

Polydactyly: Surgical Strategy and Clinical Experience with 40 Cases

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ABSTRACT

Polydactyly is the most common congenital digital anomaly of the hand and foot. It may appear in isolation or in association with other birth defects. Polydactyly can vary from unnoticeable rudimentary finger or toe to a fully developed extra digit. Surgery on polydactyly is rewarding. Various classification categories can be used as a guide for treatment, although they can't be considered as a prognostic tool to assess post operative results.

Forty patients with 48 polydactyly were operated. The age of patients at the time of operation ranged from one day to 47 years. Twenty-six patients presented with polydactyly of the hand; 15 patients with preaxial, 10 patients with postaxial polydactyly, and one patient presented with central polydactyly (synpolydactyly). Fourteen patients with foot polydactyly; out of which 8 patients with postaxial and 6 patients presented with preaxial foot polydactyly. Four patients had bilateral hand involvement (3 cases type B and one type A ulnar polydactyly), one patient presented with bilateral foot preaxial polydactyly and one patient presented with bilateral polydactyly both hands and feet. More than 82% of the patients were satisfied or very satisfied with functional and cosmetic outcomes. Postoperative complications such as scar hypertrophy, pulp atrophy, painful neuroma, joint deformity and instability were common but minor. The main purpose of this study is to evaluate clinical and cosmetic outcomes of surgical correction of polydactyly of hands and feet, in comparison with other studies.

INTRODUCTION

Polydactyly means the presence of more than the normal number of fingers or toes. It is also called polydactylism, polydactylia or hyperdactyly. It can vary from unnoticeable rudimentary finger or toe to fully developed extra digit. It can occur simultaneously with syndactyly and known as polysyndactyly or synpolydactyly. It can occur as an isolated congenital anomaly or as one aspect of multi-symptom disease or syndrome [1].

Polydactyly is the most common congenital digital anomaly of the hand and foot. Frequency is variable among populations. Hand post axial polydactyly is more frequent (75%) than foot post axial polydactyly (15%) and is less often found

with other anomalies (7% versus 15%). Both hand and foot post axial polydactyly is the least frequent occurrence (10%) [2].

Hand polydactyly:

Thumb polydactyly:

Thumb polydactyly is the most common type of polydactyly in the hand. It is believed to arise from excessive cell proliferation and disturbed cell necrosis of pre-axial ectodermal and mesodermal tissues before the eighth week of embryonic life [3]. It occurs sporadically with an incidence of 8 in 100,000 in both black and white populations [4,5]. Hereditary influence has not been documented in isolated thumb polydactyly, although Ezaki [4] found its association in several syndromes. Autosomal dominance has been reported only in triphalangism and polysyndactyly.

Currently, the Wassel classification [6] is universally accepted to categorize the pathoanatomy of thumb polydactyly and to guide respective surgical procedures. This classification categorizes thumb polydactyly into 7 groups based on the level of duplications; Type I: Bifid distal phalanx (DP), Type II: Duplicated DP, Type III: Bifid proximal phalanx (PP), Type IV: Most common type with duplication of proximal phalanx which rests on broad metacarpal, Type V: bifid metacarpal (MC), Type VI: Duplicated MC and Type VII: Triphalangism.

Operation remains the definitive treatment with a goal to improve cosmesis and possibly hand function [6-8]. Since Bilhaut first described an operation for thumb polydactyly in 1890, different surgical procedures have been reported [9-11]. It is important to evaluate and treat the skin, nail, bone, and the ligaments in a simultaneous manner in order to obtain a good reconstruction and to decrease both the complications and the need for subsequent operations [12].

Ulnar polydactyly:

Postaxial polydactyly involves the fifth digit or ray, either isolate, or more commonly, as one feature of a syndrome of congenital anomalies. Postaxial polydactyly is approximately 10 times more frequent in blacks and is more frequent in male children. In contrast, postaxial polydactyly seen in white children is usually syndromic and associated with autosomal recessive transmission. Post-axial polydactyly in both hands is very rare and along with one foot is even rarer [13].

