A 10-year experience with the surgical treatment of radial polydactyly

Ann. Ital. Chir., 2008; 79: 441-444

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A 10-year experience with the surgical treatment of radial polydactyly

PURPOSE: *Authors' clinical and surgical experience in correction of the radial polydactyly in its various degrees of severity is presented.*
MATERIAL AND METHODS: *Nineteen patients were operated due to thumb duplication in a 10-year period from 1996 to 2006. The cases were classified according to Wassel 7-type classification. The surgical techniques adopted were the Bilhaut-Cloquet and the method of exclusion of the more hypoplasic thumb with preservation of the more functional and aesthetic one.*
RESULTS: *In 95% of the cases, the performed procedures meant to sacrifice the finger that was more hypoplastic and to preserve the more functional and aesthetic finger. The Bilhaut-Cloquet procedure was utilized only in one case.*
DISCUSSION: *A correct preoperative evaluation has to be performed in order to assess the osseo-muscular, articular and neurovascular properties of the duplicated fingers. The type of the deformity, type of the selected treatment procedure, and the surgical experience of the surgeon are factors contributing to the high satisfaction rate after surgery.*

KEY WORDS: Radial polydactyly, Thumb duplication.

Introduction

Radial polydactyly is a delicate issue in paediatric surgery with not only aesthetic implications, but also, above all, a functional concern. In the 8th week of intrauterine life, division of fingers occurs and the thumb detaches from the other fingers. This congenital deformity can have a genetic or a teratogenic, environmental origin. In the first case it appears at conception, in the second case between the 25th and the 50th day of intrauterine life[1,2]. Thumb duplication is the most common congenital anomaly in the upper extremity[3]. The polydactyly of the thumb occurs in many forms and makes part of a variety of syndromes. Occasionally it is consists of only fleshy nubbins on radial border, and it could range from varying degrees of mere splitting to completely duplicated thumb. Isolated polydactyly is often an autosomal dominant or occasionally random disease, while syndrome polydactyly is commonly an autosomal recessive disease[4]. Triplication of the thumb has been reported[5]. When Wassel in 1969 introduced the classification adopted until now, this cleared many issues in the field[6] (Fig. 1). Reconstruction of radial polydactyly depends on the size and quality of each of the thumbs[7]. Authors intend to analyse this pathology focusing on the surgical treatment, resulting in a functional and an aesthetically acceptable result.

Patients and methods

Nineteen paediatric patients with diagnosis of thumb duplication, who have been treated in two different services were studied perspectively from 1996 to 2006. The majority of the patients consisted of males (68.5%) (Fig. 2). Patients' age was between 5 months and 8 years; 73.7% of cases were children aged between one and three years, 15.8% were under one year and 10.5% were older than three years (Fig. 3).
The surgical correction varied according to the Wassel type. In Type I, where thumbs are usually of the same

Pervenuto in Redazione Luglio 2008. Accettato per la pubblicazione Ottobre 2008.
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ACKNOWKEDGEMENTS: *Authors are very grateful to "Ordine dei Medici di Bologna" for the Scholarship granted to Filippo Boriani.*

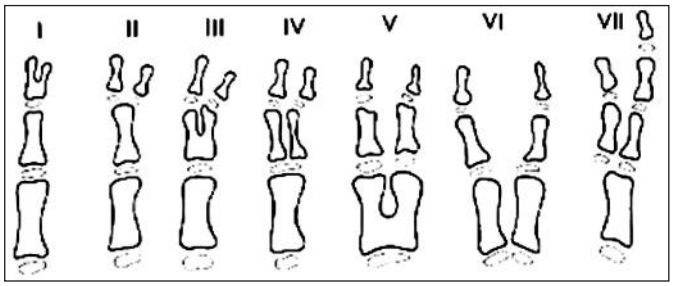

Fig. 1: Wassel classification I-VII.

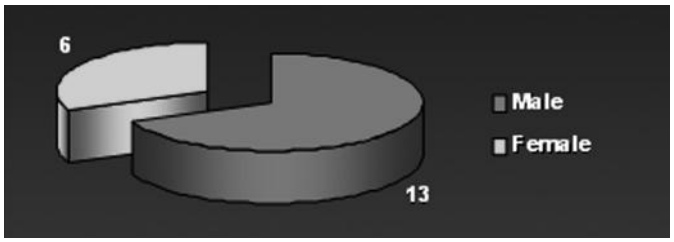

Fig. 2: Sex distribution of the patients.

