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Case Report

Surgical management of an exceptionally rare case of symptomatic central polydactyly in an adolescent

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ABSTRACT

Central polydactyly is the rarest form of digital duplication, representing only 5-15% of all cases25-06-2026 07:22:00 PM. We report the case of a 13-year-old girl presenting with symptomatic central polydactyly (Wall type 1 A) with late-onset pain and functional limitation. Radiographic evaluation demonstrated a bifid third metacarpal consistent with Tada type II classification. Surgical management involved resection of the supernumerary digit combined with a subtraction osteotomy of the third metacarpal and intertendinous suturing to restore axial alignment and centralize the extensor mechanism. At 3-year follow-up, the patient demonstrated excellent functional and aesthetic outcomes. This case highlights the importance of addressing both skeletal deformity and tendon imbalance in delayed presentations of central polydactyly.

Keywords: Central polydactyly, Bifid extensor, Adolescent, Surgical technique, Osteotomy, Outcome

INTRODUCTION

Polydactyly is one of the most common congenital hand malformations, with an incidence ranging from 0.37 to 2 per 1,000 live births.[1,2] It is categorized into three types based on the anatomical position: preaxial (radial), central (middle rays), and postaxial (ulnar).[2,3] Central polydactyly remains the rarest form25-06-2026 07:22:00 PM.[2,4] Modern literature suggests that central polydactyly, syndactyly, and cleft hand belong to a unified pathogenic spectrum termed "abnormal induction of finger rays.[5-7] These anomalies are often associated with complex osseous and soft tissue abnormalities, making surgical management particularly challenging.

CASE REPORT

A 13-year-old right-handed female student presented with a congenital duplication of the right middle finger (Figure 1). Although present since birth, the deformity became symptomatic over the previous two years, with progressive pain and functional limitation. Clinical examination revealed a duplicated central ray with preserved joint mobility and no neurovascular deficit. Radiographs demonstrated a distal bifurcation of the third metacarpal (Figure 2), identifying this as a Wall Type 1 A central synpolydactyly.[8] It also fits the Tada Type II classification, where the duplicated digit shares a bifid metacarpal with the neighbouring ray.[4-9]

To ensure the safety of the complex digital reconstruction, a preoperative arteriography of the right upper limb was performed.

The imaging demonstrated robust digital vascularization across all rays (Figure 3), confirming the feasibility of the planned resection and realignment. The procedure was performed under general anesthesia with a pneumatic tourniquet applied at the base of the limb, through a dorsal longitudinal approach centered over the third metacarpal.

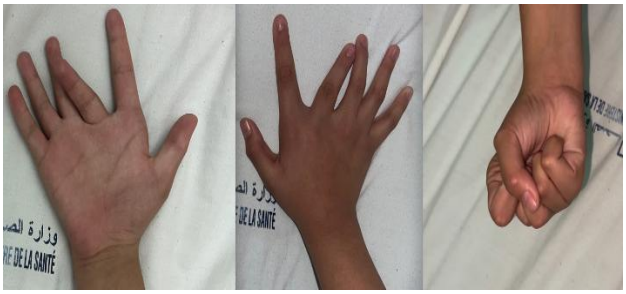

Figure 1: Clinical view of the 13-year-old patient's right hand demonstrating a central duplication of the middle finger ray.

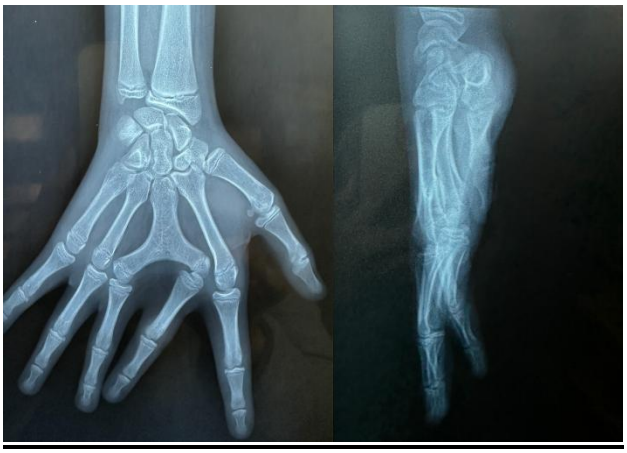

Figure 2: Anteroposterior radiographs showing a distal bifurcation of the third metacarpal with two separate digital rays.

