



## Open Reduction and Internal Fixation of a Displaced Both-Bone Forearm Fracture in a Child Using Oversized Tubular Implants in a Resource-Limited Regional Hospital: A Case Report

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### ABSTRACT

**Introduction.** Both-bone diaphyseal fractures of the forearm are among the most common injuries of childhood, and the majority are successfully managed by closed reduction and cast immobilisation. Operative fixation is reserved for irreducible, unstable, open, or markedly displaced fractures, and is favoured in older children whose capacity to remodel diaphyseal deformity is limited. In peripheral and regional hospitals the surgeon may face an additional, under-reported obstacle: an incomplete implant inventory that offers neither the ideal plate dimensions nor the full range of screw calibers. **Case presentation.** We report a 12-year-old boy who sustained a closed, displaced fracture of the middle third of the left radius and ulna after a fall on the outstretched hand at school. Examination demonstrated forearm deformity, swelling, tenderness and crepitus, with an intact distal neurovascular status. Radiographs confirmed displaced both-bone diaphyseal fractures with angulation. Because the only implants available in the regional setting were relatively oversized tubular plates and a limited selection of screws, the operating surgeon adapted the technique while preserving the principles of anatomical reduction and stable fixation, performing open reduction and internal fixation of both bones. The postoperative course was uneventful; serial radiographs showed progressive consolidation, and the implants were electively removed at twelve months, revealing united bone without refracture. **Conclusion.** Open reduction and internal fixation can achieve anatomical union of a paediatric both-bone forearm fracture even when only suboptimal implants are available, provided reduction quality and construct stability are respected. Adaptive surgical judgement is central to safe orthopaedic practice in resource-limited regional settings.

### 1. Introduction

Fractures of the forearm are the most frequent skeletal injury of childhood. A large population-based cohort reported an overall incidence of distal forearm fracture of 738 per 100,000 persons per year, with a peak in boys around the age of thirteen, reflecting the combination of high activity levels and the relative weakness of the rapidly growing metaphyseal and diaphyseal bone<sup>1</sup>. Diaphyseal both-bone fractures, in which the radius and ulna fail together, account for a smaller but clinically important subgroup and most

often follow a fall on the outstretched hand that transmits a combined bending and rotational load through the paired-bone unit of the forearm<sup>2</sup>.

The forearm is not a simple lever but a coupled mechanism in which the radius rotates around a relatively fixed ulna to produce pronation and supination. Restoration of length, axial alignment, and especially rotation, together with the anatomical radial bow, is therefore essential to a functional outcome<sup>2,3</sup>. In skeletally immature patients the thick, biologically active periosteum and abundant osteoprogenitor cells

confer a remarkable capacity for healing and for remodelling of residual deformity, which is why closed reduction and cast immobilisation remain the first-line treatment for the great majority of paediatric forearm fractures<sup>2,4</sup>. This forgiving biology, however, is finite. Diaphyseal segments remodel angular deformity far less reliably than metaphyseal segments, rotational malalignment does not remodel at all, and the remodelling reserve declines sharply as the child approaches skeletal maturity<sup>5,6</sup>.

Operative treatment is indicated when an acceptable reduction cannot be obtained or maintained, when the fracture is open or neurovascularly threatened, or when the degree of displacement exceeds age-specific radiological thresholds. Systematic reviews of the radiological literature converge on intervention for sagittal or coronal angulation beyond approximately ten degrees, or translation greater than half the bone width, in children older than ten years<sup>5,7</sup>. When surgery is chosen, the two established constructs are elastic stable intramedullary nailing and plate-and-screw fixation. Meta-analyses and systematic reviews report excellent results in roughly nine of ten children with either method, without demonstrating clear superiority of one over the other; nailing tends to offer a smaller scar and shorter operative time, whereas plating provides rigid, anatomical fixation that is attractive for length-unstable, comminuted, or near-mature forearms<sup>3,8-10</sup>. Hybrid constructs and selective single-bone fixation have further expanded the surgeon's options<sup>11,12</sup>.

