Digital Deformities of the Pediatric Foot

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Polydactyly

Polydactyly is a common congenital digital deformity characterized by formation of supernumerary digits. It is the most common congenital deformity of the hand and foot, with incidence in the foot of approximately 1 per 1000 live births [1]. Bilateral involvement is seen in 25–50% of patients [2]. No gender predilection is observed. Prevalence appears to be higher in black and Asian populations [3]. Polydactyly of the hand or foot can be associated with genetic syndromes, such as Pallister-Hall, Lawrence-Moon-Bardet-Biedl, and Ellis-Van Creveld [2], or may occur as an isolated trait with an autosomal-dominant pattern of inheritance [4]. Up to 30% of subjects report positive family history of this trait [2].

Many classification systems for polydactyly have been described. Anatomic classification has been proposed by Temtamy and McKusick [5]. It divides the deformity into preaxial, postaxial, and mixed based on the location of the supernumerary digit relative to the line bisecting the second ray. In this classification, preaxial polydactyly refers to duplication of the first or second digit, while postaxial polydactyly refers to duplication of the third, fourth, or fifth digits (Fig. 4.1).

Each category is further subdivided into types, based on the morphology of the supernumerary digit. Preaxial polydactyly is subdivided into four types: duplication of the hallux (type 1), duplication of the triphalangeal hallux (type 2), duplication of the second digit (type 3), and polysyndactyly (type 4). Postaxial polydactyly is subdivided into two types: a fully developed extra digit (Type A) and a rudimentary extra digit (Type B).

Temtamy's and McKusick's classification system doesn't account for all types of polydactyly, so several other classification systems followed in an attempt to provide the most comprehensive approach to describing the condition. Venn-Watson has proposed a scheme based on morphological configuration of the metatarsal [6]. He subdivided preaxial polydactyly into two groups: short block first metatarsal and wide first metatarsal. Postaxial polydactyly was subdivided into five categories, from least differentiated to more differentiated: soft tissue duplication, wide metatarsal head, T metatarsal, Y metatarsal, and complete duplication (Figs. 4.2 and 4.3).

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M. L. Butterworth, J. T. Marcoux (eds.), *The Pediatric Foot and Ankle*,
https://doi.org/10.1007/978-3-030-29788-6_4

