POLYDACTYLY OF THE FOOT. LITERATURE REVIEW AND CASE PRESENTATIONS

L. GALOIS, D. MAINARD, J. P. DELAGOUTTE

Polydactyly is a fairly common congenital condition of the foot and is characterized literally by supernumerary toes (digit or metatarsal). The frequency of polydactyly varies widely among populations. It may be an isolated condition or part of a congenital syndrome. Polydactyly is generally classified into three major groups : medial ray (preaxial), central ray and lateral ray (postaxial). The duplication may appear at the distal and middle phalanges or at the whole digit and metatarsal. The complexity of the deformity ranges from a simple soft-tissue problem to a completely developed accessory ray. Careful clinical and radiographic evaluation should be made prior to treatment to achieve good functional and cosmetic results. Most cases are treated during childhood before walking age. Adult cases are more rare, and surgical management of the deformity is still debated. Nevertheless, surgery can be performed at any age as in our series with good results.

Keywords : foot ; polydactyly.
Mots-clés : pied ; polydactylie.

INTRODUCTION

Polydactyly is a fairly common congenital condition of the foot and is characterized by the presence of supernumerary toes (digit or metatarsal). Although reports of polydactyly of the hand are numerous, there are few of the foot. The duplication may appear at the distal and middle phalanges or at the whole digit and metatarsal. Surgical intervention may be indicated for shoe problems, pain or for cosmetic reasons. The disorder of polydactyly has been described and classified in numerous fashions. Most cases are treated during childhood before walking age. Adult cases are more rare, and surgical management of the deformity is still debated. A review of the literature and three cases of polydactyly in the adult foot are presented.

CASES PRESENTATIONS

Case 1

A 30-year-old man presented with bilateral partial duplication of the fifth toes (fig. 1). There was

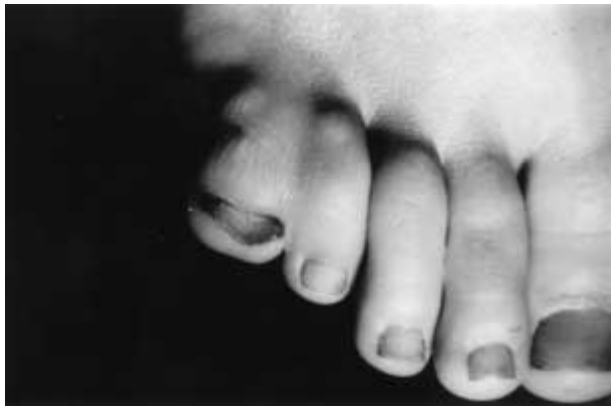

Fig. 1. — Partial duplication of the fifth toe

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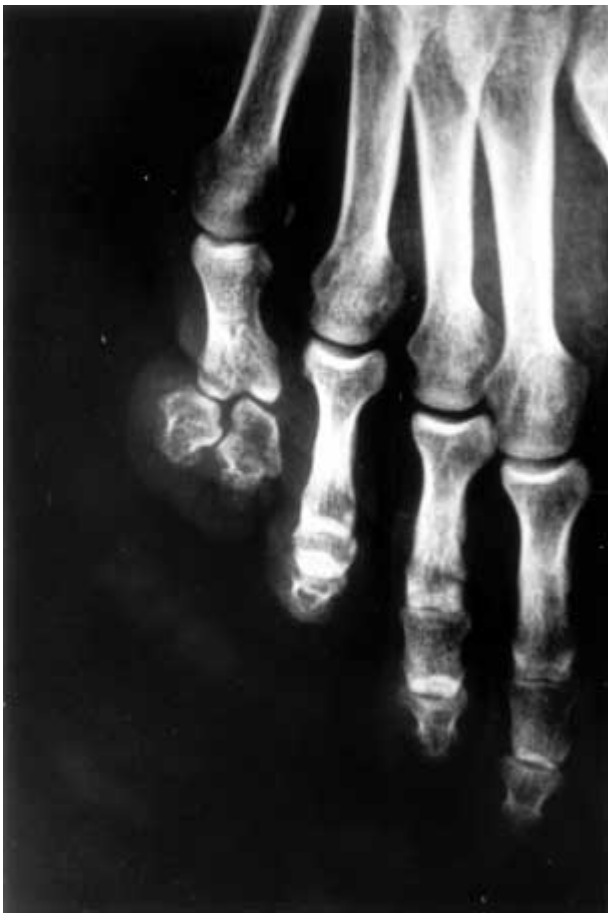

