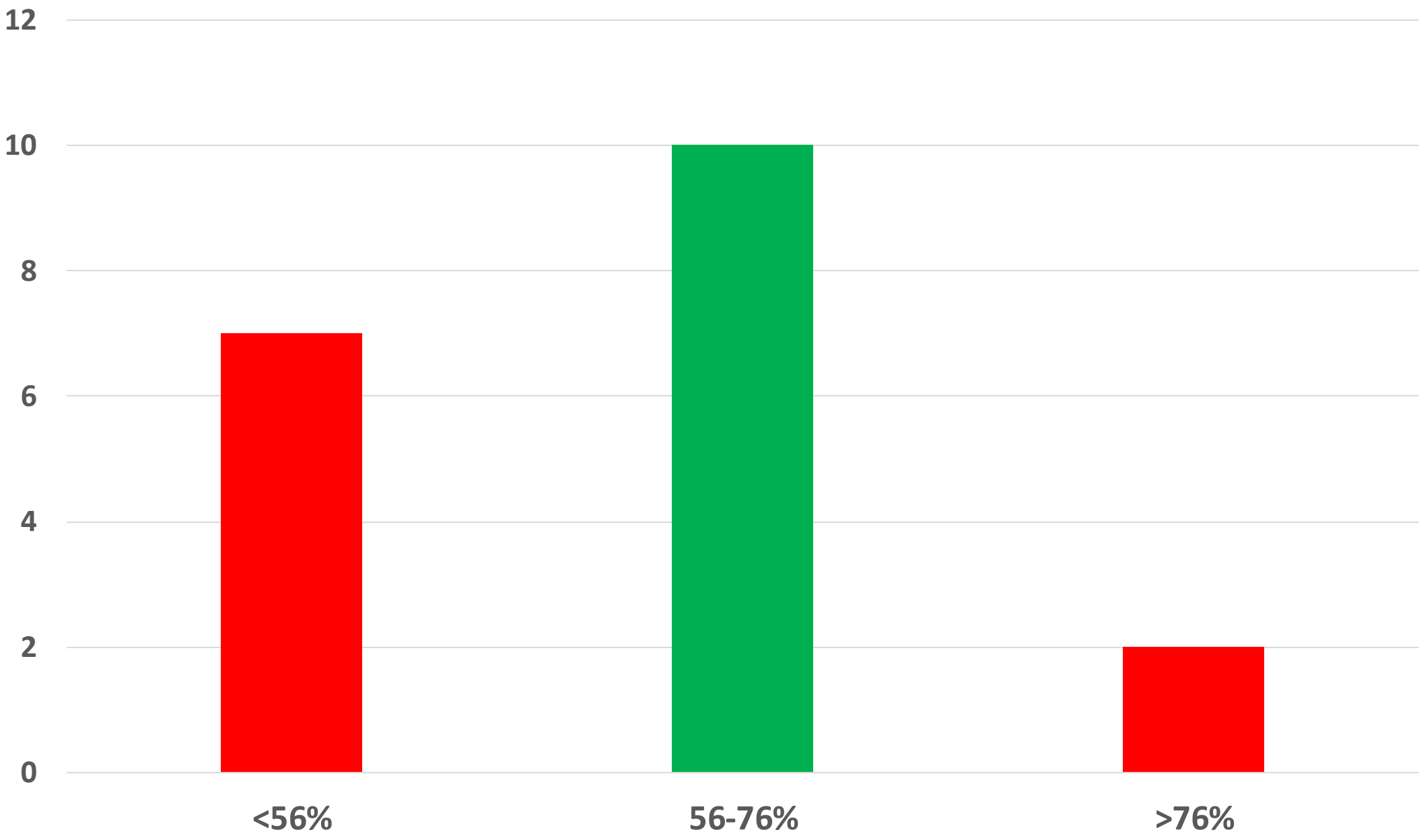


Figure 2: Graph displaying number of TENs nails by canal fill percentage

	Excellent	Satisfactory	Poor
Limb length inequality	<1.0cm	<2.0cm	>2.0cm
Malalignment	5 degrees	10 degrees	>10 degrees
Pain	None	None	Present
Complication	None	Minor and resolved	Major/lasting morbidity
Number of patients	9	2	1