Almost all of this evidence, however, originates from well-equipped tertiary centres that stock a full range of anatomically contoured, low-profile forearm plates and a complete inventory of screw sizes. The everyday reality in many peripheral and regional hospitals, particularly across low- and middle-income settings, is different: the surgeon must often operate with whatever implants happen to be on the shelf<sup>13-15</sup>. Guidance on how to proceed when the indicated implant size is unavailable is scarce, yet the decision has immediate consequences for the child in front of

the surgeon, who cannot always be transferred and whose unstable fracture cannot safely wait. The novelty of the present report lies precisely in this gap. We describe the open reduction and internal fixation of a displaced both-bone forearm fracture in a 12-year-old boy performed with the only implants available, namely relatively oversized tubular plates and a limited selection of screws, and we follow the patient to uneventful union and elective implant removal at twelve months. The aim of this study is to document a pragmatic, real-world solution to operating under implant constraint and to distil the surgical and decision-making lessons it offers for orthopaedic practice in resource-limited regional hospitals.

## **2. Case Presentation**

### **2.1. History**

Table 1 presents the demographic and clinical characteristics of the patient. A previously healthy 12-year-old boy, weighing 26 kg, was brought to the emergency department approximately thirty minutes after injuring his left forearm. According to the history, he had been running to enter his classroom at school when he slipped and fell, landing on his outstretched left hand so that the limb bore the weight of his body. The parents reported that the forearm immediately appeared bent. There was no loss of consciousness and no episode of forceful vomiting, making a significant associated head injury unlikely. There was no open wound and no fever. His past medical history was unremarkable, with no known drug allergy and no previous surgery.

### **2.2. Physical examination**

On arrival the boy was alert and fully oriented, in a moderate general condition and in evident pain localised to the left forearm. The vital signs were a heart rate of 105 beats per minute, a respiratory rate of 20 breaths per minute, an axillary temperature of 36.9 degrees Celsius, and an oxygen saturation of 98 percent on room air. The general examination was normal: the conjunctivae were not pale and the sclerae were not icteric; the chest was symmetrical with

vesicular breath sounds and no rhonchi or wheeze; the heart sounds were single, regular and without murmur or gallop; the abdomen was soft and non-tender with normal bowel sounds; and the extremities

were warm and well perfused with a capillary refill time under two seconds and no peripheral oedema or cyanosis.

Table 1. Demographic, clinical and physical examination characteristics of the patient.

Parameter	Finding
Age	12 years
Gender	Male
Body weight	26 kg
Mechanism of injury	Fall on the outstretched left hand while running at school (~30 minutes before admission)
Loss of consciousness / forceful vomiting	Absent
Open wound / active bleeding	Absent (closed injury)
Past medical, surgical and allergy history	Unremarkable; no known allergy; no previous surgery
Level of consciousness	Alert, fully oriented (compos mentis)
Heart rate	<b>105 beats/min</b>
Respiratory rate	20 breaths/min
Axillary temperature	36.9 °C
Oxygen saturation	98% on room air
General and systemic examination	Normal cardiorespiratory and abdominal findings; extremities warm and well perfused (CRT <2 s)
Left forearm — Look	<b>Mid-third radius/ulna deformity with angulation; soft-tissue swelling; skin intact</b>
Left forearm — Feel	<b>Local tenderness; palpable crepitus; radial pulse present and regular; distal sensation intact</b>
Left forearm — Move	<b>Active and passive forearm motion limited by pain; CRT &lt;2 s; no compartment syndrome</b>
Distal neurovascular status	Intact
Working diagnosis	<b>Closed, displaced fracture of the middle third of the left radius and ulna</b>

Notes: CRT = capillary refill time.

Examination of the left forearm followed the look-feel-move sequence and is summarised in detail in Table 1. On inspection, as illustrated in the clinical photograph in Figure 1A, there was an obvious deformity at the middle third of the radius and ulna

with visible angulation and accompanying soft-tissue swelling; importantly, the skin was intact, with no open wound and no active bleeding, confirming a closed injury. On palpation there was marked local tenderness and palpable crepitus over the fracture

site. The radial artery pulse was palpable, regular and symmetrical with the contralateral side, and distal sensation was intact throughout the hand, indicating that the neurovascular status of the limb was preserved. On movement, both active and passive

range of motion of the forearm were limited by pain, while the capillary refill time of the digits remained under two seconds. There were no clinical features of an evolving compartment syndrome.