Fig. 2. — Xray showing a duplication of the middle phalanx

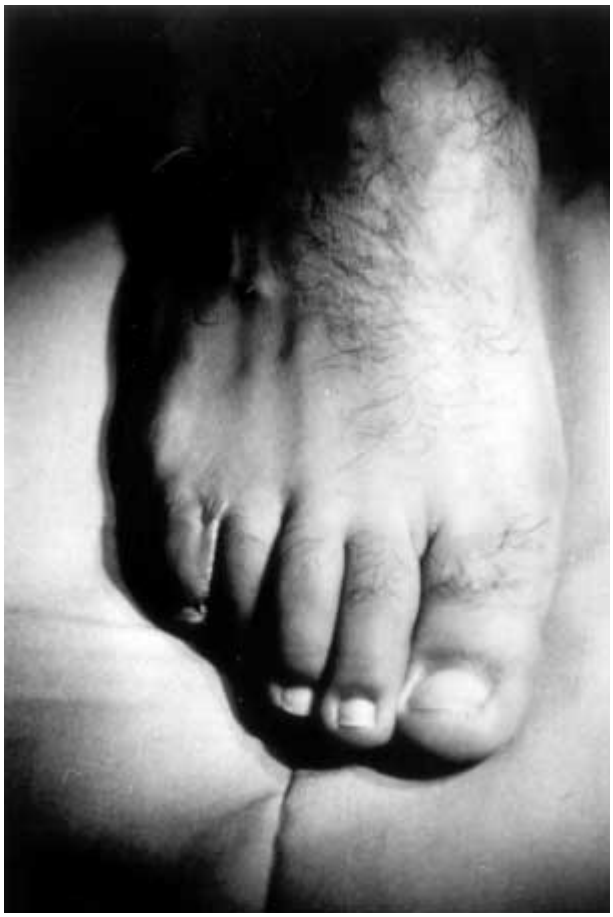

Fig. 3. — Final appearance. Good cosmetic result

no problem with shoes, but the main problem was cosmetic and also psychological. Xray showed duplication of the middle phalanx (fig. 2). Excision of the medial supernumerary toe was easily performed on both feet. The outcome was favorable with no complaints (fig. 3).

Case 2

A 30-year-old female presented with a chief complaint of a painful left foot. The left foot demonstrated a widened midfoot especially between the fourth and fifth metatarsals (fig. 4). On anteroposterior xray examination, there was partial duplication of the fifth metatarsal enlarging the fourth intermetatarsal space (fig. 5). Shoe problems were the main complaint. Therapy consisted of surgical excision of the duplicated metatarsal and repair of the transverse intermetatarsal ligament to prevent splaying of the foot. The cosmetic result was good (fig. 6), and the patient was able to wear most shoes without the necessity of modification, custom-made shoes or pairing of different sizes.

Case 3

A 26-year-old female presented with a moderately widened midfoot and six toes (fig. 7). She wanted to get married, and esthetic shoe-wear was problematic. On anteroposterior xray examination there were six complete metatarsals and toes. The fifth ray seemed to be more rudimentary, and excision of the fifth ray was chosen. It was performed through a dorsal incision (fig. 8). The transverse

Fig. 4. — A 30-year-old female with a widened midfoot especially on the lateral side between the fourth and fifth metatarsal.

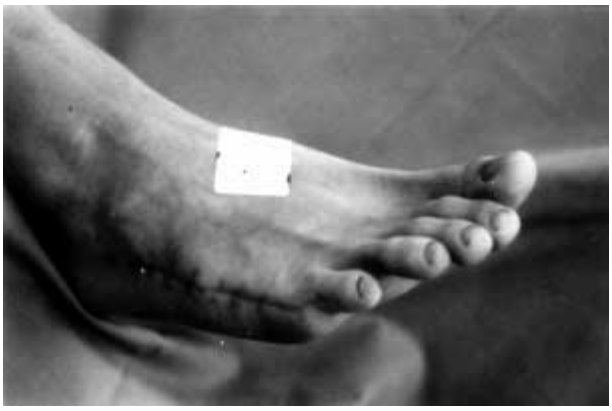

Fig. 6. — Final aspect after surgical correction with a good cosmetic result.