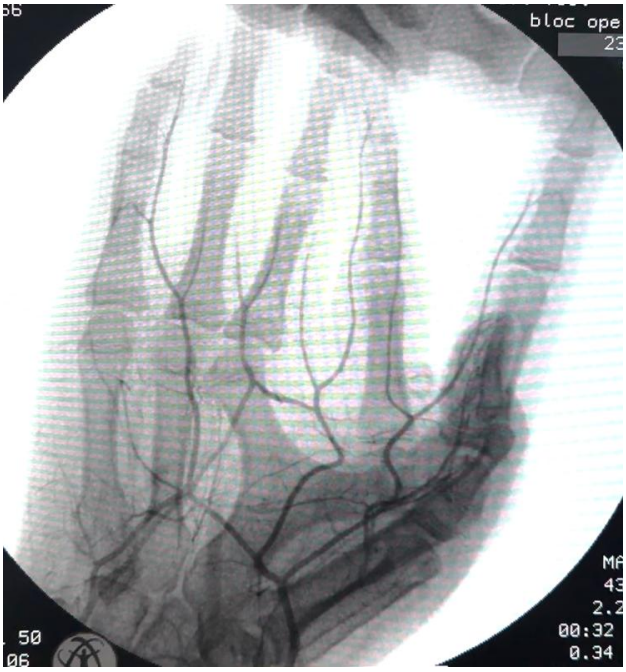

Figure 3: Preoperative arteriography confirmed adequate vascularization of the digital rays.

Findings

Dissection revealed a bifurcated extensor tendon (Figure 4), confirming duplication involving both osseous and soft tissue structures.

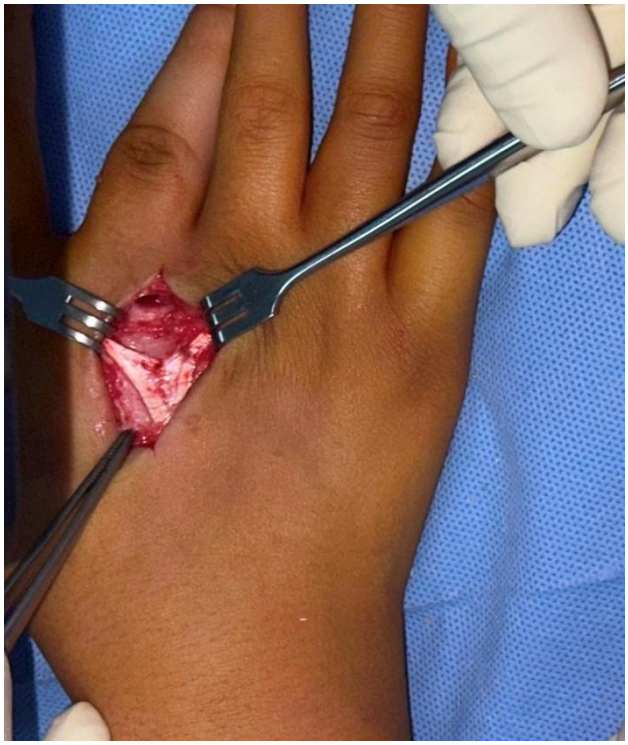

Figure 4: Surgical exposure through a dorsal incision revealing a bifurcated extensor tendon.

Resection and realignment

Excision of the supernumerary digit, followed by a subtraction osteotomy of the third metacarpal to correct the widening of the bifid metacarpal and restore proper axial alignment (Figure 5).

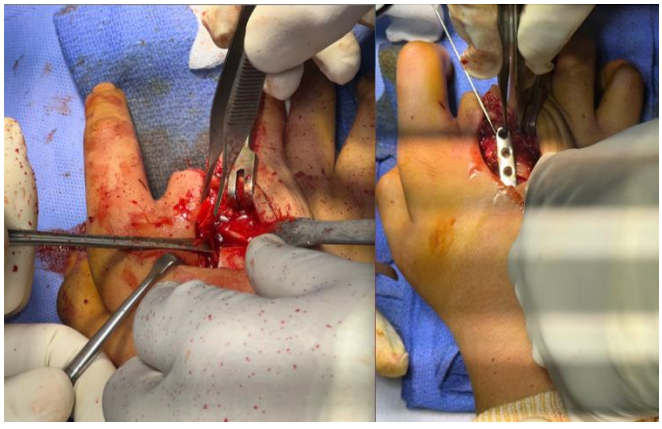

Figure 5: View of the subtraction osteotomy performed on the distal third metacarpal to address the skeletal widening and allow for axial realignment fixed with a plate.