Temtam and McKusick [14] offered a genetically based classification after noting that parents with Type A polydactyly can have children with either Type A or B ulnar polydactyly, while children of persons with Type B can have only Type B polydactyly. Both types are usually inherited as an autosomal dominant and recent studies have identified the responsible loci on chromosomes 7, 13 and 19 [13], many surgeons have considered this classification too simplistic and prefer using the Stelling classification [15], which is based on the necessary management. This classification did not gain popularity because it does not describe the pedunculated type adequately, which is a major disadvantage since the pedunculated type is the most common in all races. Light [16] recommended using "Universal" classification initially described by Buck-Gramcko and Behrens [17]. The term "Universal" means that the classification may be applied to all forms of polydactyly (little finger, central and thumb polydactyly). More recently, Rayan and Frey (2001) [18] extended the Stelling classification into five types (Table 1).

The options for treatment of postaxial polydactyly depend on the characteristics of the extra digit. If it is rudimentary and pedunculated (type B), its base can be tied with a suture in the newborn period, and it will fall off spontaneously. This procedure sometimes leave a 'residual bump' at the base [19].

Better developed extra digits (type A), especially those containing bone or cartilage, can be corrected with surgery. This procedure is usually done during the first year of life [20].

Central polydactyly:

Central polydactyly is an extra digit within the hand and not along its borders. Central polydactyly is uncommon compared with border polydactyly [21]. The ring digit is the most common duplication, followed by the long finger, and lastly the index digit. Central polydactyly occurs in isolation or is part of a syndrome. The central polydactyly may be hidden within a concomitant syndactyly (i.e., synpolydactyly). Identification of synpolydactyly requires careful

examination supplemented by radiographic verification.

Polydactyly of the foot:

Polydactyly is a fairly common congenital condition of the foot and is characterized by the presence of supernumerary toes. Digital duplications range from boneless soft tissue structures to incomplete or complete bony duplications. Postaxial polydactyly accounts for about 80% of foot polydactyly while preaxial polydactyly accounts for about 15-17% of foot polydactyly cases and central polydactyly accounts for about 3-6% of foot polydactyly cases. The duplication may appear at the distal and middle phalanges or at the whole digit and metatarsal [22].

The classification systems used for foot polydactyly have been primarily based on morphology. Polydactylous manifestations are described according to their anatomical location on the proximal, intermediate, or distal segments of the foot. Temtam and McKusick's [14] classification described polydactyly based on the location of the extra digits : medial ray (preaxial), central ray and lateral ray (postaxial) with the postaxial type A referring to a fully developed digit and type B to a rudimentary digit.

Venn-Watson [22] further subdivided post-axial duplication according to the morphologic presentation of the accessory ray. Four metatarsal patterns were noted: soft-tissue duplication, wide metatarsal head, Y-shaped metatarsal and complete duplication. Blauth and Olason [1] took into consideration the many variable presentations of polydactyly of the foot and hand. The classification was based on the position of duplication on both the longitudinal and transverse plane. The longitudinal nomenclature is based on duplication of a phalanx or ray from distal to proximal. The transverse arrangement of the classification indicates which rays were involved in the duplication. It is classified according to Roman numerals with the first digit starting on the tibial side and increasing laterally. Lastly, Watanabe et al. [23] reported an analysis of 265 cases and a morphological classification by type of ray involvement and level of duplication. The anatomic pattern types in medial ray polydactyly are tarsal, metatarsal, proximal and distal phalangeal. Central ray pattern types are metatarsal, proximal, middle and distal phalangeal. Lateral ray polydactyly was further divided into fifth ray duplication (medial supernumerary toe) and sixth ray duplication (lateral supernumerary toe).

Treatment of foot polydactyly may be indicated for shoe problems, pain or cosmetic reasons. Surgery is generally done before walking age, when the infant is between 9 and 12 months of age. Adult cases are

rarer, and surgical management of the deformity is still debated [24].

PATIENTS AND METHODS

This work included forty patients with forty-eight polydactylies. Twenty-six patients were males and 14 were females and their age at the time of operation ranged from one day to 47 years.

Twenty-six patients presented with polydactyly of the hand; 15 patients with preaxial polydactyly (10 cases type IV, 3 cases type III and 2 cases type VI according to Wassel classification [6]), ten patients with postaxial polydactyly (4 cases type A and 6 cases type B according to Temtamy and McKusick classification [14]) and only one patient presented with central polydactyly with complex syndactyly. Four patients had bilateral hand involvement (3 cases type B and one type A ulnar polydactyly).