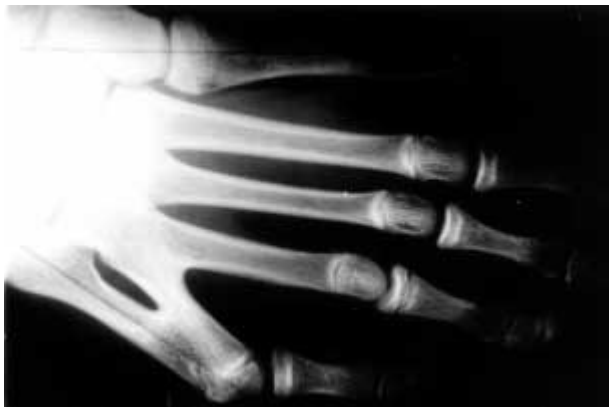

Fig. 5. — Xray showing a partial duplication of the fifth metatarsal enlarging the fourth intermetatarsal space.

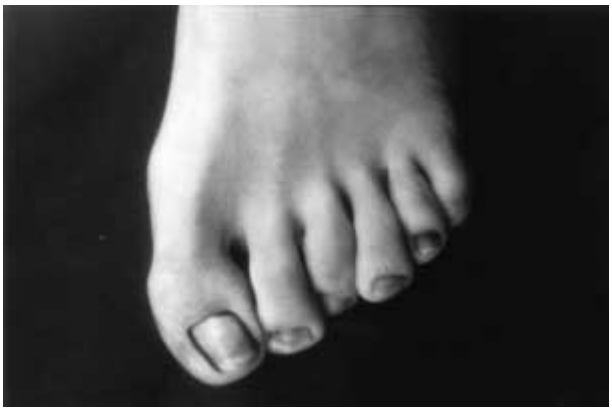

Fig. 7. — A 26-year-old female with a six- toed foot

intermetatarsal ligament was carefully repaired. The long-term result was good with no problem with shoes.

DISCUSSION

Polydactyly is a fairly common congenital condition of the foot. Several classifications have been proposed in the literature (1, 3, 4, 7) to systematize this variable malformation. The classification systems used for 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. Temtamy and McKusick's classification defines the disorder as being either isolated or part of a syndrome (7). They 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 (8) further subdivided postaxial 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. In 1988, 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

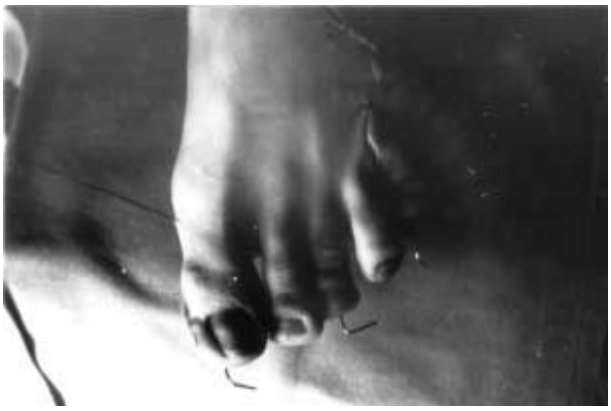

Fig. 8. — Postoperative view after radial excision of the fifth ray.

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.* (9) 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). Digital duplications range from boneless soft-tissue structures to incomplete or complete bony duplications. The frequency of polydactyly varies widely among populations (6). The high frequency of polydactyly in populations of Africa and Asia must be pointed out. The exact human embryological parameters behind polydactyly are unknown. Of the three types (preaxial, postaxial, central) postaxial polydactyly occurs most frequently (9). The majority of polydactyly reported in the African population is postaxial in nature. In contrast, in the Philippines, in Hong-Kong and in Malaysia, the majority of polydactyly is preaxial in nature (6).

We found the classification proposed by Watanabe *et al.* (9) to be simple but complete. This classification clearly indicates the type of anomaly which is very important in planning the surgery. 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 (2). In our series of postaxial polydactyly, the results were comparable to those obtained in the literature. Surgical correction of preaxial polydactyly is generally more complex with poor long-term results (5). Complications include recurrent hallux varus, splaying of the first ray and a short first metatarsal that does not bear adequate weight. Treatment of central ray duplication is not well publicized because of its rare presentation. In most cases, supernumerary central digits can be excised through a racquet-shaped incision. Treatment ranges from shoe modification to complex surgical procedures. General principles recommend saving the digit that is the most developed, that has the most normal metatarsophalangeal articulation and that will give the best contour to the foot. Surgery should not be delayed much beyond walking age to allow the maximum time for the bones to remodel. Nevertheless, surgery can be performed at any age as in our series with good results. Management of polydactyly of the foot may appear simple at first glance, but the multiformity of its configuration deserves careful consideration before and during surgical correction. Whatever the motive for the patient to consult, shoe problems, pain or cosmetic reasons, the treatment should be individualized. If surgical correction is elected, it should lead to proper alignment of toes and comfort in wearing shoes.

