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SERVICES FOR SCIENCE AND EDUCATION

Postaxial Type A Polydactyly of All Four Limbs: Surgical Management of a Rare Congenital Presentation – A Case Report and Literature Review

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ABSTRACT

Postaxial polydactyly type A is a relatively common congenital anomaly in certain populations, typically presenting as a small, soft-tissue digit attached to the ulnar or fibular side of the hand or foot. Whilst most cases are isolated and involve a single limb, the synchronous occurrence across all four extremities—both hands and both feet—is exceedingly rare. Reports describing such a presentation are notably scarce in the current literature. In this article, we present a unique case of bilateral postaxial type A polydactyly affecting both upper and lower limbs, with a focus on clinical presentation, ideal timing for surgical intervention, and technical considerations to achieve optimal aesthetic and functional outcomes. Methods: We report the case of a 10-month-old male with symmetrical postaxial type B polydactyly on all four extremities, treated with surgical excision under local anaesthesia using absorbable intradermal sutures. A systematic literature review was also conducted to contextualise this anomaly and current management strategies. Results: Surgical excision was performed without complications. At 1-month follow-up, the patient exhibited satisfactory aesthetic results, no neurovascular compromise, and proper scarring. A review of 57 studies confirms early surgical excision as the preferred approach in type B duplications, with no consensus regarding optimal timing in cases involving multiple limbs. Conclusion: Although postaxial type A polydactyly is commonly observed in the upper limbs, its presence in all four extremities is rare. Early outpatient excision ensures excellent cosmetic and functional outcomes, particularly when performed by trained paediatric surgeons or hand specialists. Accurate phenotypic classification is essential for guiding treatment and informing recurrence risk.

Keywords: postaxial polydactyly, type A, four-limb duplication, congenital anomalies, surgical excision, hand surgery, case report.

INTRODUCTION

Polydactyly, defined as the presence of supernumerary digits, is one of the most common congenital malformations of the limbs. It is typically classified as preaxial, central or postaxial, according to the location of the extra digit with respect to the axis of the hand or the foot. Among these, postaxial polydactyly (PAP), also known as ulnar or fibular polydactyly, is more prevalent in certain ethnic groups and is sub classified into type A (well-formed digits) and type B (pedunculated or rudimentary appendages), based on morphological characteristics [1,2].

PAP type B is usually an isolated anomaly that typically affects the upper limbs. Bilateral involvement of hands and feet is extremely rare and scarcely documented in the literature. Whilst type A often requires complex reconstructive techniques, type B is susceptible to simple excision in an outpatient setting. Nonetheless, controversy persists regarding the optimal timing, anaesthesia and surgical technique, particularly in patients with multiple involvement [3–5].

This report presents an exceptional case of postaxial polydactyly type A in all four extremities, accompanied by a focused review of the literature, with the aim of clarifying the current standards of management and highlighting the importance of early and minimally invasive surgical intervention.