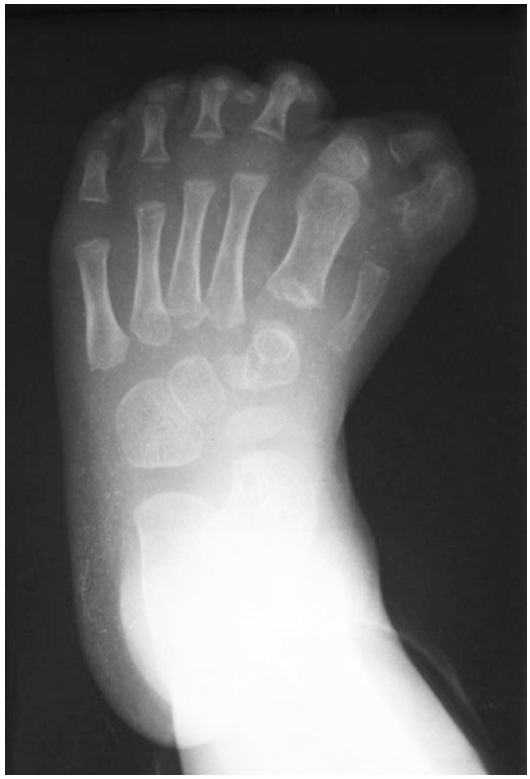

Fig. 4.1 Preaxial polydactyly

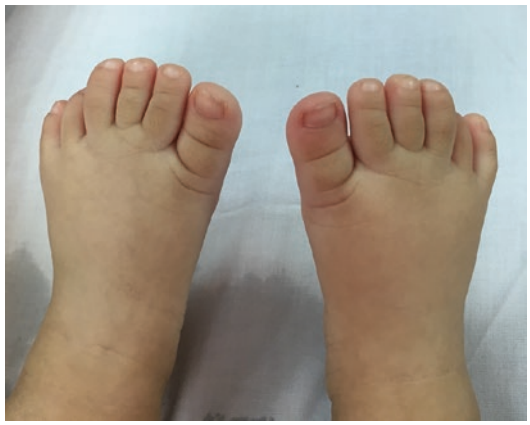

Fig. 4.2 Postaxial polydactyly

Watanabe and colleagues [7] based their classification system on the ray involvement and the level of duplication. They subdivided medial ray polydactyly into tarsal, metatarsal, proximal, and distal phalangeal types and central and lateral ray polydactyly into metatarsal, proximal, intermediate, and distal phalangeal types.

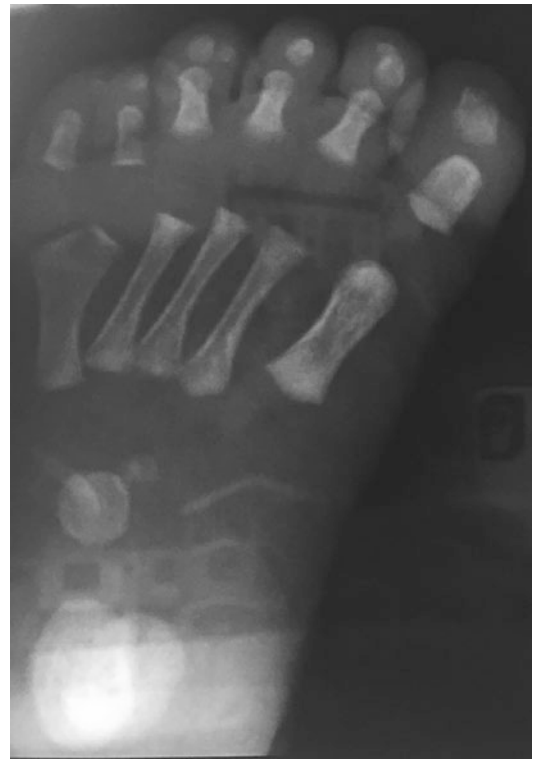

Fig. 4.3 Postaxial polydactyly, Y metatarsal

Lee and colleagues have proposed a classification system of postaxial polydactyly based on the site of origin of extra digit [8]. They divided accessory digits into five types: a floating type, middle phalangeal (MP) type, proximal phalangeal type, fifth metatarsal type, and fourth metatarsal type. The proximal phalangeal type is further subdivided into proximal phalangeal lateral (PPL), proximal phalangeal medial, and proximal phalangeal head (PPH) types. The fourth metatarsal type involves an abnormal-appearing extra digit syndactylized with the fifth digit. The authors reported that the supernumerary toes that were more distal in origin demonstrated higher degree of osseous fusion with the normal toes and were thus more difficult to manage.

Seok and Kwon have devised a classification system for polydactyly of the foot based on the key anatomic features of the deformity affecting surgical planning. This classification aimed to provide guidelines for surgical decision-making and predict outcomes. Their classification system, entitled SAM, categorizes each deformity based on the presence and the extent of syndactylism, axis deviation, and metatarsal extension. Three types were described within each category, from least severe to most severe, with each deformity designated by a combination of three letters (S, A, M, with numbers 0–2). For instance, $S_0A_0M_2$ describes a deformity with no syndactylism, less than 15 degrees of axis deviation, and metatarsal shaft duplication. The combination of letters and numbers for each deformity would also serve to guide surgical treatments, with S0 requiring simple excision versus S1 and S2 necessitating a skin graft, A1 and A2 warranting a closing wedge osteotomy and possible collateral ligament reconstruction, and M 1 and 2 potentially dictating a need for proximal extension of the dissection and excision of redundant parts of the metatarsal.

One may also consider utilizing the terms tibial polydactyly and fibular polydactyly for the location of the duplicated digit. The authors prefer this terminology as patients can have a congenital dysmorphic feature of the tibial or fibular aspects of the entire lower limb in association with polydactyly.