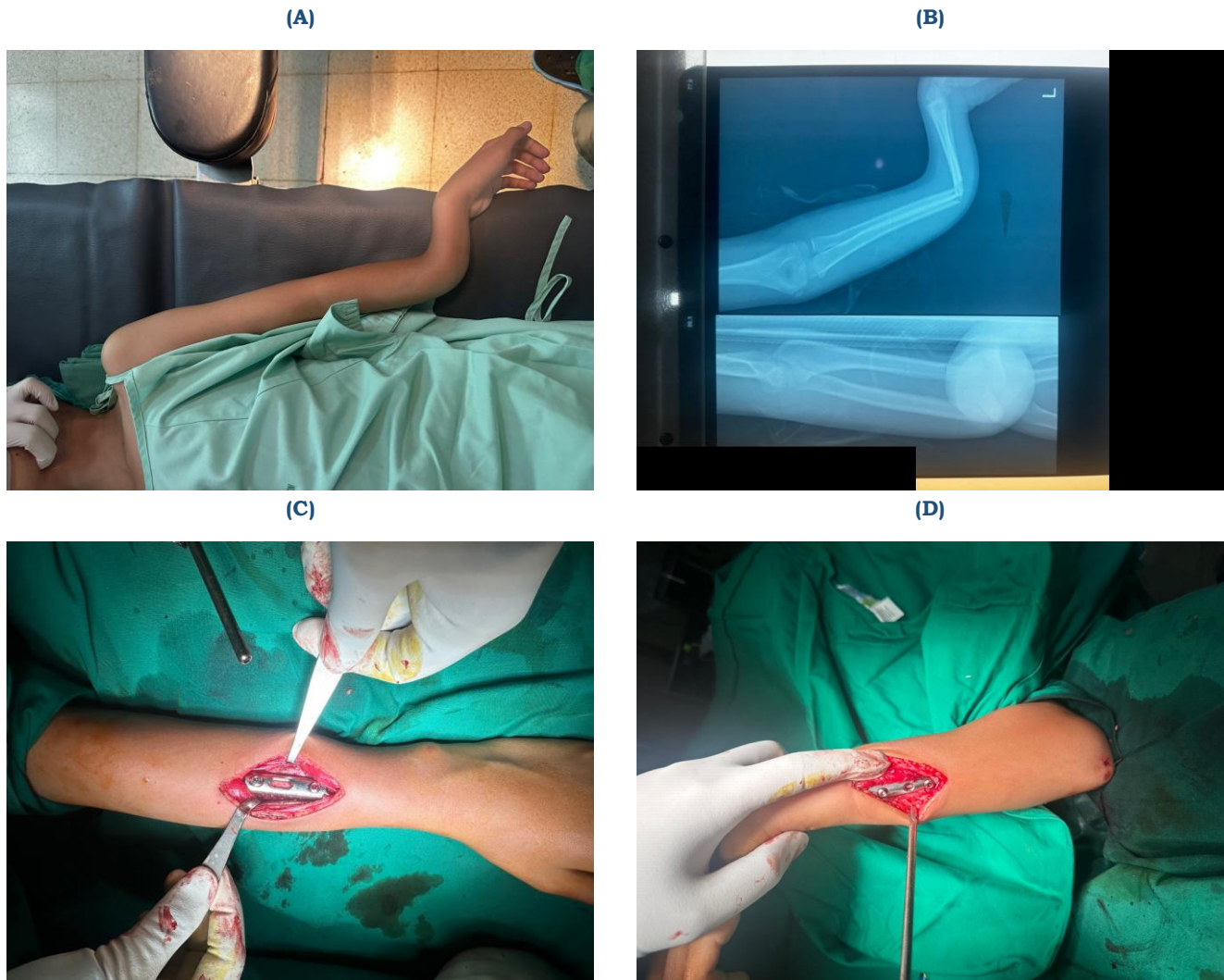


Figure 1. Preoperative and intraoperative findings. (A) Clinical photograph of the left forearm on admission showing mid-third deformity and swelling with intact skin. (B) Preoperative anteroposterior and lateral radiographs demonstrating displaced, angulated fractures of the middle third of the radius and ulna. (C) Intraoperative photograph during open reduction of the radius with plate application. (D) Intraoperative photograph after plate-and-screw fixation, showing the reduced fracture held by the available tubular plate.