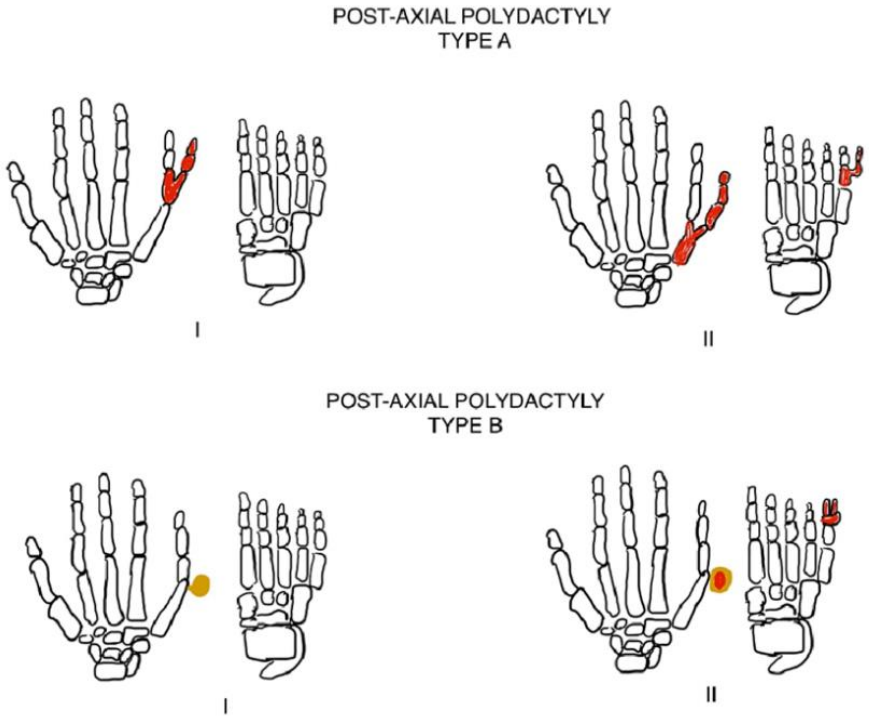

Figure 1: The image illustrates post-axial polydactyly types A and B, subdivided into types I and II. Type A shows a developed accessory digit with a joint, while type B depicts a rudimentary, non-jointed digit.

CLINICAL CASE

A 10-month-old male infant was referred to our plastic surgery unit presenting with bilateral postaxial duplications in both hands and feet. The appendages were symmetrical, pedunculated, and included well-formed bony structures and fully developed nail plates, consistent with type A morphology according to the Temtamy-McKusick classification [6]. (figure1) There was no significant prenatal history, nor any known exposure to teratogenic agents. Family history revealed similar congenital anomalies present in two siblings as well as in the father.

A thorough clinical evaluation excluded any signs of associated syndromes or systemic malformations. Radiographic imaging demonstrated ulnar polydactyly with supernumerary digits and metacarpal bones affecting all four extremities. In the operating theatre, under sedation and local anaesthesia, excision of the rudimentary digits was performed using electrocautery. Wound closure was achieved with 4-0 calibre polyglactin 910 intradermal sutures., and skiyn clousure whit 4-0 nylon skin The postoperative recovery was entirely uneventful, with no evidence of infection, haematoma formation, or neurovascular compromise. At the one-month follow-up, both functional and aesthetic outcomes were deemed excellent, and the parents reported a high degree of satisfaction with the results.