Treatment indications for foot polydactyly include shoe-fitting problems, pain and cosmesis, or social anxiety. Conservative treatment options are limited to accommodative shoe gear with widened toe box to prevent impingement and orthotics or metatarsal pads to relieve transfer metatarsalgia [4]. Surgical treatment is pursued if conservative treatment options fail to alleviate pain and for social concerns. Surgical approach and procedure choice are guided by the anatomic location of the deformity and the morphology of the supernumerary digit.

While there is not an absolute age in which to surgically intervene, many tend to wait until at least the second or third year of life to operate. Surgery should be delayed until at least the second year of life to reduce the risk of anesthesia-related complications [4]. With concerns for general anesthesia effects on cognitive development in children under 3 years of age, one may delay if patient is stable. Delaying surgical intervention can facilitate improved identification of the hypoplastic digit and the redundant tissue [4]. Unfortunately, in the presence of persistent skin problems and/or infections, some patients may require intervention sooner.

Postaxial (fibular) polydactyly is the most common form of polydactyly in the foot, accounting for roughly 80% of all cases [1]. Typically, it is also the simplest one to treat. Most studies advocate removal of either the most lateral or the most underdeveloped digit [1, 9, 10]. In the cases involving duplication or widening of the metatarsal head, excision of the redundant bone, capsular repair, and possible stabilization of the joint with a K-wire are recommended. Amputation of the most lateral digit is typically performed through a racquet incision [11]. The incision is extended proximally in a linear fashion in the cases necessitating removal of a redundant metatarsal. Long-term postoperative follow-up demonstrates that surgical treatment of postaxial polydactyly is generally very successful, with low rate of recurrences or complications [1, 9]. Osseous recurrence rates and duplicated nail regrowth rates tend to be higher in younger surgical patients.

Preaxial polydactyly is seen in 11 to 16% of all polydactyly cases [4]. Surgical treatment of preaxial polydactyly consists of removal of the most medial or the most rudimentary hallux. Careful soft tissue rebalancing with reattachment of abductor and adductor halluces tendons and intermetatarsal ligament repair is recommended to prevent hallux varus, which is a frequent complication of this surgery. In his series of 16 preaxial polydactyly cases, Phelps reported an 88% incidence of hallux varus [1]. The prevalence of hallux varus was noted to be higher in block metatarsal deformities.

Central polydactyly is the least common form of polydactyly, occurring in 6% of cases [1]. Its treatment involves excision of the supernumerary digit, which is traditionally performed through a dorsal racquet incision [12]. Persistent forefoot widening is one of the most frequent complications of this procedure [1, 7]. To improve esthetic and functional outcomes, Allen introduced a novel approach for central ray excision using plantar and dorsal advancement flaps. This technique was shown to result in improved cosmetic and functional outcomes, with forefoot narrowing maintained with growth after a mean follow-up of 8 years [12]. Due to extensive soft tissue dissection associated with this approach, special attention needs to be paid to preservation of blood supply to the adjacent digits to avoid vascular compromise.

Primary complications of surgery for the treatment of polydactyly include recurrence, infection, wound healing problems, nail bed problems, persistent swelling, and pain. Recurrence rates can be reduced by delaying surgery to allow for osseous growth. Care should be taken to minimize tension on surgical incisions. Dehiscence rates are higher when tension is increased or when hemostasis is not maintained. A running subcuticular closure or absorbable sutures in a simple fashion may be utilized to avoid office suture removal. Nylon skin closure may also be beneficial especially in areas of mobility or additional tension. The authors do not promote suture ligation in an infant given risks of infection, wound complications, and an amputation neuroma.

Syndactyly

Syndactyly is a common congenital deformity characterized by the presence of webbing between the toes. It is seen in 1 per 2000 people and usually involves 2nd and 3rd toes [4]. Syndactyly is caused by the rapid arrest in embryologic development of the limb buds between 6th and 8th weeks IU, which can be caused by genetic factors or an intrauterine assault [13]. It occurs either as an isolated deformity or as a part of a genetic syndrome. Syndactyly is seen more commonly in whites compared to blacks and exhibits no gender predilection (Fig. 4.4) [13].