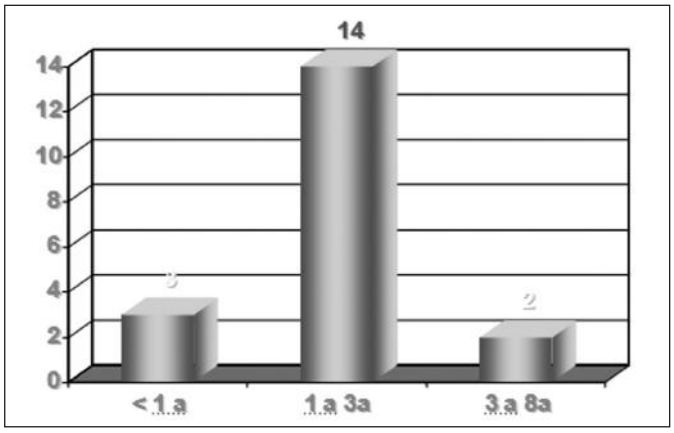

Fig. 3: Age distribution of the patients.

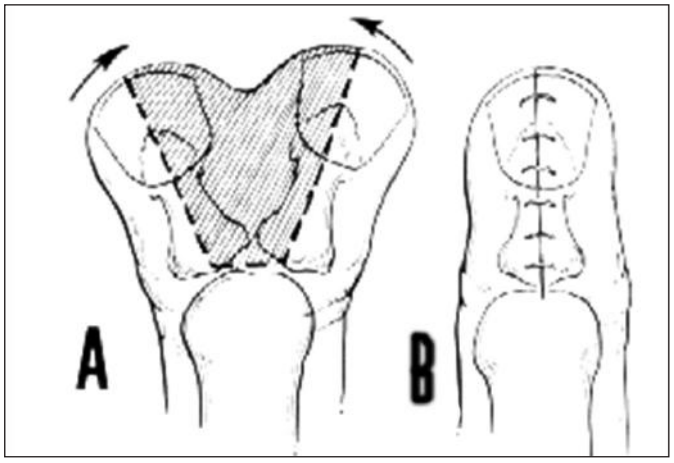

Fig. 4: *a)* Schematic view of the Bilhaut-Cloquet procedure; *b)* Schematic view of the postoperative result.

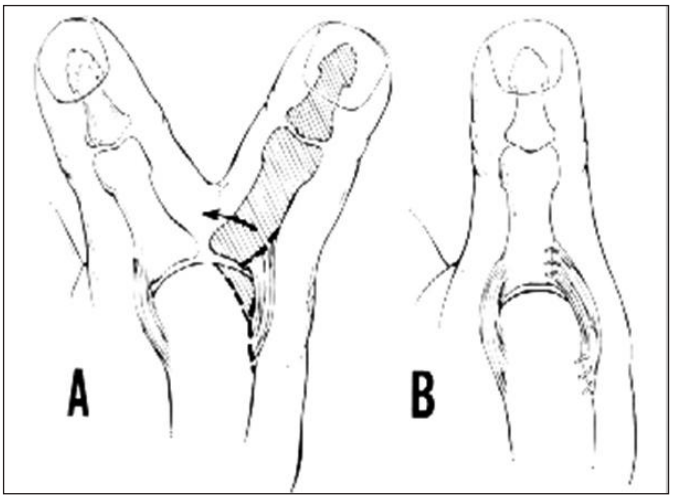

Fig. 5: Exclusion of the more hypoplastic thumb (Types III-VI).

