ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 12| Issue: 4| April 2026|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2026: 8.753 || ISI Value: 1.188

SURGICAL RESECTION OF A SUPERNUMERARY THUMB PHALANX IN A TODDLER: A RARE CASE REPORT AND LITERATURE REVIEW

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Article DOI: https://doi.org/10.36713/epra27320
DOI No: 10.36713/epra27320

ABSTRACT

Background: *supernumerary thumb phalanges are rare congenital anomalies within the spectrum of preaxial polydactyly. Although commonly classified using the Wassel system, atypical variants that do not conform to this classification present diagnostic and surgical challenges. These anomalies may occur as isolated findings or in association with syndromic conditions and can affect both function and aesthetics.*

Case Presentation: *we report the case of a 2-year-old male presenting with an isolated supernumerary phalanx on the radial aspect of the right thumb. Clinical examination demonstrated a well-formed accessory structure without functional impairment. Radiographic evaluation, including anteroposterior and oblique views, revealed a fully ossified accessory phalanx without joint or metacarpal duplication, consistent with an atypical form of preaxial polydactyly not classifiable within the Wassel system. Surgical excision was performed with preservation of ligamentous, tendinous, and neurovascular structures. Postoperative follow-up showed excellent functional and cosmetic outcomes, with full range of motion and proper thumb alignment.*

Methods*: a narrative literature review was conducted using PubMed, Google Scholar, and Cochrane Library databases. A total of 32 articles were identified, of which 15 were selected based on relevance. Search terms included: "supernumerary thumb phalanx," "radial polydactyly," "thumb duplication," "preaxial polydactyly," "pediatric hand surgery," and "surgical treatment."*

Results: *the Wassel classification remains the most widely used system for thumb duplication; however, atypical presentations are increasingly recognized. Imaging plays a critical role in identifying anatomical variations and guiding surgical planning. Evidence suggests that early, anatomically guided surgical excision yields favorable functional and aesthetic outcomes.*

Conclusion: *isolated supernumerary thumb phalanges represent a rare and atypical form of preaxial polydactyly that may not fit existing classification systems. Individualized surgical management based on detailed anatomical assessment is essential to achieve optimal outcomes. This case highlights the limitations of traditional classifications and reinforces the importance of tailored surgical strategies.*

KEYWORDS: *Supernumerary Thumb; Preaxial Polydactyly; Thumb Duplication; Pediatric Hand Surgery; Surgical Excision; Case Report*

INTRODUCTION

Preaxial polydactyly, commonly known as thumb duplication, is one of the most frequently encountered congenital anomalies of the hand, with an incidence reported between approximately 0.08 to 1.4 per 1,000 live births. This malformation arises from abnormalities in the radioulnar axis of the developing hand plate during embryogenesis and typically presents as an extra digit on the radial side of the hand. While many cases are sporadic and isolated, some may be associated with syndromic conditions and other limb anomalies(1).

Congenital anomalies of the upper extremity affect approximately 10% of all congenital malformations and represent the second most common group after cardiac defects. These anomalies may present as isolated conditions or as part of complex syndromic associations, highlighting the importance of thorough clinical evaluation and appropriate classification for optimal management(2,3).

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The classification of thumb duplications plays a pivotal role in diagnosis and surgical planning. The most widely used system, the Wassel classification, categorizes radial polydactyly based on the level of skeletal duplication as seen on standard radiographs, ranging from bifid distal phalanx to full triphalangism. This system, though simple and practical, has limitations, particularly in cases with atypical anatomy or complex duplications that challenge accurate categorization(2).

Surgical management is generally recommended for duplicated thumbs that interfere with function or cosmetic appearance, with the primary goals being restoration of a stable, mobile thumb of adequate size and acceptable aesthetic outcome. Surgical techniques vary according to the type and complexity of duplication and include simple excision of the accessory digit, excision with reconstruction of soft tissues and ligaments, and combined procedures such as the Bilhaut-Cloquet technique. Selection of the appropriate technique requires careful preoperative evaluation of bone and soft tissue structures, joint stability, and thumb alignment(4,5).

Despite the relative frequency of thumb duplications among congenital hand anomalies, isolated cases of supernumerary thumb phalanx without associated abnormalities are rare and less frequently reported in the literature. As such, detailed case reports and comprehensive literature reviews remain valuable for refining surgical strategies and helping clinicians optimize functional and aesthetic outcomes in pediatric patients(6).

CASE PRESENTATION

Patient Information

A 2-year-old male presented with a congenital deformity of the right thumb characterized by an additional structure on the radial aspect. There was no history of trauma, infection, or previous interventions. Family history was negative for congenital anomalies, and developmental milestones were normal.

Clinical Findings

Physical examination revealed a radially located accessory thumb component with a distinct contour, suggesting underlying osseous support. The overlying skin was intact, with no signs of inflammation.