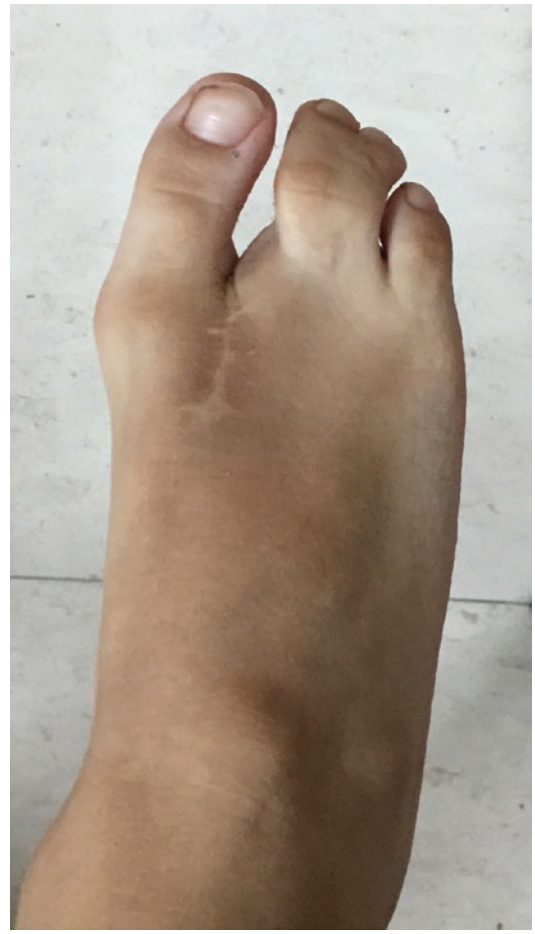

Fig. 4.4 Complex digital abnormality demonstrating syndactyly

Davis and German have classified syndactyly as incomplete or partial (the webbing doesn't extend to the distal aspect of the digits), complete (the webbing extends to the distal aspect of the digits), simple (no phalangeal involvement), and complicated (abnormal phalangeal bones) [14]. Temtamy and McKusick proposed an alternative classification based on the presence of associated deformities [5]. They divided the syndactyly into five types, zygodactyly (type 1), synpolydactyly (type 2), ring

finger-small finger syndactyly (type 3), Hass type (type 4), and syndactyly with metatacarpal fusion (type 5). Zygodactyly refers to presence of webbing between the toes without duplication of the digits. Synpolydactyly refers to syndactyly of the 4th and 5th toes with associated polydactyly of the 5th toe included in the web between the 4th and 5th digits. Types 3–5 refer to syndactyly of the hand and will not be discussed here.

Definitive treatment of syndactyly consists of surgical reconstruction of the webspace. Due to high incidence of postoperative complications seen with this procedure, treatment is typically not indicated for syndactyly without associated bony deformities [15]. Synpolydactyly, on the other hand, is commonly associated with functional problems, such as difficulty with shoe gear fitting, and may be addressed surgically.

Studies recommend delaying surgery until at least 3 years of age to minimize the risk of anesthesia-related complications. Although waiting until the fifth year of life may facilitate a more complete radiographic assessment of the problem, prolonged waiting period may cause distress.

Surgical options for desyndactylization include skin flaps, grafts, and tissue expansion. Various combinations of Z-plasties have been described [15–17]. Careful planning of the flap placement is necessary to avoid excessive tension on the desyndactylized digits and skin necrosis. Hypertrophic scar formation may lead to severe digital contracture and is one of the most common causes of failure of the procedure [15]. The use of full-thickness skin grafts obtained from the dorsum of the foot, groin, and abdomen has been described. Possible concerns associated with this procedure include donor site morbidity and pigmentation mismatch [4].