Table 1: Description of the Flynn criteria and the number of patients with each outcome

Correctly sized nails

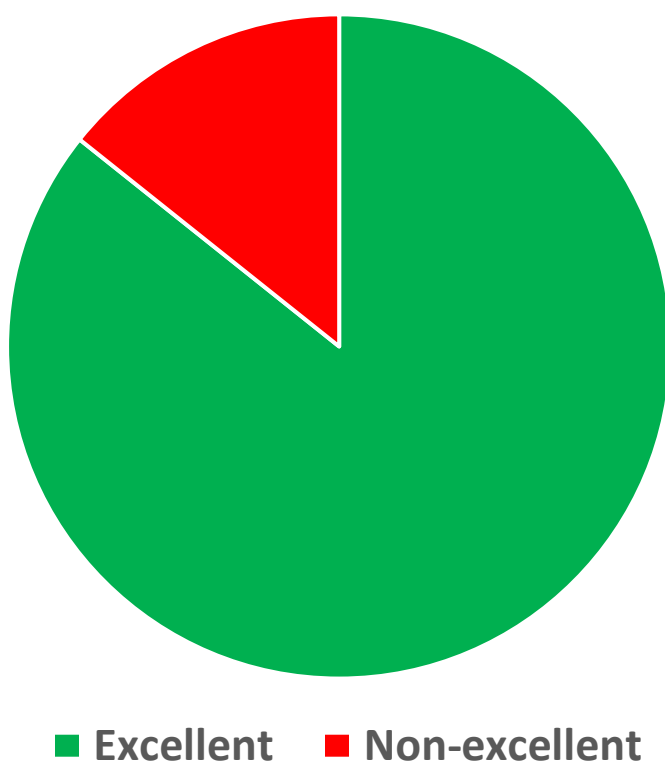


Figure 3: Pie chart displaying excellent versus non excellent outcomes in correctly sized nails

Incorrectly sized nails

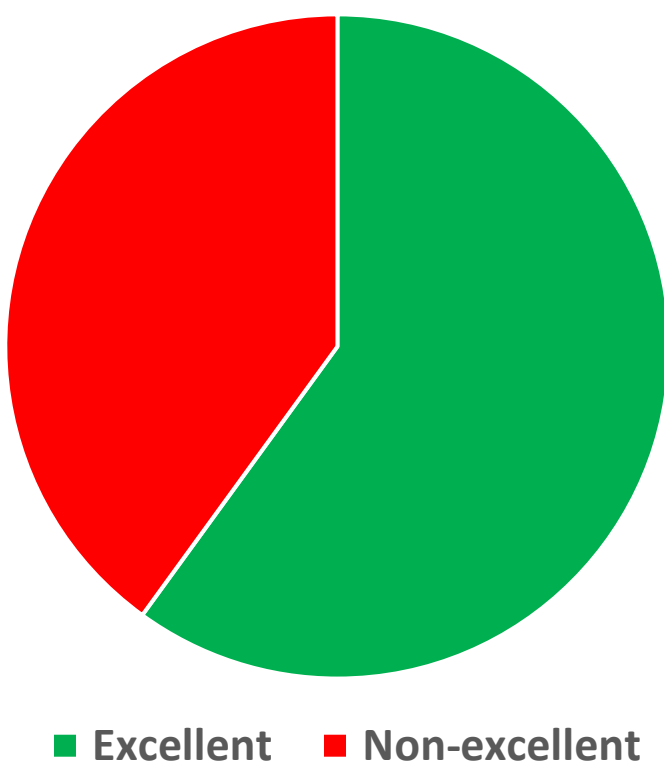


Figure 4: Pie chart displaying excellent versus non excellent outcomes in incorrectly sized nails

Discussion

Our centre consistently performs TENs fixation for both bone forearm fractures that delivers good functional outcomes with a short hospital stay; excellent outcomes appear to be more frequent in correctly sized nails.

Limitations include the small sample size, multiple operating surgeons increasing heterogeneity of technique and nail selection.

Future work should focus on prospective, forearm specific studies to determine optimal nail sizing as most outcome and biomechanical data is derived from femoral studies. Specifically, any critical levels at which over/under sizing increases the risk of complications should be defined.