

# Wassel VI Duplications: A Report of 2 Cases, Soft-tissue Anatomy, and Reconstructive Approach

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**Summary:** Preaxial polydactyly represents an embryologic failure of formation and differentiation that is most commonly classified according to the level of bony duplication. The soft-tissue anatomy and approach to reconstruction of a Wassel VI thumb, an uncommon variant in which complete duplication begins at the metacarpals has not been extensively discussed in the literature. Here, we present 2 patients with a Wassel VI duplication and a shared soft-tissue variant of anomalous insertion of the opponens pollicis muscle onto the radial hypoplastic digit. A critical component of thenar reconstruction involves preservation and reinsertion of the opponens muscle into the dominant and preserved metacarpal. (*Plast Reconstr Surg Glob Open* 2018;6:e1996; doi: 10.1097/GOX.0000000000001996; Published online 5 November 2018.)

**P**reaxial polydactyly, or thumb duplication, represents a failure of formation and differentiation along the radial/ulnar axis of the hand from abnormal signaling in the zone of polarizing activity of the limb bud. The congenital anomaly, which occurs 1 in 1,000 to 1 in 10,000 births predominantly in the Caucasian population, presents in many skeletal forms most commonly described according to the Wassel classification.<sup>1-3</sup> Type IV, followed by type II are the most common variants, and numerous studies have reported on approaches to their surgical reconstruction, such as the Bilhaut-Cloquet procedure.<sup>4,5</sup>

Few articles have reported on the incidence of the Wassel VI thumb, in which duplication extends proximal to the first metacarpal. Studies that evaluate Wassel VI thumbs tend to report overall surgical outcomes such as growth and aesthetic appearance, with decreased quality seen in Wassel VI and VII classifications.<sup>6,7</sup> Additionally, operative techniques are often broadly descriptive for all forms of duplication rather than specific to the Wassel VI.<sup>8</sup> Shen et al.<sup>9</sup> described a surgical technique for Wassel VI duplications; however, they focused on complex bony

reconstruction without addressing soft-tissue reconstructive elements. To our knowledge, there are no studies describing the critical surgical techniques for soft-tissue reconstruction in Wassel VI duplications. In this report, we present 2 patients with Wassel VI duplications of the thumb, the anomalous soft-tissue anatomy, and our approach to reconstruction.

## CASE REPORTS

### Case I

A 7-month-old boy presented to our clinic with right-sided thumb duplication requesting reconstruction. He was born full term after an uncomplicated pregnancy and delivery and had normal development for age. Clinical examination revealed a fully developed ulnar first digit and shorter more hypoplastic radial digit. Given his age, independent function of each digit could not be completely assessed. Plain radiographs revealed appropriate ossification for age and a Wassel type VI duplication (Fig. 1). Given a clear nondominant radial thumb, decision was made to ablate the radial and reconstruct the ulnar first digit.

A curvilinear shaped incision was made over the dorsum of the first metacarpals and carried down to expose the radial metacarpal. A muscular attachment, suspected to be the opponens pollicis (OP), could be seen attached to the volar metacarpal surface (Fig. 2). The OP was elevated and the nondominant digit was resected at the

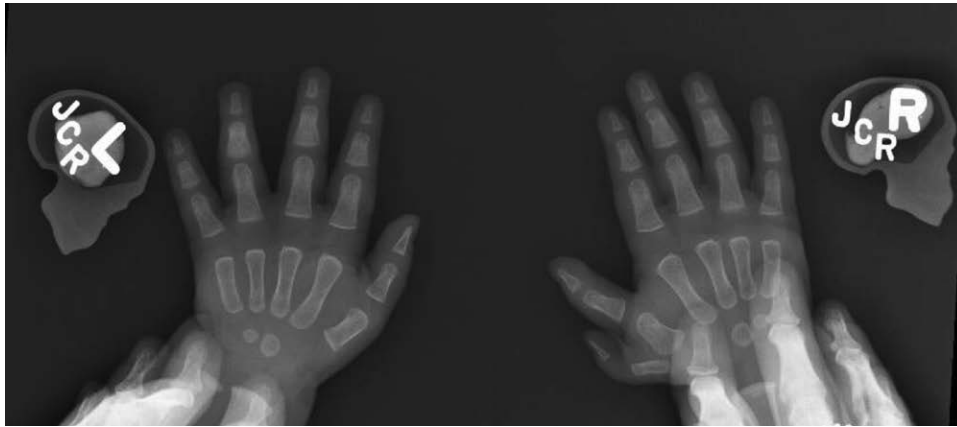
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**Fig. 1.** Preoperative plain radiographs of case I showing Wassel VI of the right thumb and normal left hand anatomy.