REFERENCES

1. Blauth W., Olason A. T. Classification of polydactyly of the hands and feet. Arch. Orthop. Trauma. Surg., 1988, 107, 334-344.
2. Chiang H., Huang S. C. Polydactyly of the foot : Manifestations and treatment. J. Formos. Med. Assoc., 1997, 96, 194-198.
3. Coppolelli B. G., Ready J. E., Awbrey B. J., Smith L. S. Polydactyly of the foot in adults : Literature review and unusual case presentation with diagnostic and treatment recommendations. J. Foot Surg., 1991, 30, 12-18.

4. Kleanthous J. K., Kleanthous E. M., Hahn P. J. Jr. Polydactyly of the foot. Overview with case presentations. J. Am. Podiatr. Med. Assoc., 1998, 88, 493-499.
5. Masada K., Tsuyuguchi Y., Kawabata H., Ono K. Treatment of preaxial polydactyly of the foot. Plast. Reconstr. Surg., 1987, 79, 251-258.
6. Murphy K. A. A prehistoric exemple of polydactyly from the iron age site of Simbusenga, Zambia. Am. J. Phys. Anthropol., 1999, 108, 311-319.
7. Temtamy S., McKusick V. A. The genetics of hand malformations with particular emphasis on genetic factors. Birth Defects, 1969, 14, 364-423.
8. Venn-Watson E. A. Problems in polydactyly of the foot. Orthop. Clin. North Am., 1976, 7, 909-927.
9. Watanabe H., Fujita S., Oka I. Polydactyly of the foot : An analysis of 265 cases and a morphological classification. Plast. Reconstr. Surg., 1992, 89, 856-877.

SAMENVATTING

L. GALOIS, D. MAINARD, J. P. DELAGOUTTE. Polydactalie van de voet. Literatuurstudie en voorstelling van gevallen.

Polydactalie van de voet, gekenmerkt door de aanwezigheid van supernumeraire tenen en eventueel metatarsalen, is niet zeldzaam. De frequentie van voorkomen verschilt volgens bevolkingsgroep. Polydactilie komt geïsoleerd voor, maar ook in een congenitaal syndroom samen met andere afwijkingen.
Drie groepen worden onderscheiden : polydactylie van de mediale straal (preaxiaal), de centrale straal en de laterale straal (postaxiaal). De ontdubbeling kan zich beperken tot een eenvoudig weekdeel probleem, een splitsing van het middenste en distale kootje van de teen, een splitsing van de ganse teen, en een splitsing van de metatarsaal, zodat een volledig ontwikkelde bijgevoegde straal is gevormd. Een goed cosmetisch en functioneel resultaat vereist een zorgvuldige klinische en radiologische oppuntstelling. De behandeling gebeurt meestal vóór de loopleeftijd is bereikt. Bij volwassenen is heelkunde aanvechtbaar, alhoewel de auteurs goede resultaten bereikten op gelijk welke leeftijd.

RÉSUMÉ

L. GALOIS, D. MAINARD, J. P. DELAGOUTTE. Les polydactylies au pied. Analyse de la littérature et cas cliniques.

Les polydactylies au pied, malformation congénitale rare, se caractérisent par l'existence d'un orteil surnuméraire (phalange ou métatarsien). Leur fréquence est variable selon les populations étudiées. La malformation peut être isolée ou associée à un syndrome polymalformatif. Les polydactylies sont généralement classées en 3 groupes : formes médiales, centrales et latérales. La duplication peut ne concerner que l'appareil phalangien ou l'ensemble du rayon. L'existence de très nombreuses formes cliniques (de la plus simple à la plus complexe) exige une évaluation clinique et radiographique préopératoire rigoureuse dont dépendra le résultat. Dans la majorité des cas, le traitement chirurgical est effectué pendant la petite enfance avant l'âge de la marche. Les formes cliniques à l'âge adulte sont plus rares et leur traitement fait toujours l'objet de discussions. Néanmoins, la correction chirurgicale peut être pratiquée à tout âge comme dans notre série.