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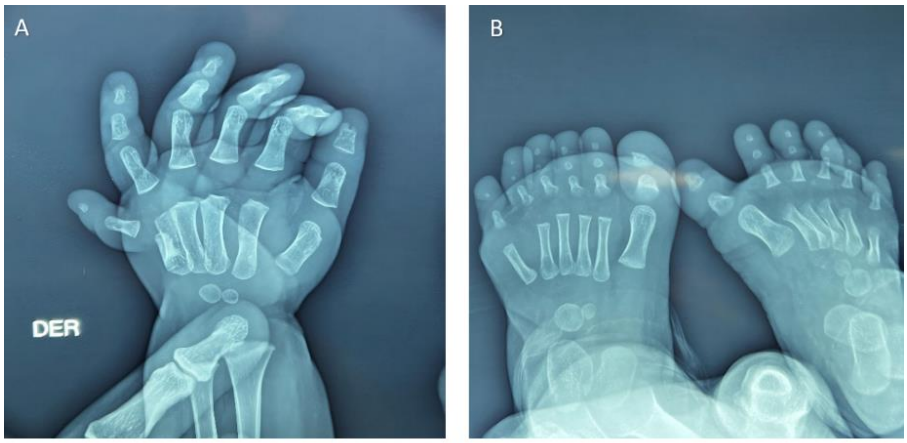
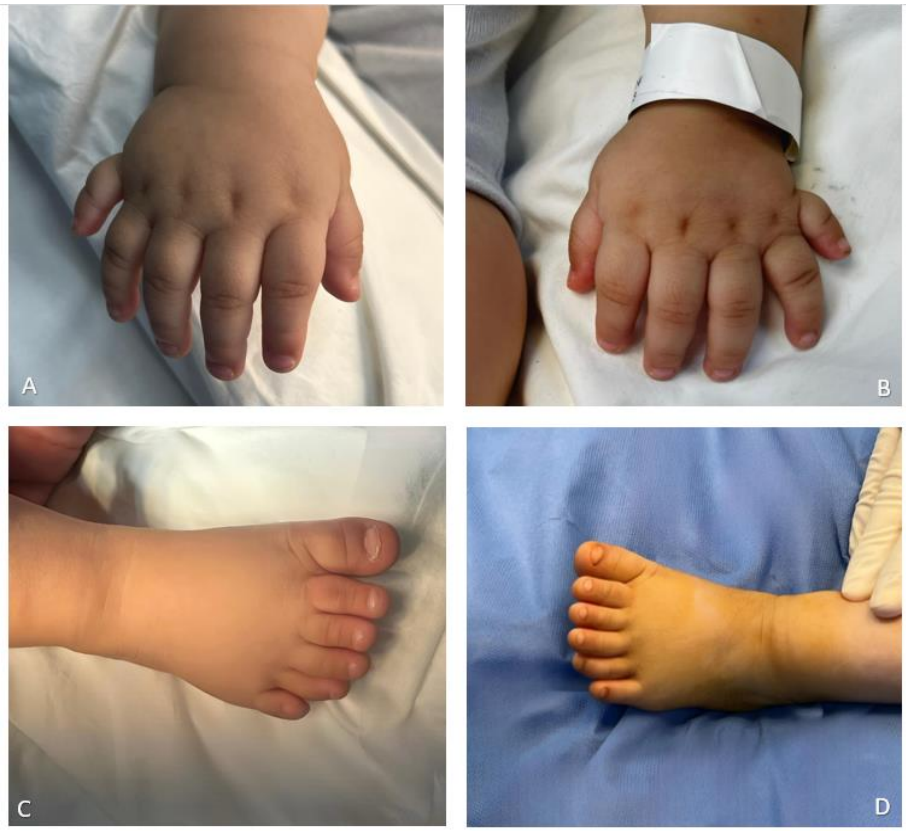
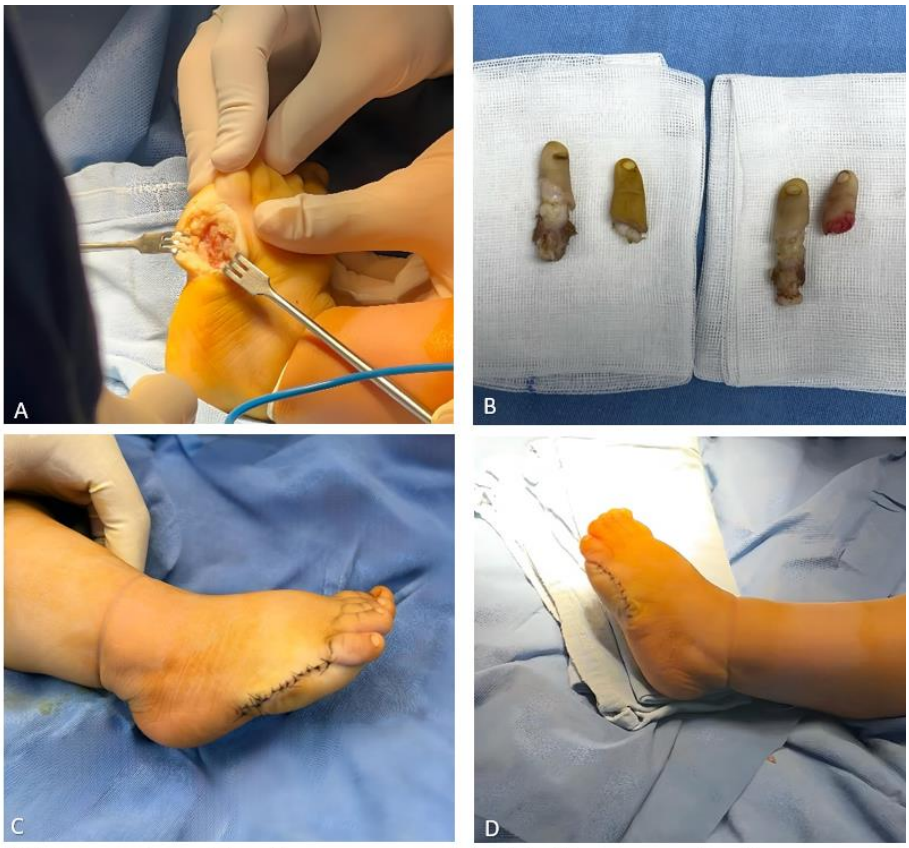


A) *Palmar X-ray of the right hand shows postaxial polydactyly type A with a fully formed extra digit articulating with the fifth metacarpal.*
B) *Dorsal X-rays of both feet demonstrate bilateral postaxial polydactyly type A, with well-developed supernumerary lateral toes and distinct bony structures.*



(A, B) Unusual bilateral hand postaxial polydactyly type A, displaying a fully formed extra digit articulating beside the fifth finger.
(C, D) Bilateral foot images reveal postaxial polydactyly type A, with complete supernumerary toes lateral to the fifth toes, preserving normal skin integrity and alignment.