**Fig. 2.** Intraoperative image of case I demonstrating exposure of the radial metacarpal. The attachment of the opponens pollicis can be seen volarly.



**Fig. 3.** After the hypoplastic digit has been excised, the opponens pollicis has been reinserted into the radial aspect of the ulnar metacarpal.

carpometacarpal junction. The OP was reinserted into the periosteum on the radial aspect of the remaining metacarpal and the skin was closed with absorbable sutures (Fig. 3). The patient was placed in a long arm cast for 2 weeks and then allowed free range of motion with age appropriate activity.

**Case II**

The second patient was a 23-month old boy, born full term after an uncomplicated pregnancy and delivery, presenting with bilateral thumb duplication. Clinically, the patient had normal development with suspected right

hand dominance. Plain radiographs revealed a left Wassel IV duplication with a dominant radial thumb, and a right Wassel VI duplication with a dominant ulnar digit. Due to suspected hand dominance, reconstruction of the right thumb duplication was performed first.

Similar to the first case, a curvilinear shaped incision was made over the dorsal aspect of the first metacarpals and carried down to expose the radial metacarpal. An attenuated but distinct extensor pollicis tendon was transected proximally. The OP was again reflected off the volar metacarpal surface. The nondominant digit was resected at the carpometacarpal joint. There was also a



**Fig. 4.** Six-week postoperative views of case I showing the volar hand and contour of the thenar eminence.

distinct flexor tendon that was resected volarly. As in the first case, the OP was reinserted into the periosteum of the dominant metacarpal and the skin was closed with absorbable suture.

## DISCUSSION

Studies describing surgical approaches to preaxial polydactyly most often focus on the common variants, namely the Wassel IV and Wassel II forms. However, the incidence and best approach to less common variants are not as well reported in the literature. Shen et al.<sup>9</sup> recently described a surgical technique for Wassel VI reconstruction in patients with triphalangeal thumb. Given the even more unusual and complex variant—a combination of Wassel VI and Wassel VII subtypes—the authors focused on bony reconstruction and did not provide a description of soft-tissue anatomy or reconstruction.<sup>8</sup> In this article, we add to the literature by presenting 2 patients with a Wassel VI thumb duplication and describe our surgical approach to reconstruction particularly of the soft tissue anatomy.

Both patients had dominant ulnar digits and underwent radial digit ablation. Through a curvilinear incision, dissection revealed a consistent anatomical variant in both cases; OP insertion into the more radial and hypoplastic rather than dominant metacarpal. To the best of our knowledge, the incision design and identification and management of this soft-tissue anomaly, particularly the OP metacarpal insertion, has not been previously described in reports of Wassel VI duplications. We found that the critical component to the reconstruction involved preserving the OP and reinserting it into the dominant metacarpal to recreate bulk and function of the thenar eminence (Figs. 3, 4). The

presence of a flexor or extensor pollicis longus in the hypoplastic digit was inconsistent, but should be considered and appropriately resected. The curvilinear incision used in both cases gives ample exposure for identifying extensors abnormalities, volar access to flexor tendons and neurovascular structures, and allows for a cosmetic wound closure.

The presence of aberrant thenar musculature in a Wassel VI thumb is consistent with a study by Saito et al.<sup>10</sup> who demonstrated progressive thenar muscle dysplasia with more proximal bifurcation in radial polydactyly. They hypothesized that an osseous bifurcation limits longitudinal muscle development, which was observed in abductor pollicis brevis and flexor pollicis brevis muscles. In our patients, we did not observe anomalous abductor pollicis brevis or flexor pollicis brevis anatomy, and the aberrant insertion of OP into the radial duplication was a unique finding.

Goldfarb et al.<sup>7</sup> evaluated 31 thumbs after preaxial polydactyly reconstruction. At almost 4 years postoperatively, Wassel VI and VII subtypes were significantly smaller and have worse aesthetic outcomes according to visual analog scale assessment by surgeons, psychologists, and caretakers.<sup>6</sup> The description of soft-tissue reconstruction, particularly the incisional approach and OP insertion, may assist surgeons in understanding the relationship between soft tissue and bony structures in Wassel VI duplications and guide restoration of normal anatomy with improvement of aesthetic outcomes.

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