The thumb demonstrated:

- Full active and passive range of motion
- Normal stability
- Preserved neurovascular status

No axial deviation or functional limitation was observed. No other musculoskeletal abnormalities were identified.

Imaging Studies

Plain radiographs of the right hand, including anteroposterior and oblique views, demonstrated a well-ossified supernumerary phalanx located along the radial aspect of the thumb.

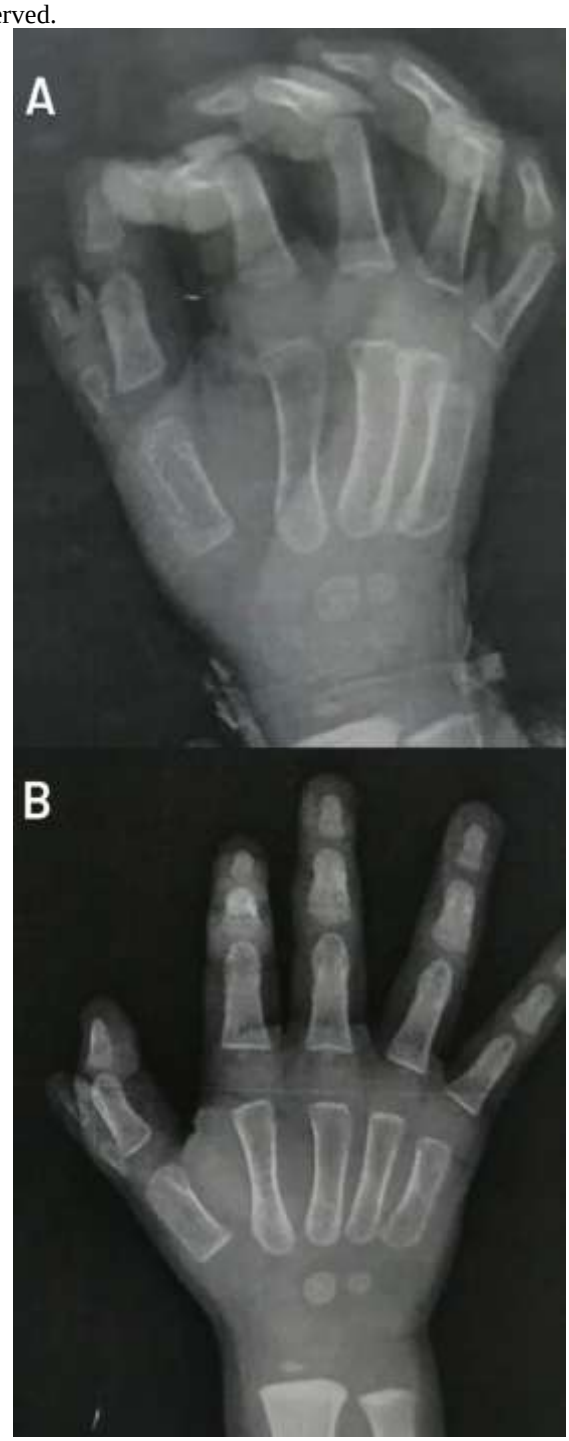
The accessory phalanx:

- Did not involve the metacarpal
- Showed no clear duplication of interphalangeal or metacarpophalangeal joints
- Appeared as an independent osseous structure adjacent to the native phalanx

These findings are consistent with an atypical form of preaxial polydactyly, not fully classifiable within the traditional Wassel system.

Figure 1. Preoperative radiographic evaluation of the right hand

(A) Oblique view and (B) anteroposterior (AP) view of the right hand demonstrating a supernumerary phalanx of the thumb. The images reveal an additional well-formed ossified structure located between the proximal and distal phalanges, consistent with a supernumerary intermediate phalanx. No associated skeletal abnormalities or duplication of the metacarpal are observed.



Source: The Authors.

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Surgical Planning

Given the anatomical configuration and potential for future functional and cosmetic impairment, surgical excision was indicated.

The surgical strategy focused on:

- Preservation of the dominant thumb ray
- Protection of radial digital nerve and vessels
- Maintenance of collateral ligament stability
- Restoration of normal anatomical alignment

Surgical Procedure

Under general anesthesia, a longitudinal incision was made along the radial aspect of the thumb. Careful dissection was performed to identify and preserve neurovascular structures.

The accessory phalanx was excised en bloc. Reconstruction included:

- Reinsertion of soft tissues
- Stabilization of collateral ligaments
- Preservation of tendon balance

Layered closure was performed using absorbable sutures, followed by application of a soft dressing.