Fourteen patients with foot polydactyly; out of which 8 patients presented with postaxial and 6 patients with preaxial foot polydactyly. One patient presented with bilateral foot preaxial polydactyly together with simple complete syndactyly i.e. synpolydactyly, and one patient presented with bilateral polydactyly both hands and feet.

Surgical strategy:

In general, ablation of the extra fingers or toes was the principal surgery. Surgical correction can be done at any age if the anesthesia can be tolerated. For hand polydactyly; earlier treatment gives better result, usually during the first year of life, however, treatment of foot polydactyly is generally done before walking age, between the age of 9 and 12 months.

Hand polydactyly:

Surgical strategy was to remove the hypoplastic or malpositioned finger and to augment thumb reconstruction with tissues borrowed from the accessory digit. If there are two equal digits, we chose to remove the radial digit and reconstruct the radial collateral ligament rather than the ulnar collateral ligament. Duplicated extensor pollicis longus and flexor pollicis longus should be transferred over to the remaining digits. Abductor brevis is transferred along with its periosteum to an anatomic insertion site on the other digit just distal to the epiphysis. Alternatively, the abductor brevis can be transferred over with a small piece of bone (requires a K-wire for fixation). If web space may be contracted, the dorsal skin from the discarded digit should be used to assist with web space deepening. Importantly, in elderly patients, if there's

manifest angulations of the digit, corrective osteotomies should be carried out to regain the normal finger alignment. Chondroplasty is usually performed to trim down the size of the articulating surface in order to restore joint stability, mobility, and axial alignment.

The options for primary treatment of postaxial type B polydactyly include no intervention, string ligation, and surgical amputation. While many cases of ulnar polydactyly can be treated nonsurgically, a significant subset would benefit from a procedure directed at eliminating the need for subsequent revisions for incomplete amputation or painful neuroma. The indications for primary surgical intervention would include presence of a bony or ligamentous attachment (type A), or presence of a wide digital base (more than 2mm).

Treatment of central polydactyly depends on the status and extent of the extra digit and the presence or absence of concurrent anomalies, such as syndactyly. A central polydactyly that has a fully formed digit and normal function does not require removal to restore the normal complement of digits. An isolated central polydactyly with limited motion of the extra digit is treated with ray resection. The span of the hand is maintained by transposition of adjacent digits and/or intermetacarpal ligament reconstruction.

Synpolydactyly is treated with syndactyly separation and reduction of the concealed polydactyly. Complete removal of the redundant bones, however, is difficult to accomplish without jeopardizing joint structure or digital circulation. Partial central polydactyly is treated with similar principles used to reconstruct the duplicated thumb.

Foot polydactyly:

The general surgical goal is to excise the toe which provides the foot with the most normal contour, usually this involves excision of the most medial or the most lateral toe, depending on whether the deformity is pre, or postaxial.

In the foot preaxial group, the tibial side toe was usually removed with disarticulation, trimming of the wide metatarsal head, capsular repair and reinsertion of abductor, adductor, flexor or extensor hallucis tendons.

Patients with central polydactyly of the foot often have a widened forefoot (splayed) which is often cannot be corrected with surgical removal of the duplicated digits. This results from laxity of the intermetatarsal ligament. Surgery involves removing the central ray duplications through a

dorsal racquet-shape incision at the base of the duplication, excision of the toe, and re-approximation of the intermetatarsal ligament.

In postaxial group, excision of the most lateral toe or simple amputation of the deformity toes was performed. If the metatarsal head is prominent, it should be trimmed flush to the metatarsal shaft (at right angles to the physis). Leaving the metatarsal head prominent may cause a painful postoperative bunion. The metatarsal bowing which results from excision of a "Y" metatarsal will usually remodels over several years. The joint capsule should be carefully repaired.

Cases presentation:

Case I:

A three year old girl presented with right hand type IV preaxial polydactyly (Fig. 1). Ablation of the duplicated thumb on the radial side and augmentation of the remaining digit with soft tissue borrowed from the amputated finger were done together with repair of the radial collateral ligament of the metacarpophalangeal joint and K-wire fixation.

Case II:

A five year old girl presented with left hand type IV thumb polydactyly (Fig. 2), with simple incomplete syndactyly between the two digits, i.e. synpolydactyly. Ablation of the extra digit on the radial side was done. Augmentation of the remaining digit with soft tissues from the removed one, repair of the metacarpophalangeal joint and K-wire fixation were carried out.