length, the Bilhaut-Cloquet (Fig. 4) separation procedure can be performed. It is based on the excision of the excess of the skin, nail and the bone from the middle part of the duplicated thumb. The difficulties associated with this procedure are the residual nail deformity and the unintentional epiphyseodeses, which can be avoided by excision of the nail from one of the two thumbs. In type II, the size, deviation, function and passive mobilization can render the choice easy. Nevertheless when the two thumbs are similar, the choice can be made according to the tendon and nerve anatomy. It is essential to analyse the insertions of flexor and extensor tendons, and to test the force of collateral ligaments. The Bilhaut-Cloquet separation procedure can be performed. In Type III, the surgeon can be completely impartial with regard to the thumb to be resected depending on aesthetic-functional evaluation. Of primary importance are the reinsertion of the collateral ligament in the incision side and the regularization of the bifid proximal phalanx. In Type IV, the most common, the ulnar thumb has to be preferred, as this avoids the reconstruction of the ulnar collateral ligament, which is important for the stabilization of the thumb. Exploration and appropriate realignment of the insertions of flexors and extensors, particularly in divergent-convergent polydactyly, is an essential task. Regularization of metacarpal diaphysis and head, and excision of the duplicated head are important surgical steps in order to eliminate an unacceptable postoperative result. Moreover the preservation of the ligament between the two duplicated proximal phalanxes and the one between the metacarpal and the dismissed phalanx is important for the reconstruction of the collateral ligament. When the first web space is contracted, the skin of the duplicated thumb to be dismissed has to be saved, with a dorsally based flap to be transposed into the defect created by the release (Fig. 5). In Type V the surgical approach is similar to Type IV, with priority in saving the ulnar thumb and reinsertion of the collateral ligament of the metacarpal-pha-

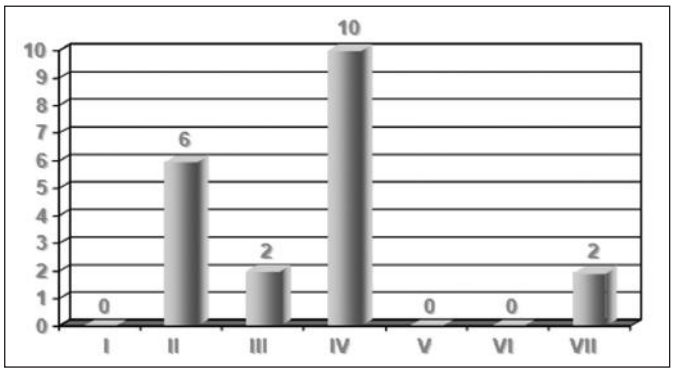

Fig. 6: Patient distribution according to Wassel classification.

langeal radial joint by means of a periosteal-ligamentar flap proximally based on the metacarpus. In Type VI, it is important to preserve the ulnar side, reinsert the radial collateral ligament of the metacarpal-trapezoidal joint and to verify in the ulnar thumb the presence and localization of abductor brevis. In tri-phalagic thumb, a delta phalanx has to be completely excised and the soft tissues have to be reconstructed. If diagnosis is late, arthrodesis of a joint along with cuneiform osteotomy is necessary. A rectangular phalanx is treated through resection and arthrodesis of the distal joint; furthermore it is mandatory to perform an oponensplasty, an enlargement of the first web space and a shortening of the metacarpus.

Results

Patients underwent surgery between 1996 and 2006. With regard to Wassel classification 50% of cases were Type IV, 30% Type II, in 10% of patients the Wassel Type was III and in another 10% the Type was VII. Types I, V and VI were not found (Fig. 6).The Bilhaut-Cloquet procedure was utilized in one case, Wassel Type II (Figg. 7-8). In the rest, the performed procedures meant to sacrifice the finger that was more hypoplasic and to preserve the more functional and aesthetic digit (Figg. 9-10). The collateral ligament repair, reinsertions of the flexor and extensor tendons to the preserved thumb and correctives osteotomies were performed, when necessary. All the surgical interventions were performed by the senior consultant plastic surgeon. The