A) Intraoperative excision of supernumerary digit. B) Striking presentation of supernumerary digits on all four limbs. C) Right foot following meticulous excision and primary skin closure. D) Postoperative appearance of the left foot, demonstrating restored anatomy.

EPIDEMIOLOGY AND GENETIC CONSIDERATIONS

Postaxial polydactyly exhibits notable racial and geographical variability. Type B occurs more frequently among individuals of African descent, with an incidence of up to 1 in 100 live births, whereas in Caucasian populations it is estimated at approximately 1 in 1,500 [7]. The condition commonly follows an autosomal dominant inheritance pattern with variable penetrance, although sporadic cases are also observed [9]. This case underscores the relevance of detailed phenotypic classification and thorough clinical assessment to exclude syndromic associations, such as Ellis-van Creveld, Bardet-Biedl, and Meckel-Gruber syndromes, particularly in patients presenting with bilateral involvement or atypical patterns of manifestation [10].

TIMING OF SURGERY AND TECHNIQUE

Although suture ligation during the neonatal period has historically been employed for type B postaxial polydactyly, recent literature urges caution due to potential complications such as residual neuroma formation, incomplete excision, and poor aesthetic outcomes [11,12]. As demonstrated in this case, excision utilising electrocautery under local anaesthesia in an outpatient setting represents a safe and effective alternative. The surgical management of postaxial polydactyly has been documented in outpatient environments, where the use of local anaesthesia and the omission of anaesthetic personnel, hospital pharmacy resources, and formal operative theatre time allow for significant cost savings. The procedure typically lasts between 7 and 11 minutes and is regarded as minimally traumatic from a psychological

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perspective, permitting parental presence and the use of distraction techniques. This outpatient model constitutes a paradigm shift that is replicable, particularly within high-volume or resource-limited paediatric surgical systems [18]. Absorbable intradermal sutures offer the advantage of minimising visible scarring and reducing parental anxiety associated with suture removal. Surgery between 4 and 6 months of age is recommended by several authors, as it balances tissue maturity and anaesthetic safety while simultaneously preventing the psychological impact of visible deformity during early developmental stages [13,14].

LITERATURE REVIEW

A focused literature review identified 17 relevant case series and 40 retrospective studies published between 2000 and 2024, all centred on the management of both type A and type B postaxial polydactyly. The vast majority support early surgical excision as the gold standard in uncommon cases. Nevertheless, documentation of cases involving all four extremities remains anecdotal, with only isolated reports available in the current medical literature [3,5,15–17].

Polydactyly represents one of the most frequent congenital anomalies of the hand and foot, characterised by considerable phenotypic variability and genetic heterogeneity. Preaxial polydactyly is the duplication on the thumb side of the hand or great toe side of the foot, whereas postaxial polydactyly is the duplication on the little finger side of the hand or little toe side of the foot. While type B duplications are typically small, pedunculated appendages without bone, type A duplication (figure 2) — as in the present case — comprise well-formed osseous structures, joints, and nail complexes, thus requiring more intricate surgical planning and reconstruction [1,2,3,6].