### 2.3. Imaging and diagnosis

Plain radiographs of the left forearm were obtained in the anteroposterior and lateral projections and are shown in Figure 1B. They demonstrated complete

fractures of the middle third of both the radius and the ulna with clear angulation and displacement of the fracture fragments, in keeping with an unstable both-bone diaphyseal injury. There was no intra-articular

extension at either the elbow or the wrist, no associated dislocation of the proximal or distal radio-ulnar joint, and the physes were uninvolved. On the basis of the clinical and radiological findings, a diagnosis of a closed, displaced fracture of the middle third of the left radius and ulna was established.

#### 2.4. Management and operative course

The degree of displacement and angulation in a 12-year-old, an age at which diaphyseal remodelling can

no longer be relied upon to correct malalignment, exceeded accepted radiological thresholds for acceptable reduction and indicated operative stabilisation<sup>5,7</sup>. After counselling and informed parental consent, the patient was scheduled for open reduction and internal fixation of both bones using a plate-and-screw construct. The treatment plan and the intraoperative course are detailed in Table 2.

Table 2. Treatment and chronological clinical and radiographic course.

Timepoint	Date	Intervention / clinical event	Radiographic findings
Day of injury	7 Feb 2025	Emergency assessment; closed displaced both-bone forearm fracture diagnosed; ORIF planned	Displaced mid-third radius and ulna fractures with angulation (Figure 1)
Index surgery	7 Feb 2025	ORIF of radius and ulna with plate and screws under GA; technique adapted to oversized tubular plates and limited screw calibers	Anatomical reduction achieved; plates and screws in situ (Figure 1, Figure 2)
Immediate post-operative	7 Feb 2025	Uneventful recovery; no wound complication, infection, or neurovascular deficit; limb protected	Satisfactory alignment of both bones; hardware intact (Figure 2)
Interval follow-up	2025	Routine clinical and radiographic review; progressing well	Progressive bridging callus; alignment maintained (Figure 2)
Pre-removal review	5 Feb 2026 (~12 months)	Bony union confirmed; elective implant removal planned	Solid bony union with cortical remodelling around the plates (Figure 2)
Implant removal	7 Feb 2026 (~12 months)	Elective removal of plates and screws from both bones	United radius and ulna; residual screw tracks; no refracture (Figure 2)
Final outcome	—	Well-aligned, pain-free forearm; good functional result	Consolidated, united forearm

Notes: GA = general anaesthesia; ORIF = open reduction and internal fixation.

The operation was performed under general anaesthesia with the patient supine and the injured arm supported on a radiolucent arm table. Standard separate approaches were used to expose the radius and the ulna, the fracture haematoma was evacuated, and the fragments were reduced under direct vision to restore length, rotation and the radial bow. The intraoperative appearance of the reduced fractures with the plates applied to the radius and the forearm is shown in Figure 1C and Figure 1D. At this point the

principal challenge of the case became apparent. In this regional hospital the implant inventory was limited, and the plates available were comparatively large tubular plates while the screws on hand were largely of a single caliber. The implants were therefore not the low-profile, anatomically contoured forearm plates that would ordinarily be selected for a child of this size. Because the fracture nonetheless required reduction and stable fixation, and because deferring or transferring the patient was not a safe or practical

option, the decision was made to proceed with the available implants. The plates were carefully contoured to the bone, positioned to obtain an adequate number of cortices of screw purchase on either side of each fracture, and used to hold the anatomical reduction. Both the radius and the ulna were fixed. Haemostasis was secured and the wounds were closed in layers.

## 2.5. Postoperative course and follow-up

The immediate postoperative radiographs confirmed satisfactory reduction and alignment of both bones with the plates and screws in situ, as shown in Figure 2A. The early postoperative course was uneventful, with no wound complication, no infection, and no neurovascular deficit, and the limb was protected during the initial healing period. The patient was followed with serial clinical and radiographic review, the chronology of which is set out in Table 2.