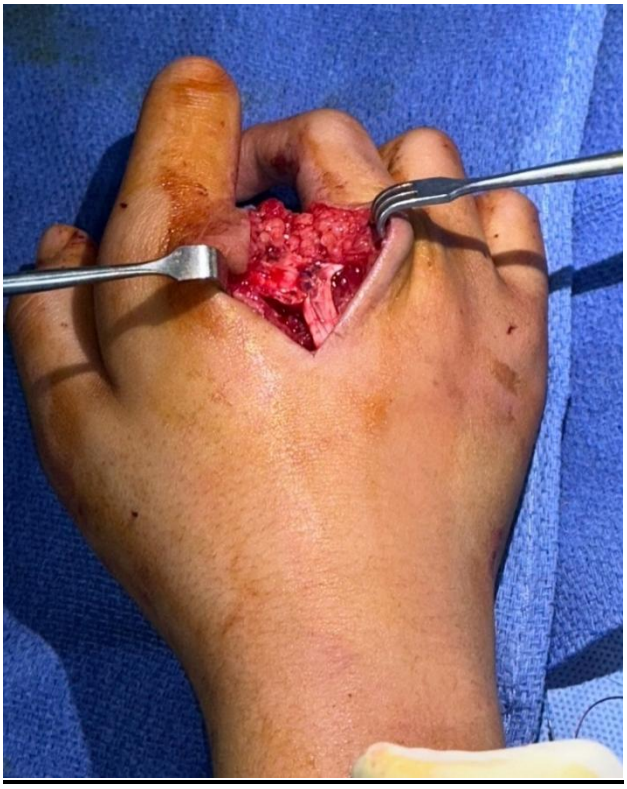

Figure 6: The dominant tendon was sutured to the intertendinous junction to centralize the extensor mechanism.

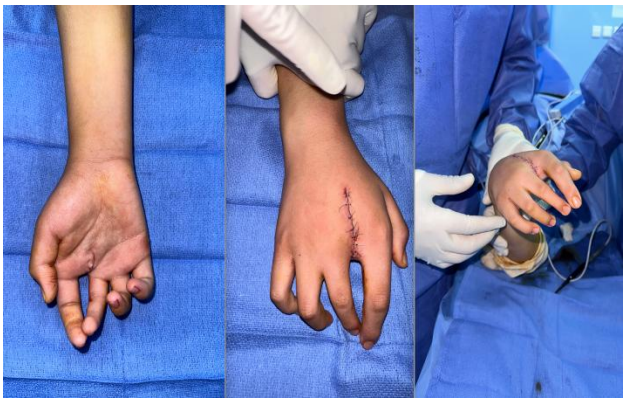

Figure 7: Intraoperative view of the right hand immediately following layer-by-layer closure.

Fixation

Fixation was achieved using a plate and screws. The preserved tendon was sutured to the intertendinous junction to centralize the extensor mechanism and realign it with the axis of the digit (Figure 6).

The wound was closed in layers (Figure 7). We performed anteroposterior radiograph immediately after surgery, illustrating successful third ray reconstruction (Figure 8) and the hand was immobilized in a splint for three weeks then progressive rehabilitation was initiated.

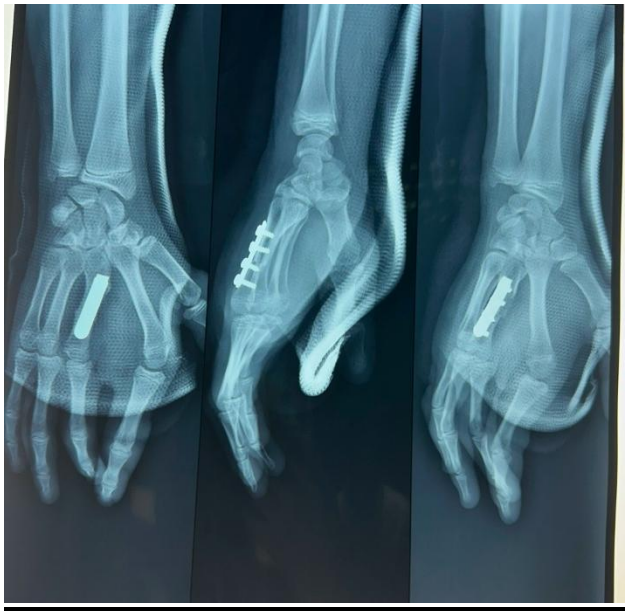

Figure 8: Immediate postoperative AP view of the right hand showing successful reconstruction of the third ray.