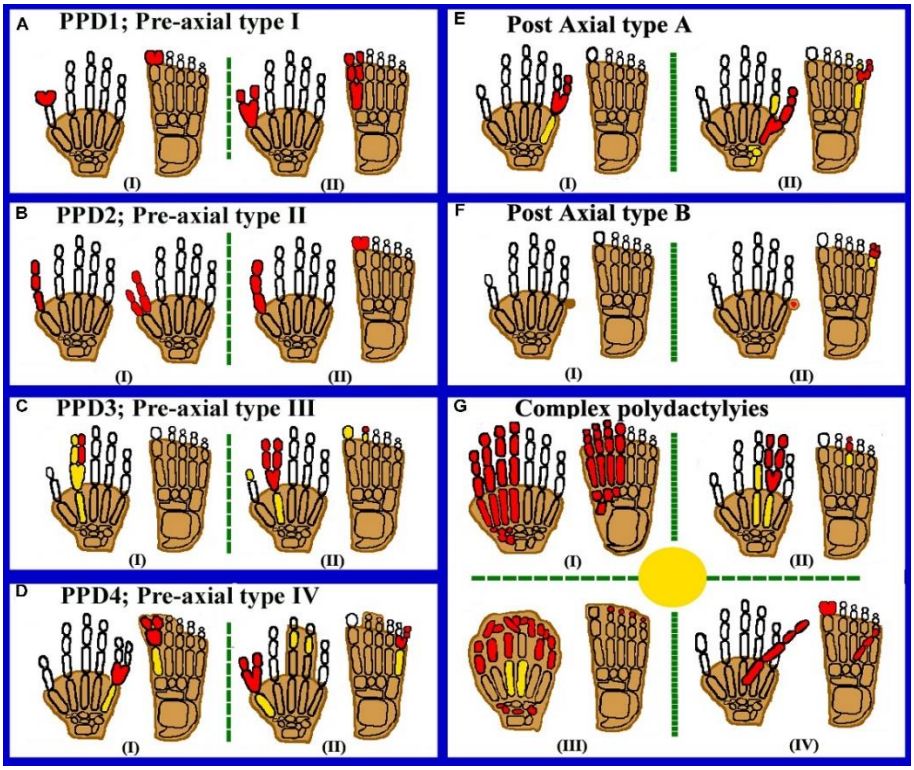

Figure 2: Illustration showcasing the differences between preaxial and postaxial polydactyly subtypes, including both type A and B variants, and highlighting complex cases with full osseous and joint duplication

Epidemiologically, postaxial polydactyly demonstrates striking racial and geographic differences, with type B being notably more common among individuals of African descent, where prevalence reaches up to 1 in 100 live births, compared with 1 in 1500 in Caucasian populations [7]. Autosomal dominant inheritance with variable expressivity and penetrance is well documented, although sporadic cases are not uncommon [8,9]. Studies by Biesecker [9] and others have contributed significantly to the identification of multiple genetic loci involved, including GLI3 and ZRS regulatory regions, which play crucial roles in limb development. However, specific associations with simultaneous four-limb involvement remain elusive, underscoring the need for ongoing molecular research [9,16].

From a surgical perspective, several studies have reported the outcomes of various techniques for managing postaxial polydactyly. Traditional ligation has been criticised due to the risk of neuroma formation, incomplete removal, and poor cosmetic results [10,11]. Modern practice increasingly favours precise surgical excision under local anaesthesia, even in neonates and infants, given the short operative times and the procedure's minimal psychological trauma [3,5,12,17]. Recent reports highlight that the average duration of surgery ranges between 7 and 11 minutes, and office-based excision has been successfully implemented in many centres, yielding excellent functional and aesthetic outcomes [5,17].

Furthermore, the use of absorbable intradermal sutures has been advocated to minimise visible scarring and avoid parental anxiety related to suture removal . Optimal timing for surgery remains debated; however, many authors suggest intervention between four and six months of age to balance tissue maturity with anaesthetic safety and to mitigate the psychosocial consequences of visible deformities during early development [13,14]. The benefits of early intervention include improved scar quality and prevention of abnormal gait or hand function development in polydactyly of the feet and hands, respectively [13].

Despite this substantial body of research, reports detailing polydactyly affecting all four extremities, especially involving type A morphology, remain exceedingly rare and largely anecdotal [1,9,16]. This highlights a significant gap in the evidence base and calls for further multicentre studies to standardise surgical protocols and to evaluate long-term functional and psychosocial outcomes [16,17].

In summary, current literature underscores early, precise surgical intervention as the cornerstone of postaxial polydactyly management, while simultaneously recognising the importance of individualised treatment plans, particularly in rare presentations involving multiple limbs. The scarcity of comprehensive reports addressing four-limb involvement necessitates continued research to establish evidence-based guidelines and to ensure optimal outcomes for affected patients and their families [1–17].