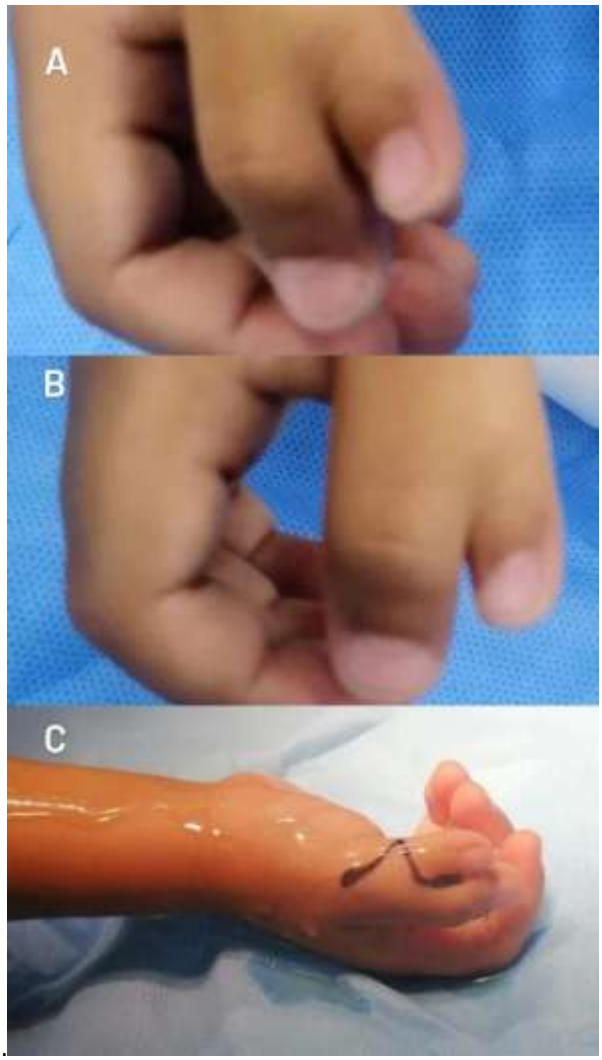


Figure 2. Clinical presentation and preoperative planning
(A, B) Preoperative clinical images of the right thumb showing a subtle enlargement and altered contour consistent with an underlying supernumerary phalanx, without evident functional limitation. (C) Intraoperative marking and surgical planning outlining the incision approach for excision of the supernumerary phalanx, with attention to preservation of surrounding soft tissue structures

Source: The Authors.

Postoperative Course

The patient tolerated the procedure well. Immediate postoperative assessment confirmed:

- Adequate perfusion
- Preserved sensation

Follow-up evaluations at 2 weeks and 3 months showed:

- Proper wound healing
- Full range of motion
- Good thumb alignment

No complications were observed.

Outcome

At 6-month follow-up, the patient demonstrated:

- Normal thumb function
- Excellent cosmetic appearance
- No pain or functional limitation

Parental and clinical satisfaction were high.

METHODS

This study consists of a case report combined with a narrative literature review conducted in accordance with the CARE guidelines for case reports.

A comprehensive search of the literature was performed using the databases PubMed, Google Scholar, and the Cochrane

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Library. The search included articles published up to 2025 in English, Spanish, and Portuguese.

The following keywords and MeSH terms were used: "supernumerary thumb phalanx," "radial polydactyly," "thumb duplication," "preaxial polydactyly," "pediatric hand surgery," and "surgical treatment."

Inclusion criteria comprised:

- Original articles, case reports, and review articles
- Studies addressing classification, clinical presentation, imaging, and surgical management of thumb duplication
- Articles with clear methodological description and clinical relevance

Exclusion criteria included:

- Articles lacking full text availability
- Studies not directly related to thumb duplication or supernumerary phalanges
- Publications with insufficient clinical or surgical detail

A total of 32 articles were initially identified. After screening for relevance and quality, 15 articles were selected for qualitative analysis.

Data extraction focused on:

- Classification systems (Wassel and alternative systems)
- Indications for surgical treatment
- Surgical techniques employed
- Functional and cosmetic outcomes
- Reported complications

RESULTS

A total of 32 articles were identified through the initial search strategy. After applying inclusion and exclusion criteria, 15 studies were selected for qualitative analysis, including case reports, retrospective studies, and review articles.

The literature confirms that the Wassel classification remains the most commonly used system for categorizing thumb duplication, with types I and II being the most frequently reported in less complex forms. However, several authors highlight the presence of atypical variants that are not adequately classified within this system.

Surgical management varied depending on anatomical complexity. The most commonly reported techniques included simple excision for hypoplastic or accessory components and reconstructive procedures for more complex duplications. Functional outcomes were generally favorable, with most patients achieving good range of motion and satisfactory cosmetic results.

Reported complications included joint instability, angular deformity, and residual asymmetry, particularly in more complex cases or when soft tissue reconstruction was insufficient.