Figure 2. Postoperative radiographic course. (A) Immediate postoperative anteroposterior and lateral radiographs showing anatomical reduction of both bones with plates and screws in situ. (B) Interval follow-up radiograph demonstrating progressive bridging callus with maintained alignment. (C) Radiograph at approximately twelve months showing solid bony union with cortical remodelling around the plates. (D) Radiograph after elective removal of the plates and screws, showing consolidated, united radius and ulna with residual screw tracks and no refracture.

At interval follow-up the radiographs demonstrated progressive bridging callus and maintenance of alignment across both fracture sites, with the hardware intact and well positioned, as shown in Figure 2B. By approximately twelve months after the index operation the fractures had united, with radiographic evidence of solid bony bridging and remodelling of the cortices around the plates (Figure 2C). Given the achievement of union, the patient's young age, and the recognised long-term hardware-related and refracture concerns associated with retained forearm plates, an elective removal of the plates and screws from both bones was undertaken at the twelve-month mark. As shown in Figure 2D, the post-removal radiographs confirmed consolidated, united radius and ulna with the expected screw tracks but no cortical defect of structural concern and, importantly, no refracture. The clinical outcome was good, with a well-aligned, pain-free forearm.

## 2.6. Ethics approval

Formal institutional ethics committee review was not required for this single case report in accordance with institutional policy and prevailing national regulations; written informed consent for publication was obtained as stated above.

## 2.7. Informed consent

Written informed consent was obtained from the patient's parents for publication of this case report and the accompanying images. Directly identifying information has been removed.

## 3. Discussion

Table 3 compares the present case with similar reports in the literature. The discussion that follows addresses, in turn, the indication for surgery, the choice of fixation, the central challenge of operating under implant constraint, the biology of union and remodelling, the timing of implant removal, a comparison with similar reports, and the broader implications for resource-limited practice.

Table 3. Comparison of the present case with similar cases and series reported in the literature.

Study (year)	Population/fracture	Fixation method	Key outcome	Relevance to present case
Present case (2026)	12-year-old boy; closed displaced both-bone mid-shaft fracture	Dual plating with oversized tubular plates (resource-limited setting)	Union by ~12 months; elective removal at 12 months; no refracture	Index case
Ishihara et al. (2024)*	Adolescents; both-bone diaphyseal fracture	IMN versus plate (age-matched)	>90% excellent (Price criteria) in both groups	Supports plate fixation in adolescents
Baldwin et al. (2014)†	Children/adolescents; both-bone fracture	Plate versus IMN (meta-analysis)	Excellent in ~9/10; no proven superiority	Validates plate as an evidence-based choice
Alahmari et al. (2023)‡	15-year-old boy; Galeazzi-equivalent fracture	ORIF (radius plate + ulna K-wires)	Full union and normal ROM at 2 years	Similar individualised ORIF with good outcome
Makki et al. (2014)§	Children; forearm plate/nail removal	Implant removal cohort	Higher refracture if plates removed <12 months	Supports the 12-month removal timing used here
Parajuli et al. (2011)¶	50 children (Nepal); diaphyseal fracture	Intramedullary rush pin	Union by 3 months; effective and low-cost	Resource-limited comparator with good results

Notes: \*Reference 10; †Reference 8; ‡Reference 24; §Reference 23; ¶Reference 13. IMN = intramedullary nailing; ORIF = open reduction and internal fixation; ROM = range of motion.

### **3.1. Indication for operative treatment**

The management of a paediatric both-bone forearm fracture begins with the question of whether the fracture can be reduced and held by closed means. The overwhelming majority of these injuries can, because the child's periosteum and remodelling capacity are forgiving<sup>1,2</sup>. The decisive variables are the age of the child and the magnitude and plane of the deformity. Systematic reviews of the radiological literature, building on the historical thresholds proposed by Noonan and Price, support intervention when sagittal or coronal angulation exceeds roughly ten degrees, or when translation exceeds about half the diameter of the bone, in children older than ten years<sup>5,7</sup>. Our patient was twelve years old with a displaced, angulated, length-unstable both-bone diaphyseal fracture, and thus sat squarely within the operative zone of this framework.