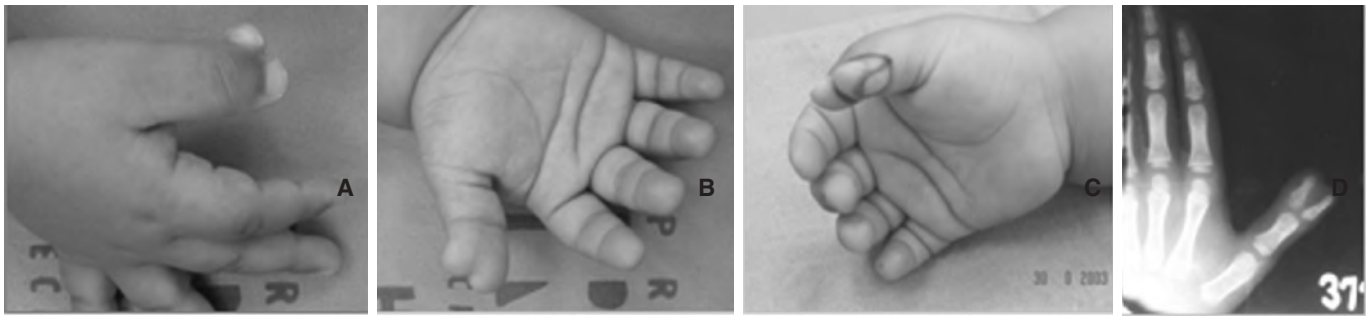

Fig. 7: *a)* Wassel II preoperative dorsal view; *b)* Wassel II preoperative palmar view; *c)* Surgical marking; *d)* Preoperative radiologic view.

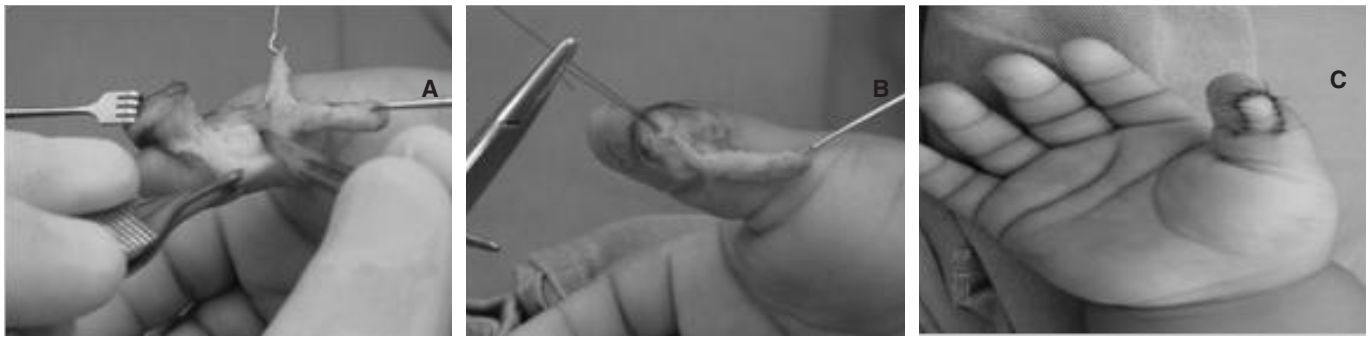

Fig. 8: *a)* Wassel II intraoperative view; *b)* Intraoperative view of the Bilhaut-Cloquet procedure; *c)* Immediate postoperative view.

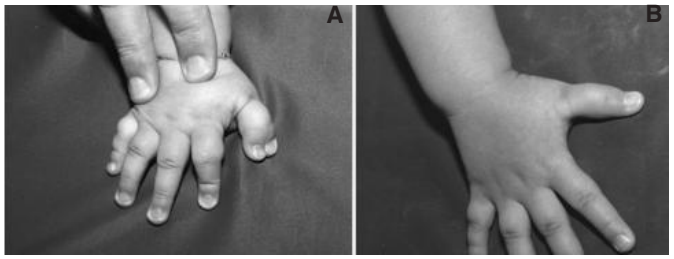

Fig. 9: *a)* Wassel IV preoperative view; *b)* Two year postoperative view.

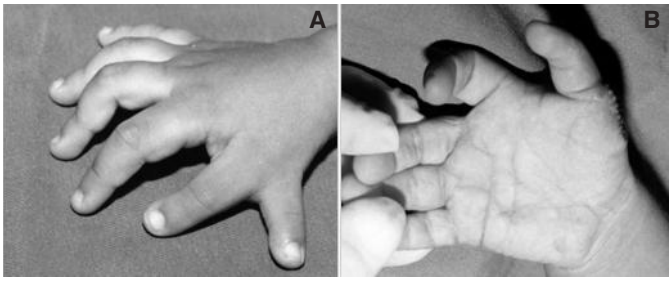

Fig. 10: *a)* Wassel VII preoperative view; *b)* Immediate postoperative view.

follow up ranged between 4 and 10 years. The mean follow up was 6.4 years. All the patients and /or their parents were satisfied. The functional and aesthetic appearance of the thumb was significantly improved compared with the preoperative condition. In 2 cases a re-intervention was necessary: one child needed a terminalisation of metacarpal head (Type VII) and the other one a revision of soft tissue redundancy (Type IV). No post-operative complications were noticed.