Macrodactyly

Macrodactyly is a rare congenital deformity of the hands and feet characterized by the enlargement of soft tissue and osseous elements of the digit [18]. The condition may occur as a part of a syndrome, such as Klippel-Trenaunay-Weber, proteus, or neurofibromatosis, or as an isolated phenomenon [19]. The etiology of the deformity is unknown, though some studies implicate hyperinduction of a neurotrophic mechanism responsible for normal pedal growth [20]. Slight male predilection has been noted [21]. Second and third digits are affected most often [21]. The deformity is manifested by the enlargement of the bony phalanges and accumulation of the fibrofatty tissue (Fig. 4.5).

Concomitant metatarsal enlargement is seen in over 50% of the patients [4]. Tendons and nerves are often spared in the foot [21]. The condition is described as static, when the enlargement of the digit is present at birth, and its growth is proportional to the growth of the normal digits, or progressive, when the involved digit grows faster than the normal digits [19].

Clinically and radiographically, the affected foot appears wider and longer compared to the unaffected one. The enlarged digit tends to sublux

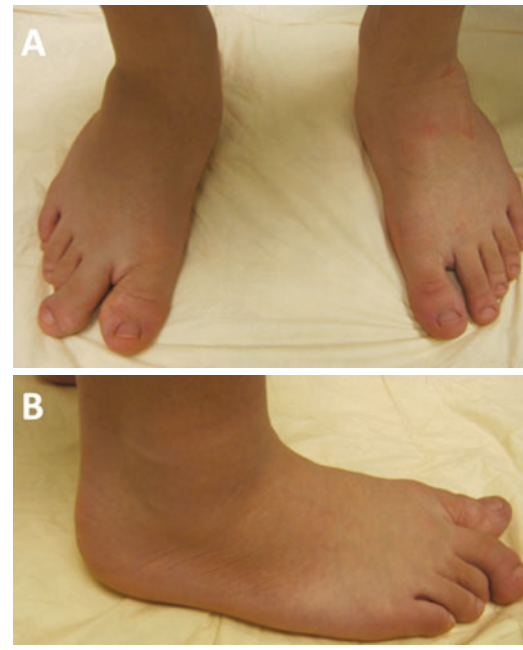

Fig. 4.5 (**a**) Macrodactyly. (**b**) Second toe demonstrates asymmetrical growth of soft tissue and bone

dorsally and deviate laterally or medially due to asymmetrical growth of the soft tissue and bone. Finding a shoe to accommodate the deformity can be challenging. Due to abnormal biomechanics and pain, patients with macrodactyly frequently exhibit apropulsive gait.

Treatment options include shoe gear modifications for mild deformity and surgical correction for moderate or severe deformity. The goal of surgical treatment is to produce a painless cosmetically acceptable foot that can be accommodated in regular shoe gear.

Optimal timing of surgical intervention is controversial. Most authors recommend performing the surgery before or around the walking age (12–13 months) in order to minimize the effect on the adjacent digits and prevent gait abnormalities [21, 22]. Some authors, however, advocate waiting anywhere from 4 years of age to skeletal maturity, to facilitate proper assessment of the growth potential of the hypertrophic tissues [23].

Pre-operative evaluation should include clinical examination and weight-bearing X-rays of the affected foot. Procedure selection should be guided by the anatomic location and the level of the deformity. Macrodactyly limited to phalanges can be treated with isolated digital procedures, which include soft tissue debulking, phalangectomy, arthroplasty or arthrodesis, epiphysiodesis, and amputations. Isolated soft tissue debulking is usually not recommended, as it carries a risk of wound healing complications and high recurrence rate [22]. Procedures for shortening of the digit include arthrodesis [19], excision of the distal phalanx and soft tissue reconstruction with a dorsal flap [24], phalangectomy of the middle phalanx [25], and epiphysiodesis of the proximal phalanx [26]. Indications for digit-sparing procedures, however, may be limited to mild cases of static macrodactyly, since these surgeries don't address increased girth of the digit, and are associated with high recurrence rates especially in cases of progressive deformity. Studies suggest that in cases of moderate or severe deformity, and progressive form of macrodactyly, digital amputations may be more successful [18].