COMPARATIVE SURGICAL MANAGEMENT OF POLYDACTYLY

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ASPECT	POSTAXIAL TYPE A	POSTAXIAL TYPE B	PREAXIAL (THUMB) POLYDACTYLY	CENTRAL POLYDACTYLY	REFERENCES
DEFINITION	Fully developed extra digit with bone, joints, tendons, and nail.	Soft tissue nubbin, usually pedunculated, without bony structures.	Duplication of thumb rays; may involve soft tissue, bone, joints, tendons.	Duplication of central digits (index, middle, ring); rare and complex.	Malik [1], Kozin, Tonkin [12]
TIMING OF SURGERY	Typically at 6–12 months to allow optimal bone remodelling and functional outcome.	Neonatal period if ligation is chosen; surgical excision often delayed to around 6 months to reduce neuroma risk.	Recommended at 6–12 months for joint development and tendon balancing.	Frequently delayed until 1–2 years due to surgical complexity.	Kozin [2], Goldfarb [3], Dijkman [5]
SURGICAL TECHNIQUE	Formal ray resection with osteotomy and soft-tissue balancing.	Simple excision is preferred over ligation to reduce neuroma risk.	Modified Bilhaut–Cloquet procedure, ray resection, or reconstruction, depending on Wassel type.	Complex osteotomies, tendon balancing, and soft-tissue reconstruction.	Goldfarb [3], Tonkin [12], Al-Qattan [15]
ANAESTHESIA SETTING	Performed in theatre under general anaesthesia.	May be office-based under local anaesthesia for minor excision or ligation; otherwise performed in theatre.	Carried out in theatre under general anaesthesia.	Conducted in theatre under general anaesthesia.	Kozin [2], Goldfarb [3], Lonie [17]
NEUROMA RISK	Low if nerves are carefully managed during resection.	Higher risk after simple ligation; surgical excision lowers neuroma risk.	Low risk if meticulous dissection is performed.	Generally low, though dependent on surgical complexity.	Ogino [10], Goldfarb [3], Al-Qattan [15]
AESTHETIC OUTCOME	Generally excellent, maintaining symmetrical hand contour.	Excellent if properly excised; ligation may leave residual nubbin or scar.	Good outcomes, although risk of thumb narrowing exists with Bilhaut–Cloquet procedure.	Variable; often less satisfactory due to surgical complexity.	Tonkin [12], Goldfarb [3], Lonie [17]
FUNCTIONAL OUTCOME	Typically excellent, particularly when non-dominant digits are involved.	Excellent functional results; cosmetic concerns may persist if a residual stump remains.	Good function is achievable; precise joint alignment is critical.	May result in stiffness, scarring, or growth disturbances.	Kozin [2], Tonkin [12], Goldfarb [3]
CONSIDERATIONS	Important to assess for potential syndromic associations.	Parental counselling essential regarding neuroma risks and aesthetic outcomes.	Requires detailed preoperative classification, e.g. Wassel types.	Rare; often syndromic; requires comprehensive preoperative planning.	Malik [1], Goldfarb [3], Marangi [16]

CONCLUSIONS

This case of type A postaxial polydactyly affecting all four limbs represents an exceptionally rare but surgically manageable congenital anomaly, with reports in the literature remaining scarce [9,16]. Surgical excision using electrocautery and absorbable sutures during early infancy has been shown to provide excellent functional and aesthetic outcomes while significantly reducing complications associated with traditional methods such as suture ligation, which have been linked to neuroma formation, incomplete excision, and suboptimal cosmetic results [10].

Current evidence supports early surgical intervention, ideally between four and six months of age, to optimise wound healing, minimise psychological impact, and prevent future functional impairment [5,12,13]. However, simultaneous involvement of all four extremities raises important questions regarding potential underlying genetic mechanisms that remain incompletely elucidated, highlighting the need for further molecular and clinical research [16]. Given the rarity of this condition and the lack of large case series addressing multi-limb involvement, multicentre studies are warranted to establish standardised management protocols and to evaluate long-term functional, aesthetic, and psychosocial outcomes [5,16]. Such efforts will be critical to ensuring safe, efficient, and individualised surgical care for patients with complex phenotypic presentations.

Conflict of Interests

There is no conflict of interest to disclose.

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