

Reconstruction of The Hand in Congenital Polydactyly

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1. Abstract

A new method of surgical treatment of polydactyly of the hand, the most common pathology among congenital malformations of the upper limb, is proposed. Reconstruction of insufficiently functional and poor appearance of a thumb was performed in a child aged 1.5 years. A feature of the operation was the conscious use of the tissues of the removed accessory toe to form a new thumb. As a result of the treatment, an effective function and a good aesthetic appearance of the child's hand were obtained.

2. Introduction

Polydactyly is a congenital malformation of the hand, when instead of one there are two first fingers, limiting the function and violating the cosmetics of the child's hand. Usually it follows an autosomal dominant mode of inheritance and many teratogenic factors are involved in its occurrence [1,5, 8, 22]. To clarify the spectrum of genetic variations and genotype-phenotype correlation in patients with polydactyly, a number of scientists conducted a comprehensive genetic analysis of patients using targeted sequencing [24]. They found that pathogenic or likely pathogenic variants were identified in 10 genes, providing a positive molecular diagnosis of 7.7%.

Other researchers believe that there are many syndromes associated with ulnar polydactyly [2]. However, genetic defects in these syndromes result in an imbalance between the two forms of the protein, which are known as Gli3-A and Gli3-R.

Polydactyly has the highest incidence among congenital limb defects and has many different classifications that approach the heterogeneity of polydactyly in different ways [7,14,15,18].

The allocated postaxial, preaxial, or central forms depend on the radioulnar location of the doubled fingers. Postaxial polydactyly occurs most often, with the radially located finger completely ex-

cised, followed by suturing the skin [6].

Correction of the defect is also carried out by amputation of a less functional finger or by Bilhaut-type surgery - a longitudinal intermediate resection of each of them, followed by alignment of the halves and thus forming a full-fledged first finger. [21,10,3,4, 9, 11-13, 16, 17,19, 23].

The disadvantage of the first method is the amputation of the first toe, parts of which can be used in its reconstruction. Another method is technically difficult, especially if the functional finger is located in the first interdigital space, then it cannot be connected to the half of the other. In other words, the operation is technically excluded or is associated with prolonged healing and a possible unsatisfactory final result. A common disadvantage of the considered surgical operations is that the reconstruction of the first toe does not satisfy the necessary functional and aesthetic needs.

We proposed the reconstruction of 1 toe, performed using the tissues of the removed accessory toe and regardless of the location of the more functional one. Its ultimate goal was to obtain an effective function and aesthetic appearance [19].

3. Material and Methods

Reconstruction of 1 toe was performed on a 1.5-year-old child (Figure 1, a-b).

Initially, through a figured incision in the lateral surface area of little functional and supposed to be removed "radial" accessory finger, access to the bone fragments of its phalanges was performed, which were completely removed (Figure 2, a-b).

Then transposition of the “ulnar” accessory finger was performed, the bone fragments of which were located above the level of the distal part of the first metacarpal bone and fixed to it by means of an axial wire until the bone fragments were completely fused (Figure 3).

The reconstructed thumb was additionally formed from the soft tissues of the removed little-functional "radial" finger, thereby providing a functional and aesthetic result of the treatment (**Figure 4, a-b**).

The effectiveness of the proposed method of reconstruction of 1 finger in congenital polydactyly lies in the availability of the treatment stages, obtaining sufficient gripping force for the reconstructed finger of the hand for self-service, its adequate anatomical location and a good aesthetic result.



Figure 1: Hand of a child 1.5 years old with congenital polydactyly before surgery (a). Radiograph of the same hand (b): the little functional external accessory finger to be removed and the more functional internal one located in the interdigital space

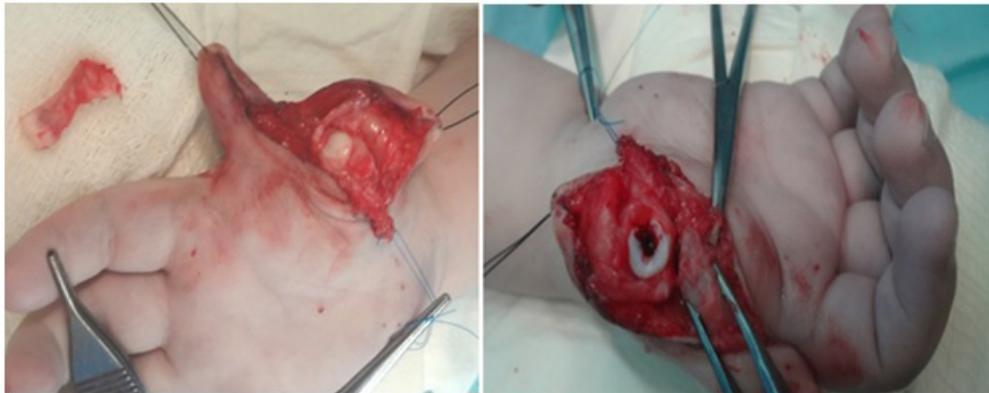


Figure 2: Details of the operation - reconstruction of the thumb with its polydactyly: excision of the rudimentary bone formations of the little functional outer thumb while preserving its skin (a-b).



Figure 3: Transposition of bone fragments of a more functional accessory finger to the distal metacarpal bone with fixation with an axial pin: an X-ray showing the bone rudiments of a movable finger located in the projection of the first metacarpal bone and fixed with an axial pin.



Figure 4: View of the hand and the formed first finger after surgery (a-b).

3. Results and Discussion

The technical result of the task was achieved by the fact that in order to form a full-fledged first finger, we excised bone fragments of a little functional accessory finger and preserved its nourishing skin. Then, a more functional finger was transposed to the distal part of the first metacarpal bone with fixation with an axial wire. At the same time, its volumetric dimensions were increased to normal due to plastic surgery with the preserved skin of the removed little functional accessory toe.

4. Conclusion

The method of reconstruction of the hand in congenital polydactyly differed from the known ones in that when removing a little functional accessory finger, its skin was specially preserved. After transposition and fixation of the bony part of the accessory toe on the distal part of the new first ray, the skin was used to form its full volumetric dimensions, which ultimately ensured good hand function and its appearance.

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