Discussion

Thumb duplication is a deformity that is normally brought to physician's attention soon after patients' birth. The surgical intervention should be reserved for after the first year[8]. Fourteen of the patients were operated between one and three years. At this age, a better defined anatomy is observed and the child is still in pre-scholar age. The aim of the treatment is not only to aesthetically correct the deformity but also to preserve the function of the thumb by reconstructing the collateral ligaments, the flexor and extensor tendons and by performing wedge osteotomies. In bilateral cases, the decision of operating the two hands in the same surgical stage will vary according with surgical complexity. In the pre-operative planning, a doubt that could arise is the choice of which finger to exclude. The morphologic appearance has to be taken into account, in the meaning of preserving the finger that is closest to normality and warranting the best functionality, by means of a clinical history collected with parents' help, through a physical examination both passive and active and through the intraoperative observation of the anatomic structures. The aim is to obtain the best result in a single surgical stage, but in some cases, it is more prudent to wait for a second surgical stage for the final adjustment of functionality, i.e. the so called thumb pinch. The temporary articular fixation by K-wires for a period of 3 to 4 weeks was used in our study. Cases of postoperative articular instability, not seen in our study, when diagnosed they have to be surgically re-examined, especially in the ulnar border of metacarpus-phalangeal and interphalangeal joint. The execution of an arthrodeses is absolutely contraindicated, as children are still in growing phase. In case of phalanx delta, two cases in our study, this has to be excised, especially when causing a radial deviation of the interphalangeal joint which impedes the adequate contact between the pulp of the thumb and the other fingers. In our cases we had two re-interventions, one for regularization of the metacarpal head and the other one for revision of soft tissue redundancy. The high rate of satisfaction after surgical intervention of radial polydactyly has been reported previously[9]. Although a high satisfaction rate was observed also in our study, this could be possibly biased, as patients may have felt obliged to express their gratitude to the surgeon. Even though it has been reported that the incidence of unsatisfactory results has been high in Wassel type 3, in the two cases included in our study, the result was satisfactory[10]. All the surgical interventions were performed by the senior surgeon, whose surgical experience contributed to the low complication rate. A correct preoperative evaluation has to be performed in order to assess the osseomuscular, articular and neurovascular properties of the duplicated fingers. By doing so, we can correctly choose and apply to the specific case the most appropriate surgical technique. The type of the deformity, type of procedure, and the skilfulness of the surgeon are factors contributing to the low complication and high satisfaction rate after surgery.

Riassunto

OBIETTIVO: viene presentata l'esperienza clinica e chirurgica degli Autori nella correzione della polidattilia radiale nei suoi vari livelli di gravità.
MATERIALE E METODI: 19 pazienti sono stati operati per duplicazione del pollice nei 10 anni dal 1996 al 2006. I casi sono stati raggruppati in base alla Classificazione a 7 tipi di Wassel. Le tecniche chirurgiche adottate dagli autori sono la tecnica di Bilhaut-Cloquet ed il metodo di esclusione del pollice più ipoplasico con preservazione di quello più funzionale ed estetico.
RISULTATI: nel 95% dei casi l'intervento ha previsto il sacrificio del pollice più ipoplasico e la preservazione del dito più funzionale ed estetico. La tecnica di Bilhaut-Cloquet è stata utilizzata in un unico caso.
DISCUSSIONE: una corretta valutazione preopoeratoria deve essere svolta allo scopo di valutare le proprietà osteo-muscolari, articolari e neurovascolari delle dita duplicate. Il tipo di deformità, il tipo di intervento selezionato e l'esperienza chirurgica del chirurgo sono fattori che contribuiscono all'alto livello di soddisfazione dopo la chirurgia.

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