Case III:

A 33 year old gentleman presented with right hand type IV thumb synpolydactyly (Fig. 3). We removed the radial side digit and re-enforced the extensor pollicis tendon from the excised finger and repaired the metacarpophalangeal joint. K-wire fixation was done to maintain the normal alignment.

Case IV:

A three year old boy presented with left hand type VI thumb polydactyly (Fig. 4). Ablation of the extra digit and repair of the carpo-metacarpal joint were done with a satisfactory result.

Case V:

A 13 year old girl presented with Z-thumb deformity in a type II polydactyly. The patient had undergone the first operation elsewhere and presented to our department ten years later. The exact nature of that operation was unknown but Z thumb

deformity was present; there was a tight capsule and scarring in the radial collateral ligament and an eccentric pull of the malaligned flexor pollicis longus tendon. Release of scarred tissue on the radial side, re-alignment of the extensor pollicis longus tendon, lengthening of the flexor pollicis longus tendon and K-wire fixation were performed, with satisfactory cosmetic & functional recovery (Fig. 5).

Case VI:

A two year old girl presented with left hand type A postaxial polydactyly (Fig. 6). Ablating the ulnar digit, re-insertion of the abductor digiti minimi muscle, and repair of the common metacarpophalangeal joint were carried out.

Case VII:

A fourteen year old boy presented with bilateral type A ulnar polydactyly (Fig. 7) with Y-shaped fifth metacarpal (more on right hand). Ablation of the lateral most fingers, trimming of the Y-metacarpal, and repair of metacarpophalangeal joints done with satisfactory result.

Case VIII:

A fifteen month old boy presented with bilateral postaxial polydactyly of both hands and feet (Fig. 8). The duplicated ulnar fingers and the outermost supernumerary toes were removed and repair of the metacarpophalangeal and metatarsophalangeal joints were carried out with satisfactory results.

Case IX:

A thirteen month old baby presented with right hand central polydactyly associated with complex syndactyly; complex synpolydactyly (Fig. 9). Resection of the extra digit, release of syndactyly and repair of the middle and ring fingers were done together with K-wire fixation.

Case X:

A thirteen year old girl presented with left big toe polydactyly (Fig. 10). Both digits were articulating at the same metatarso-phalangeal (MTP) joint with two articulating facets and severe hallux valgus. The supernumerary toe on the tibial side was removed together with re-attachment of the abductor and extensor hallucis tendons. Because there was manifest angulation at the first MTP joint, wedge osteotomy of the first metatarsal bone was done and fixation with K-wire was carried out to retain the normal alignment of the MTP joint.

CASE XI:

An eight year old boy presented with left foot postaxial polydactyly (Fig. 11), with simple com-

plete syndactyly between the fifth and sixth digits, i.e. synpolydactyly. For this patient we chose to remove the tibial side toe because it was hypoplastic though it was not the outermost toe. Tightening of the collateral ligament of the metatarsophalangeal joint and external finger splint was enough to keep the normal contour of the foot on long term result.

RESULTS

This study comprised 26 male and 14 female patients with 48 polydactylies. There was no peri-operative mortality or wound infection. Patients with thumb polydactyly were assessed using Tada score [25], and patients with foot polydactyly were evaluated with Phleps-Gorgan [26] protocol. More than 82% of the patients were satisfied or very satisfied with functional and cosmetic outcomes.

Hand polydactyly:

Fifteen patients presented with thumb polydactyly, ten patients with postaxial polydactyly and one patient presented with central polydactyly of the hand.

Patients with thumb polydactyly were evaluated clinically according to Tada score [25]. That score is a comprehensive tool, which has been validated in the assessment of surgical outcomes of thumb polydactyly, as it takes cosmesis, functional, and radiographic evaluations into account. Thumb strength is mostly dependent on joint stability and muscle power. It is difficult to assess grip and pinch strength in very young patients, as they are either too weak to perform the test or too immature to follow instructions. Its significance in clinical documentation in the very young age-group is doubtful. Assessment specifically addressed first web contracture and bone growth. Evaluation of growth potential, instability, and deformity were performed clinically and radiologically.

Seven patients developed post operative dissatisfaction; two patients showed hypertrophic scars managed conservatively, three patients developed joint instability and two patients showed digit angulations managed conservatively with adequate improvement. One patient, aged 11 years developed painful neuroma following excision of type-A ulnar polydactyly, revision done after 2 months with adequate result.