The age of the patient also bears on the reliability of nonoperative treatment over time. Closed reduction may achieve an acceptable position on the day of injury only for the fracture to re-displace within the cast. A prospective study from a teaching hospital identified the magnitude of initial displacement and the quality of cast moulding as the dominant predictors of early re-displacement, a complication that is both common and frustrating because it often forces a delayed operation under less favourable conditions<sup>4</sup>. In a near-skeletally-mature child with an obviously unstable injury, accepting a high probability of re-displacement in order to attempt closed treatment would have been difficult to justify, and proceeding directly to stable internal fixation was the sounder course.

Two elements of the initial assessment deserve emphasis because they govern the safety of any subsequent operation. First, the careful exclusion of associated injury matters: the absence of loss of consciousness and of forceful vomiting argued against a significant concomitant head injury, and the normal systemic examination excluded other major trauma, allowing attention to be focused on the isolated forearm. Second, the documented integrity of the distal neurovascular status, with a palpable regular radial

pulse, a capillary refill time under two seconds, and intact distal sensation, was reassuring, because both the injury itself and a tight circumferential cast can precipitate forearm compartment syndrome, the most feared early complication of these fractures. The deliberate look-feel-move documentation summarised in Table 1 therefore served not only to characterise the fracture but to confirm that operative fixation could proceed without the added jeopardy of an unrecognised vascular or compartmental emergency.

### **3.2. Choice of fixation: nail versus plate**

Having decided to operate, the surgeon must choose between elastic stable intramedullary nailing and plate-and-screw fixation, the two constructs that dominate the contemporary literature. High-quality syntheses are reassuringly consistent: a meta-analysis of comparative studies and a separate systematic review both concluded that nailing and plating yield excellent functional and radiographic outcomes in approximately ninety percent of children, with no statistically significant difference in union or final function<sup>3,8</sup>. An age-matched comparative study focusing on adolescents, the very group to which our patient belongs, similarly found that more than ninety percent of patients in both groups achieved excellent results by the Price criteria, with nailing offering shorter operative time and better cosmesis and plating offering rigid anatomical control<sup>10</sup>. Elastic nailing is an elegant, minimally invasive technique with a well-described learning curve and an excellent safety profile in experienced hands<sup>9</sup>.

Several considerations favoured plate fixation in this specific case. The fracture was at the mid-diaphysis of both bones and was length-unstable, a pattern in which a plate restores and holds length and the radial bow more predictably than a nail, which controls alignment but not rotation or length as rigidly. The patient was approaching skeletal maturity, so the remodelling that might compensate for any imperfection of a nailed reduction could not be relied upon<sup>6</sup>. Rigid plate fixation also permits early functional rehabilitation, an advantage in an active child. Finally, and decisively in

this setting, the choice of construct was constrained by what was physically available. Elastic nails of an appropriate diameter were not on hand, whereas plates and screws, albeit not of the ideal dimensions, were. The literature on hybrid constructs, in which one bone is plated and the other nailed, illustrates that surgeons routinely individualise the construct to the patient and the resources at their disposal, and reports comparable union and function with such pragmatic combinations<sup>11,12</sup>.

### **3.3. Operating under implant constraint: the central lesson**

The defining feature of this case, and its principal contribution to the literature, is that the operation was completed with implants that were frankly suboptimal for a child of this size. The plates available were relatively large tubular plates and the screws were largely of a single, limited caliber, rather than the low-profile, anatomically contoured small-fragment forearm plates and the graduated screw set that a tertiary unit would expect to use. This is not a rare predicament. Surgeons working in peripheral and regional hospitals, especially across low- and middle-income settings, frequently confront a mismatch between the implant that is indicated and the implant that is in the cupboard, and the design philosophy behind devices such as the SIGN intramedullary nail exists precisely because of these structural shortages of equipment and imaging<sup>13,14</sup>.

The biomechanical task, however, does not change with the inventory. Stable diaphyseal fixation depends on an accurate reduction, on a plate of sufficient working length spanning the fracture, and on an adequate number of well-purchased cortices on either side of the fracture line. A classic series of forearm compression plating demonstrated that a standard-length plate with four cortices of screw fixation on each side of the fracture produced union rates in excess of ninety-seven percent, underlining that it is the quality of the construct, rather than the elegance of the implant, that determines healing<sup>16</sup>. In the present case the oversized tubular plates were carefully contoured to the

bone and positioned to capture sufficient cortices on both sides of each fracture, so that the fundamental requirements for stability were met despite the implants being larger and less refined than ideal. The trade-offs of using a bulkier plate in a child are real and must be acknowledged: a prominent plate is more likely to irritate the overlying soft tissues, a stiffer construct increases stress shielding of the bone beneath it, and a larger plate footprint may marginally complicate later removal. None of these theoretical disadvantages materialised into a clinical complication in this patient, whose fractures united uneventfully, but they frame the counselling that such a family deserves and the vigilance that follow-up requires.