Options for treatment of macrodactyly of the forefoot include epiphysiodesis with soft tissue debulking and ray resection. Chang and colleagues have proposed a simple protocol for treatment of forefoot macrodactyly based on the ratio of metatarsal spread angles (MSA) between the affected and unaffected foot [22]. The MSA is measured on anteroposterior weight-bearing radiographs and represents an angle formed by the medial border of the first metatarsal and lateral border of the fifth metatarsal. The authors suggested that MSA can be reduced by an average of 10 degrees following a ray resection. Based on this finding, they suggested that macrodactyly with MSA of less than 10 degrees can be treated with a combination of metatarsal epiphysiodesis and soft tissue debulking, while deformities with MSA greater than 10 should be addressed with ray resection.

Treatment of hallux and first ray macrodactyly is especially challenging due to the important role of the first ray in weight bearing and normal gait. Studies recommend avoiding resection whenever possible and performing shortening and debulking procedures instead [22].

Curly Toes (Fig. 4.6)

Curly or underlapping toe is a common congenital digital deformity characterized by plantarflexion, medial deviation, and varus rotation of the toe at the distal interphalangeal (DIP) or both DIP and proximal interphalangeal (PIP) joints. The condition is often hereditary, with positive family history and autosomal-dominant pattern of inheritance [13]. Bilateral involvement is common. Third, fourth, and fifth digits are most frequently affected [27]. The etiology of the deformity is not completely understood. Curly toes are seen more frequently in patients with flexible pes planus and metatarsal adductus

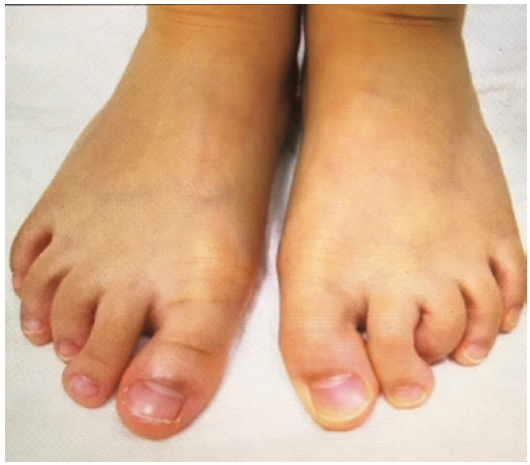

Fig. 4.6 Curly toe

[28], which may suggest that the flexor stabilization mechanism is an important driving force in this deformity.

Curly toes are usually noticed in early infancy. At this stage, they are rarely symptomatic but may cause parental anxiety. Parental reassurance and education are the main goals of that initial visit. Spontaneous self-correction of the deformity before the age of 6 occurs in up to 25% of the patients [29]. Therefore, delaying surgical intervention until the age of 6 is usually recommended.

Toe strapping is one of the available non-operative treatment modalities, which can be attempted at any age. Its effectiveness, however, is controversial. In a study by Turner, toe strapping was performed daily on 28 children over 5 months of age for an average of 13 months [30]. No statistically significant difference was noted in the improvement rates between the study group and a control group, consisting of children, who received no treatment. In another study, Smith and colleagues performed daily toe strapping for 3 months on 68 children with underlapping and overlapping toes, all of whom were no older than 10 days [29]. The authors observed a 94% improvement rate, which led them to suggest that toe strapping may be more successful in younger children.

Surgical treatment is reserved for patients with persistent deformity that is symptomatic. The patients may present with blisters or calluses at the tip of the underlapping toe or the plantar aspect of the adjacent toe. Others may present with nail deformities or pain in shoes [31]. Waiting until the child is at least 6 years old is recommended to allow a toe sufficient time to self-correct. If condition is becoming more semi rigid intervention may take place sooner to minimize the need for osseous procedures to come.Likwise if the child is undergoing another procedure under general anesthesia it may be performed to minimize subsequent anesthesia events. Tendon transfers and tenotomies are recommended for the patients with reducible curly toe deformity, while arthroplasties, arthrodesis procedures, and phalangectomies are reserved for patients with semi-rigid or rigid contractures.