Foot polydactyly:

Fourteen patients with foot polydactyly were operated; out of which 8 patients with postaxial and 6 patients presented with preaxial foot polydactyly. All foot polydactyly patients were evalu-

ated with Phelps-Grogan's protocol [26] (Table 2). Eleven patients were graded as excellent and three were categorized as good. Foot function and contour were restored to near normal after operation with minimal surgical scar and no patient complained of pain or callosity. Hallux varus was observed in 2 patients yet; all patients were able to wear shoes without the necessity of modification, custom-made shoes, or pairing of different sizes.

Table (1): Classification systems of ulnar polydactyly.

Name of classification	Description of the classification
Temtamy-McKusick classification (Temtamy & McKusick, 1969) [14].	Type A: The extra digit is well formed and has an articulation Type B: The extra digit is poorly formed and is connected to the hand by a skin bridge
Stelling classification (Stelling, 1963) [15].	I: Soft tissue only II: Duplication of the phalanges III: Complete duplication of the phalanges and metacarpal
'Universal' classification (Buck-Gramcko and Behrens, 1989) [17].	Soft tissue: Type V Rud (Rudimentary fifth digit) Bony: Type V distal phalanx, distal interphalangeal joint, middle phalanx, proximal interphalangeal joint, proximal phalanx, metacarpophalangeal joint, metacarpal, carpometacarpal joint
Rayan-Frey classification (Rayan and Frey, 2001) [18].	I: Soft tissue nubbin II: Pedunculated non-functioning digit III: A well formed functioning digit which is articulating with a bifid fifth metacarpal head or fused to the fifth metacarpal at a 90 angle IV: Complete duplication with a separate 6 th metacarpal V: Polysyndactyly (there is syndactyly between the little finger and its duplicate)

Table (2): Phelps-Gorgan protocol [26].

Criteria	Excellent	Good	Poor
Pain	None	Occasional	Constant
Callosity	None	Present but not painful	Constantly painful
Deformity of the remaining toes	Not significant	Minimal	Marked
Scar cosmesis	Satisfactory	Minimal complaint	Complaint

Case I



Fig. (1A): Right hand type IV thumb polydactyly.



Fig. (1B): X-ray appearance.



Fig. (1C): Surgical design.



Fig. (1D): Re-insertion of extensor pollicis tendon and augmentation of the remaining digit with soft tissues from the ablated one.



Fig. (1E): K-wire fixation.



Fig. (1F): Post operative view.



Fig. (1G,H): Precise grip few weeks after repair.

Case II



Fig. (2A): Left hand, type IV, thumb polydactyly, dorsal view.



Fig. (2B): Left hand, type IV, thumb polydactyly, palmar view.



Fig. (2C): Left hand, type IV, thumb polydactyly, X-ray view.



Fig. (2D): Post operative X-ray view.

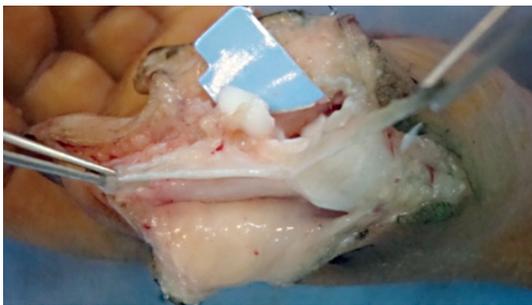


Fig. (2E): Repair of the MP joint.



Fig. (2F): K-wire fixation.



Fig. (2G): Postoperative dorsal view.



Fig. (2H): Postoperative palmar view.
Case III



Fig. (3A,B): Right hand, type IV thumb polydactyly.



Fig. (3C): Preoperative X-ray view.



Fig. (3D): The radial digit is removed and augmentation of the remaining finger together with repair of the MP joint of the thumb.



Fig. (3E): Post operative appearance.



Fig. (3F): Post operative appearance showing the precise grip.



Fig. (3G): Post operative X-ray appearance.



Fig. (3H): Post operative X-ray appearance showing the precise grip.

Case IV



Fig. (4A): Left hand type VI thumb polydactyly.



Fig. (4B): Left hand type VI thumb polydactyly, preoperative marking.



Fig. (4C): Post operative view (palmar side).