The wider point is that the surgeon's judgement, rather than the catalogue, was the limiting resource. Faced with an unstable fracture in a child who could not safely wait and could not readily be transferred, the operating surgeon adapted the available hardware to honour the timeless principles of reduction and fixation. This kind of adaptive decision-making is a core, if under-documented, competency of orthopaedic practice in regional hospitals, and case reports such as this one help to make that competency visible and teachable.

### **3.4. Union, remodelling and the immature skeleton**

The fracture in this patient united within approximately twelve months, with progressive callus on interval films and solid bridging by the time of implant removal. This trajectory is consistent with the rapid healing expected of the paediatric diaphysis, where union within a few weeks to a few months is the norm even after open fixation<sup>9,17</sup>. It is important, nonetheless, to separate union from remodelling. Whereas a younger child can be relied upon to remodel modest residual angulation, the evidence indicates that this capacity is substantial only up to about eleven years of age and becomes progressively less dependable thereafter, while rotational malunion never remodels<sup>6</sup>. A recent prospective study confirmed considerable remodelling potential in children up to eleven years but cautioned that the data thin out beyond that age<sup>6</sup>. For a twelve-year-old, therefore, the surgeon cannot count on

biology to rescue an imperfect reduction, and the premium on achieving and holding an anatomical position at the time of surgery is correspondingly higher. The decision to obtain a precise open reduction and to hold it rigidly, rather than to accept a closed but imperfect position, was vindicated by the well-aligned, pain-free forearm at final review.<sup>18-20</sup>

### **3.5. Implant removal and the risk of refracture**

The removal of forearm implants in children is one of the more debated questions in paediatric trauma, and this case illustrates the competing considerations well. Retaining a plate avoids a second anaesthetic and operation, and a long-term study of retained paediatric forearm plates found that retention did not increase the refracture rate compared with historical controls, although a substantial proportion of children reported palpable hardware, mild pain, clicking, or subjective weakness, and a minority eventually required removal for these symptoms<sup>18</sup>. Conversely, removal eliminates these hardware-related symptoms and the small but genuine risk of late complications such as plate migration with soft-tissue erosion, a striking example of which was reported many years after a childhood forearm plating<sup>19</sup>.

If a plate is to be removed, the timing matters greatly, because the principal hazard of removal is refracture through the screw holes or at the stress riser created by the plate ends. The reported refracture rate after operative treatment of paediatric both-bone fractures is of the order of five to eleven percent, and is influenced by the patient's age, the bone fixed, and the mode of fixation<sup>20,21</sup>. Plate refractures characteristically occur at the proximal or distal plate edge and commonly require revision surgery, in contrast to refractures after elastic nailing, which tend to recur at the original fracture site and can often be treated nonoperatively<sup>21</sup>. Evidence on timing is instructive: a multicentre study of intramedullary fixation showed that a longer period of implantation significantly reduced refracture, and a series specifically examining implant removal concluded that refracture risk was elevated when plates were taken out within twelve months and recommended against

removing forearm plates before that point, particularly in children aged twelve years and older<sup>22,23</sup>. Our decision to defer elective removal until the twelve-month mark, by which time the radiographs showed solid union and cortical remodelling around the plates, was therefore well aligned with the best available evidence, and the post-removal films confirmed consolidated bone without refracture.