DISCUSSION

Pathogenesis and the "abnormal induction" theory

The discovery of a bifurcated extensor tendon in this case supports the theory that central anomalies are "splits" rather than additions.[5,6] Experimental rat models using busulfan have shown that abnormal clefts in the central embryonic plate lead to divergent phenotypes: central polydactyly, syndactyly, or cleft hand.[6] This explains "hidden" polydactylies where a hand appears cleft but radiographs reveal an extra metacarpal.[5-7] Genetic studies involving the HOXD13 gene have linked these malformations to autosomal dominant inheritance patterns.[1,4,8]

Surgical timing

Surgical management of polydactyly is traditionally recommended between 6 and 12 months of age.[1-9] This early timing allows for optimal cortical adaptation prior to the development of fine motor skills and helps prevent progressive deformity due to the influence of supernumerary rays on adjacent skeletal structures.[1,2]

Central polydactyly is an exceptionally rare condition, it is rarely encountered as an isolated anomaly and is most commonly associated with complex congenital malformations such as syndactyly or cleft hand deformities.[4,8,9] In this context, the presentation of a pure Wall type 1A central polydactyly represents a particularly uncommon and noteworthy entity in the literature.[8]

In the present case, the patient presented at the age of 13 years, significantly later than the usual timing for surgical

correction. The indication for surgery was driven by functional impairment and pain, rather than purely aesthetic concerns. In such delayed presentations, the surgical approach must be adapted accordingly. Instead of simple ablation, a subtraction metacarpal osteotomy and tendon balance restoration are often required to restore proper mechanical alignment and optimize hand function.[1,2]

Postoperative outcome (evolution)

At the three-year follow-up, the patient demonstrated excellent clinical and functional outcomes. Healing was uneventful, with a well-healed scar, complete resolution of preoperative pain, preservation of full active range of motion and normal grip strength (Figure 9). Radiographic evaluation confirmed solid consolidation at the osteotomy site, with no evidence of complications (Figure 10).

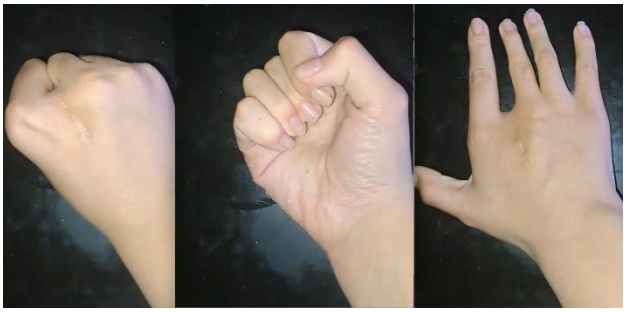

Figure 9: Three years after the intervention, the patient demonstrated a favourable outcome, with a well-healed, clean scar and satisfactory aesthetic and functional results.

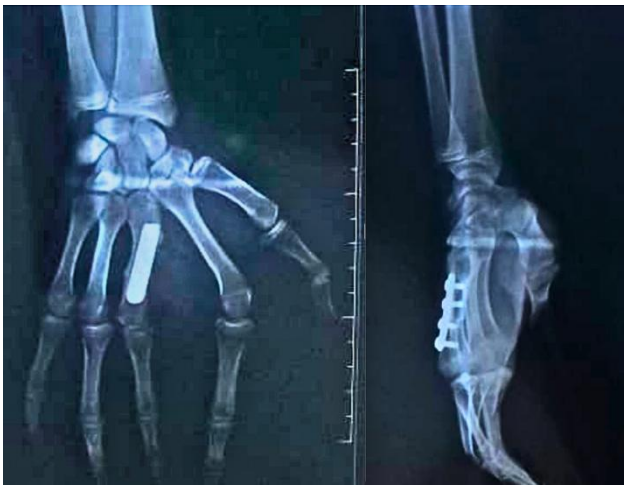

Figure 10: The three-year follow-up radiograph demonstrates osseous consolidation at the site of the third metacarpal subtraction osteotomy with no evidence of secondary complications.

These observations align with current literature, which suggests that for the central digital rays (index, middle, and ring fingers), acceptable function is routinely achievable; however, some degree of stiffness or residual functional limitation should be anticipated relative to a normal hand.[2] This acknowledges the clinical reality that a reconstructed digit, particularly in the context of complex central polydactyly, cannot fully replicate standard anatomy. Nevertheless, the primary surgical goal remains the restoration of a stable mechanical alignment and functional grip, with favorable long-term outcomes consistently reported in the literature when these objectives are prioritized.[2]

This case highlights that, although early intervention remains the gold standard, delayed surgical management in adolescents can still yield excellent functional and aesthetic results when appropriately indicated and technically well executed.[1,2]

CONCLUSION

This case underscores the importance of precise soft-tissue management in rare meso-axial duplications. The identification of a bifurcated extensor apparatus required a specific strategy of tendon centralization following the subtraction osteotomy to prevent secondary axial deviations. We achieved excellent functional recovery and a natural anatomical profile at a 3-year follow-up.

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