Fig. (4D): Post operative view (scar site).

Case V



Fig. (5A): Z thumb.



Fig. (5B): Release of scarred tissue, capsulorrhaphy, flexor pollicis lengthening, re-alignment of the proximal phalanx and K-wire fixation were done.



Fig. (5C): Lengthening of the flexor pollicis and realignment of the extensor pollicis longus tendons.



Fig. (5D): Postoperative result.



Fig. (5E): Postoperative result.
Case VI



Fig. (6A): Left hand type A post-axial polydactyly.



Fig. (6B): Re-insertion of the abductor digiti minimi muscle with the tendon of the removed digit.



Fig. (6C): Early post operative view.
Case VII



Fig. (7A): Bilateral, type A, ulnar polydactyly.



Fig. (7B): X-ray appearance.



Fig. (7C): Post operative view.



Fig. (7D): Post operative view.

Case VIII



Fig. (8A): Bilateral post-axial polydactyly both hands.



Fig. (8B): Bilateral post-axial polydactyly both feet.



Fig. (8C): Post operative result.



Fig. (8D): Post operative result.

Case IX



Fig. (9A): Right central polysyndactyly, preoperative presentation.



Fig. (9B): Right central polysyndactyly, radiological appearance.



Fig. (9C): Planning for release of syndactyly and excision of the central polydactyly.



Fig. (9D): Post operative result few months later.

Case X



Fig. (10A,B): Left foot big toe polydactyly.



Fig. (10C): X-ray view.

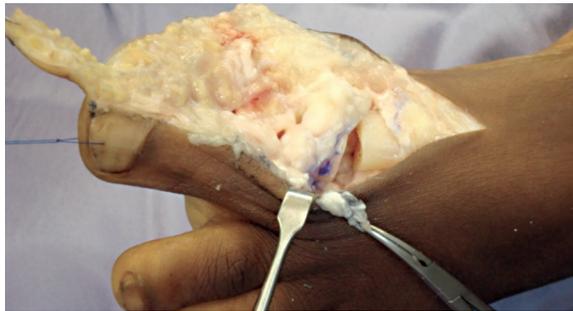


Fig. (10D): Ablation of the tibial digit, re-attachment of the extensor and abductor hallucis tendons, and wedge osteotomy of the 1st metatarsal.

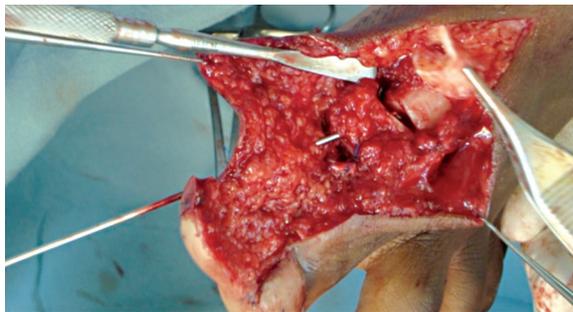


Fig. (10E): K-wire fixation and repair of the MTP joint.



Fig. (10F): Post operative X-ray.



Fig. (10G): Post operative view.

Case XI



Fig. (11A): Left foot postaxial polydactyly and simple complete syndactyly i.e. synpolydactylt.



Fig. (11B): Left foot postaxial polydactyly and simple complete syndactyly i.e. synpolydactylt.



Fig. (11C): Radiological appearance.



Fig. (11D): Radiological appearance (close up view).



Fig. (11E): Early post operative view after ablation of the tibial side toe.

DISCUSSION

Polydactyly is perhaps the most common congenital hand anomaly [13]. However, despite the extensive use of the developing limb as a classical developmental model, the cellular and genetic mechanisms that control the number and identity of the digits are not completely understood. Talamillo et al. [27]. With regards to the surgical correction of the polydactyly, is almost always indicated, not only for cosmetic improvement but also for better function.