Flexor-to-extensor tendon transfer has been popularized by Girdlestone and Taylor for treatment of claw toes in 1951 [32]. The procedure allows to recreate the dynamic pull of the intrinsic muscles and provides triplanar correction [33]. This procedure was shown to be effective for correction of central curly toes, 2, 3, and 4. The procedure is performed through a dorsolateral incision made over the extensor expansion. The long flexor is divided close to its insertion and transferred dorsolaterally, slightly distal to the extensor expansion, where it is attached under tension. Toe stiffness is a common side effect following this procedure [27].

Open or percutaneous flexor tenotomy may be preferred to flexor-to-extensor tendon transfer to avoid postoperative toe stiffness. The procedure is performed through a small transverse stab incision on the plantar aspect of the toe or a more extensive longitudinal incision [34]. The long and short flexor tendons are released, and the toe is pinned with a K-wire or taped in the corrected position. Studies comparing flexor-to-extensor transfer and flexor tenotomy procedures suggest similar success rates with both procedures, with patient satisfaction being higher with flexor tenotomy [27, 35]. This procedure is also

preferred for treatment of the underlapping fifth toe, for which flexor-to-extensor tendon transfer is not indicated [31].

Treatment of a rigid or semi-rigid overlapping toe involves proximal interphalangeal joint arthroplasty or fusion with concomitant flexor tenotomy or transfer [31]. Dorsolateral closing wedge arthroplasty may be performed to shorten and derotate the digit [36]. The procedure may be supplemented with capsular releases and phalangeal osteotomies for corrections of severe deformities. Postoperatively, the toe is usually held reduced with a K-wire for 6 weeks to prevent loss of correction. Treatment of a rigid underlapping fifth toe represents a surgical challenge. No satisfactory solutions for this problem have been described as of yet.

Overlapping Toes

Overlapping toe is a congenital deformity characterized by adduction and hyperextension of the toe at metatarsophalangeal joint, which results in the toe overriding the adjacent digit. Fourth and fifth toes are most commonly involved [13]. The condition is seen bilaterally in about 25% of patients [37] and may be a source of considerable discomfort. The etiology of the deformity is not completely understood. Strong familial component has been implied. Tightness of dorsomedial capsule, ligaments, extensor tendon, and skin at the medial aspect of the digit is frequently noted [37].

As with curly toes, parents' education and reassurance are essential in treating small children. Depending on the severity of the deformity, crossover toes may remain asymptomatic, which is the case in about 50% of the patients [38]. Spontaneous resolution of the deformity when the child begins to walk occurs in about 15% of the cases [37].

Symptomatic patients complain of painful corns on both the overriding and the underriding digits, pain on the ball of the foot, footwear-related discomfort, and activity limitations. Non-operative treatment options include toe strapping, shoe gear accommodations, callus debridement, orthotics, and activity modification. The effectiveness of toe strapping is controversial [29, 30], but it may provide temporary relief by holding the toe in the reduced position while the patient is wearing shoes.

Surgical treatment options include soft tissue procedures, osseous corrections, and amputations. Soft tissue procedures are indicated for treatment of reducible deformities in younger patients and consist of skin plasties, soft tissue releases, and tendon transfers.

Dorsomedial skin contracture at the base of the overlapping toe can be addressed with V-to-Y skin plasty [39, 40], double-racquet incision [38], or syndactylization of the overlapping toe to the adjacent digit [41]. When performing a V-to-Y plasty, a V-shaped incision is placed over the dorsomedial base of the affected toe [40]. The apex of the incision is extended proximally to form a "Y" and is closed without tension. No high-quality outcome data on this technique is available, but in his small case series of 10 patients with overlapping 5th toes treated with a combination of V-to-Y skin plasty, capsulotomy, and extensor tenotomy, Paton reported deformity recurrence in 60% of the patients at 2 years mostly due to formation of the hypertrophic scar [40]. Double-racquet incision was described by Butler and consists of a circumferential incision around the base of the digit with plantar and dorsal handles, which allow for contracture release and skin closure [38]. In his retrospective case series of 36 pediatric patients with overriding 5th toe, Black reported excellent results in 78% of the patients. Potential complication of this procedure is neurovascular compromise, which can be avoided by employing meticulous dissection. Syndactylization of the overlapping toe with an adjacent toe (usually 4th and 5th toes) has been advocated for young children as a technically simple technique for permanent splinting of the overlapping toe. Good functional outcomes have been reported by Marek et al. [42]. In older children and adults with a more rigid deformity, concomitant phalangectomy is recommended [13]. Abnormal cosmetic appearance of the toe following the procedure may be a cause of dissatisfaction for the parents and the patient. Therefore,

thorough pre-operative discussion with the parents and patient is recommended.