DISCUSSION

Comparison with the Literature: Indications for Resection vs Reconstruction and Functional Outcomes

The management of radial polydactyly depends on the anatomical configuration and the degree of development of each duplicated component. In most cases, surgical treatment involves either simple excision, excision with reconstruction, or combination techniques such as the Bilhaut-Cloquet procedure. Simple excision alone is typically reserved for hypoplastic or accessory elements with minimal functional contribution, whereas more complex duplications require reconstruction to preserve stability and alignment. Functional outcomes are generally favorable, with most patients achieving normal daily hand function; however, up to 15% may require secondary procedures due to residual deformities such as angular deviation or joint instability(7–9).

Recent studies have shown that outcomes are strongly influenced by the type of duplication and surgical technique employed. Hypoplastic duplications treated with simple excision tend to have better aesthetic outcomes, whereas more complex forms require reconstructive procedures to optimize function. Overall, surgical treatment provides good to excellent functional and cosmetic results, particularly when appropriate technique selection is based on anatomical characteristics(10).

In the present case, the accessory phalanx behaved as a structurally independent but non-articulating element, making it amenable to simple excision without the need for complex reconstruction. This aligns with current evidence supporting isolated excision in anatomically simple variants.

Preoperative evaluation plays a critical role in determining surgical strategy and predicting outcomes. Radiographic classification, particularly using the Wassel system, remains the most widely used tool; however, it has recognized limitations in atypical cases, as it does not account for soft tissue abnormalities, joint instability, or dominance between duplicated elements(2,11–13).

Advanced assessment must include not only the level of skeletal duplication but also factors such as tendon insertion, ligament integrity, angular deformity, and joint functionality. These parameters directly influence surgical decision-making and postoperative outcomes. Cases with balanced and well-aligned duplications tend to have better functional results, whereas imbalanced or angulated duplications are associated with poorer outcomes and increased technical complexity(1).

In this case, careful radiographic and clinical evaluation allowed identification of an atypical isolated supernumerary phalanx without joint involvement, facilitating a targeted surgical approach focused on excision and preservation of key stabilizing structures.

Congenital hand anomalies demonstrate significant anatomical variability, and although classification systems such as Wassel are widely used, they do not encompass all possible presentations. Recent literature emphasizes that atypical variants require individualized assessment, as surgical

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decision-making should be based not only on classification but also on detailed anatomical and functional evaluation(6).

Complications and Their Prevention

Complications following surgical treatment of thumb duplication include joint instability, axial deviation, stiffness, and residual deformity. These complications are more frequently associated with complex duplications and inadequate reconstruction of ligamentous and tendinous structures. Reported complication rates can reach up to 27%, particularly in patients undergoing surgery at older ages or with higher-grade duplications (Wassel types III–IV)(14,15).

Instability and angular deformity are the most common postoperative issues and are often related to insufficient reconstruction of collateral ligaments or improper alignment during surgery.

In the present case, complications were minimized through meticulous surgical technique, including preservation of neurovascular structures and careful reconstruction of soft tissues to maintain joint stability. Early surgical intervention and the relatively simple anatomical configuration likely contributed to the excellent functional and cosmetic outcome observed.

Key Scientific Contribution of This Case

This case highlights an atypical presentation of preaxial polydactyly that does not conform to traditional classification systems such as Wassel. It reinforces the concept that classification systems should guide—but not dictate—management, and that individualized surgical planning based on detailed anatomical assessment is essential for optimal outcomes.

This study has limitations inherent to single case reports, including lack of generalizability and absence of long-term follow-up. Additionally, the rarity of this anatomical variant limits comparison with large case series.

This case emphasizes the importance of individualized surgical planning in atypical presentations of preaxial polydactyly, where standard classification systems may not adequately guide treatment

CONCLUSIONS

Isolated supernumerary thumb phalanges represent a rare and atypical presentation within the spectrum of preaxial polydactyly. As demonstrated in this case, such variants may not conform to traditional classification systems, including the Wassel classification, highlighting their limitations in capturing the full range of anatomical presentations.

Careful clinical and radiographic evaluation is essential for accurate diagnosis and surgical planning. In atypical cases, management should be guided by detailed anatomical assessment rather than strict adherence to classification systems.

Surgical excision, when appropriately indicated and meticulously performed with preservation of ligamentous, tendinous, and neurovascular structures, can result in excellent functional and cosmetic outcomes. Early intervention may further optimize results by facilitating normal hand development and minimizing psychosocial impact.

This case supports existing literature emphasizing individualized treatment strategies and contributes to the understanding of uncommon anatomical variants, reinforcing the need for flexible and patient-specific approaches in pediatric hand surgery.

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Conflict of Interest Declaration

The authors declare no conflicts of interest.

Funding

The authors report no funding from any organization or company.

Written informed consent was obtained from the patient's legal guardians for publication of clinical data and images. Institutional ethical approval was obtained or waived according to local regulations.