Surgery on thumb polydactyly is rewarding. The Wassel classification for thumb polydactyly was used for its simplicity for the purposes of clinical categorization and planning of surgical procedures [6]. Lister [28] has identified six qualities that provide the normal thumb with unique functional capabilities: (1) Length, (2) Stability, (3) Sensibility, (4) Mobility, (5) Dexterity, and (6) Power. Joint instability and angular deformity following thumb reconstruction is often due to nonparallel joint alignment [29,30], this occurs most often in types II and IV thumbs, in which a single proximal articular surface supports two distally diverging digits. It has recently been suggested that preoperative splinting may improve digital alignment and facilitate surgical reconstruction [31]. On surgical reconstruction, it is advisable to realign articular surfaces by osteotomy to establish proper axial alignment [32]. The interphalangeal and metacarpophalangeal joints should be realigned so that the joint line of each is perpendicular to the long axis of the metacarpal. Closing wedge metacarpal osteotomy is often indicated in type IV thumbs and may be simply fixed with the same longitudinal K-wire placed to maintain metacarpophalangeal joint congruency particularly in older child [32]. In our series two cases with type IV thumb polydactyly developed angular deformity partly improved with physiotherapy and finger

splinting. However osteotomies for younger patient are still controversial.

Surgical treatment of central polydactyly is not rewarding [21], particularly if associated with complex bony fusion, yielding non satisfactory result. Function should be balanced with cosmetic result when operating on central polydactyly because the associated anomalies most probably limit the functional outcome.

The options for primary treatment of postaxial type B hand polydactyly include no intervention, suture ligation, and surgical amputation. In the United Kingdom, a survey of pediatricians and surgeons found that 79% of pediatricians and 67% of hand surgeons would advocate specialty referral for postaxial type B polydactyly with a narrow pedicle with the remainder recommending suture ligation by pediatricians [33].

Kanter and Upton [34] called the narrow pedicled, pedunculated polydactyly a “pacifier” polydactyly and they suggested that babies suck it in utero. They described three cases with imminent ischemic necrosis of the extra digit at birth. In our series two cases presented to us with gangrenous type B ulnar polydactyly without apparent cause (Figs. 12,13), one infant was a new born and the other seen when he was one month old. Surgical amputation of the extra-digit under short general anesthesia was done with good result.

In the same survey mentioned above asking about treatment of postaxial type A polydactyly with an almost fully formed accessory finger with a broad pedicle attachment, 99% of pediatricians and 97% of surgeons advocated surgical specialist management [33], however the indications for primary surgical intervention for type A postaxial hand polydactyly would include presence of a bony or ligamentous attachment or presence of a wide digital base (more than 2mm).



Fig. (12)



Fig. (13)

Figs. (12,13): Gangrene of type B ulnar polydactyly.

Polydactyly is a fairly common congenital condition of the foot. Several classifications [14, 22,23] have been proposed in the literature to systematize this variable malformation.

Surgery for foot polydactyly should not be delayed much beyond walking age to allow the maximum time for the bones to remodel. In most cases of postaxial polydactyly, the surgical procedure is relatively simple (excision of the lateral digit) and long-term results have been good to excellent in most studies [23]. Surgical correction of preaxial foot polydactyly is generally more complex with poor long-term results [35].

To conclude, management of polydactyly may appear simple at first glance, but the multiformity of its configuration deserves careful consideration before and during surgical correction. Creativity and intraoperative flexibility may be required to restore the best functioning digit using components of each part [21], and each patient should be treated individually depending on the deformity, yet the outcome may still be disappointing.

The timing of excision of the extra-digit and deciding which digit will be removed are controversial. Surgical reconstruction for polydactyly could be carried out at the age the patient can withstand anesthesia. Generally, thumb polydactyly is operated between 18 months to 5 years, while foot polydactyly better operated before walking age, when the infant is between 9 and 12 months.

Basically, our strategy for surgical management of patients with polydactyly was coinciding with other strategies [6-11,16-18,24-26,30,31,34-37]. Removal of the most medial or most lateral digit that can gain the normal contour of the hand or foot was our principal goal for all patients. Soft tissue augmentation of the remaining digit with tissues borrowed from the ablated digits and re-orientation of the carefully dissected tendons maintained the maximum functional and cosmetic outcome.

In case of sharing a common joint, repair of the ligaments is as important as capsulorrhaphy, however, chondroplasty may be indicated to correct the articulating surfaces. In case of severe digit angulation, particularly in old children, osteotomy with K-wire fixation may be required to regain the normal osseous alignment.

In our study, more than 82% of patients were satisfied or very satisfied with the surgical procedure, largely comparable to results mentioned in literature. Thus the surgical outcome appeared to have met patient and parent expectations; their

prime concern being removal of the supernumerary digit.

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