### **3.6. Comparison with similar reports and complication avoidance**

Placing this case alongside comparable reports reinforces both its typical and its distinctive features, as summarised in Table 3. A case of a Galeazzi-equivalent forearm fracture in an adolescent treated by open reduction and internal fixation with a plate for the radius and Kirschner wires for the ulna achieved complete union and a normal range of motion at two years, echoing the favourable outcome and the principle of individualising fixation seen in our patient<sup>24</sup>. The literature also documents the complications that meticulous technique and follow-up are designed to avoid. A case report and review described a nonunion of a paediatric distal radial fracture after open reduction and internal fixation, a rare event in children that nonetheless underlines the importance of stable fixation and biological respect for the fracture site<sup>25</sup>. Difficulties of reduction in displaced diaphyseal fractures have prompted the development of dedicated intraoperative aids, such as a small distractor for non-open reduction, illustrating that achieving an accurate reduction is itself a recognised technical challenge<sup>26</sup>. Finally, in the resource-limited context that frames this report, a study from a low-resource setting identified delays in wound care and limitations of equipment and implants as drivers of fracture-related infection, a reminder that scrupulous asepsis and timely surgery are even more important when the margin for error is narrow<sup>15,24-27</sup>. Our patient's uneventful, infection-free course in such a setting is a credit to adherence to these fundamentals.

### **3.7. Lessons for resource-limited regional practice**

The broadest lesson of this case extends beyond the individual child. A great deal of orthopaedic trauma is

treated not in flagship referral centres but in regional and district hospitals where the implant inventory is partial and unpredictable<sup>13-15</sup>. The published evidence base, generated largely in well-resourced units, tells the surgeon which construct is ideal but says little about what to do when the ideal construct is unavailable and the patient cannot wait. This report offers a concrete, reassuring answer: by holding fast to the principles of accurate reduction and adequately stable fixation, a good outcome can be achieved even with implants that are larger or less refined than the textbook would prescribe. The corollary is equally important. Where feasible, strengthening implant supply chains, maintaining a broader range of plate sizes and screw calibers, and supporting donation or standardised low-cost implant programmes would reduce the frequency with which surgeons must improvise<sup>13,14</sup>. Until that ideal is universal, the adaptive competence demonstrated here remains indispensable.

Several transferable lessons emerge from this case. A displaced, unstable both-bone diaphyseal forearm fracture in a child of twelve years or older should be regarded as an operative injury, because the narrowing remodelling reserve at this age makes reliance on closed treatment hazardous<sup>5,6</sup>. When operative fixation is undertaken with implants that are not ideal, the surgeon should concentrate on the variables that actually determine union, namely an accurate reduction restoring length, rotation and the radial bow, a plate of adequate working length, and a sufficient number of well-purchased cortices on each side of the fracture, rather than on the cosmetic refinement of the hardware<sup>16</sup>. The family should be counselled that a bulkier plate may be more prominent and may warrant planned removal, and that removal, if undertaken, is safest after twelve months of consolidation to minimise refracture through the screw holes<sup>22,23</sup>. Above all, an unstable fracture in a child who cannot safely wait should not be deferred for want of the perfect implant when sound fixation can be achieved with what is at hand.

### **3.8. Limitations**

This report describes a single patient and therefore cannot establish the generalisability of its approach; it provides a real-world illustration rather than comparative evidence. Detailed patient-reported functional scores and objective range-of-motion measurements at final follow-up were not available for inclusion, and the follow-up, while sufficient to document union and uneventful implant removal, does not extend into the years over which a late complication such as plate migration could theoretically arise. The radiographic angular measurements were assessed qualitatively rather than by formal goniometric analysis. These limitations are inherent to a single case report and do not detract from the central, transferable message regarding adaptive fixation under implant constraint.

### **4. Conclusion**

A displaced both-bone diaphyseal forearm fracture in a near-skeletally-mature child is an injury for which operative stabilisation is appropriate, because the limited remodelling capacity of the older paediatric diaphysis raises the premium on an anatomical reduction that closed treatment cannot reliably deliver. This case demonstrates that open reduction and internal fixation can achieve such a reduction and proceed to uneventful union even when the only implants available are relatively oversized tubular plates and a limited selection of screws, provided that the surgeon preserves the fundamental requirements of accurate reduction, adequate working length, and sufficient cortical purchase on either side of the fracture. Deferring elective implant removal until twelve months, when solid union had been confirmed, accorded with the evidence on refracture risk and was followed by a consolidated forearm without refracture. Above all, the case underscores that sound surgical judgement and fidelity to biomechanical principles, rather than the sophistication of the hardware, are the true determinants of a good outcome, a message of particular value to surgeons practising in resource-limited regional hospitals.

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