Extensor tendon lengthening or release, along with release of dorsomedial metatarsophalangeal joint capsule, is an important part of soft tissue correction for treatment of the overlapping toe. Lapidus reported excellent results with extensor stabilization consisting of transfer of the long extensor tendon to the abductor digiti minimi [43]. The drawbacks of the procedure are extensive dissection and postoperative toe stiffness.

Osteotomy or arthroplasty is indicated for treatment of the rigid overlapping toe deformity, which is usually seen in older patients. Complete proximal phalangectomy of the 5th toe has been described with mixed outcomes due to high incidence of overshortening of the toe leading to hammertoe deformity of the adjacent digit [13].

Amputation of the overlapping toe was popularized in the 1940s but subsequently drifted out of favor mostly due to cosmetic concerns. Amputation remains, however, a simple procedure with rapid functional recovery and effective pain relief [31]. Occasional complaints of prominent 5th metatarsal head leading to plantar lateral callus formation can be addressed with padding or possible osseous procedure of the metatarsal.

Digital Deformities and Genetic Syndromes

Congenital digital deformities may occur as an isolated condition or as a part of a known genetic syndrome. In some cases, digital deformities may be the most easily recognizable manifestations of a generalized genetic disorder. A foot and ankle surgeon may, therefore, be the first clinician to make the diagnosis and refer the patient for further evaluation. For this reason, general knowledge of genetic syndromes associated with digital pathology and understanding of the elements of history and clinical exam that may provide the necessary clues are very important. Below, we provide a brief review of the genetic syndromes associated with digital deformities.

Polydactyly is encountered in over 300 of well-characterized genetic syndromes [44, 45]. When it is a part of a generalized genetic condition, polydactyly can be seen in several generations and be bilateral and symmetrical [44]. Ellis-Van Creveld syndrome is an autosomal recessive condition characterized by postaxial polydactyly; dwarfism; dysplasia of nails, teeth, and gums; and congenital heart disease. About half of the patients die in early childhood due to cardiopulmonary complications. The rest of the patients may live well into the adulthood and be functional members of the society occupying variety of jobs despite their significant orthopedic malformations. Weiner reported on a large community of Amish patients with Ellis-Van Creveld living in rural Pennsylvania, who successfully participated in a variety of manual labor jobs [46].

Polydactyly is a commonly seen feature of Down syndrome, or Trisomy 21. Patients with this disorder suffer from intellectual and physical disability, generalized joint laxity, and hypotonia. Foot problems are very prevalent in this patient population, with up to 66% of patients experiencing foot pain daily [47]. Besides polydactyly, patients with Down syndrome often present with severe pes planus and hallux valgus [48]. The clinical exam of these patients is notable for reduced lower extremity muscle strength, apropulsive gait pattern, and postural instability [49]. Treatment approach to these patients should be focused on reducing pain and providing a stable weight-bearing platform. Multiple deformities may need to be addressed simultaneously instead of focusing on correcting just one specific deformity or one area of the foot.

Multiple syndactylies of the hands and feet are the hallmark of Apert's syndrome. The condition is very rare, with incidence of 1 case per 65,000 live births [50]. It is characterized by craniosynostosis, midfacial hypoplasia, syndactyly of all digits, and a broad thumb or hallux. Other common features seen in patients with Apert's are fusions between metatarsals and tarsal coalitions (Fig. 4.7) [51].

The extent and severity of a limb deformity dictates treatment approach. As is the case in patients with Down syndrome, the surgical goal for patients with Apert's syndrome is to provide

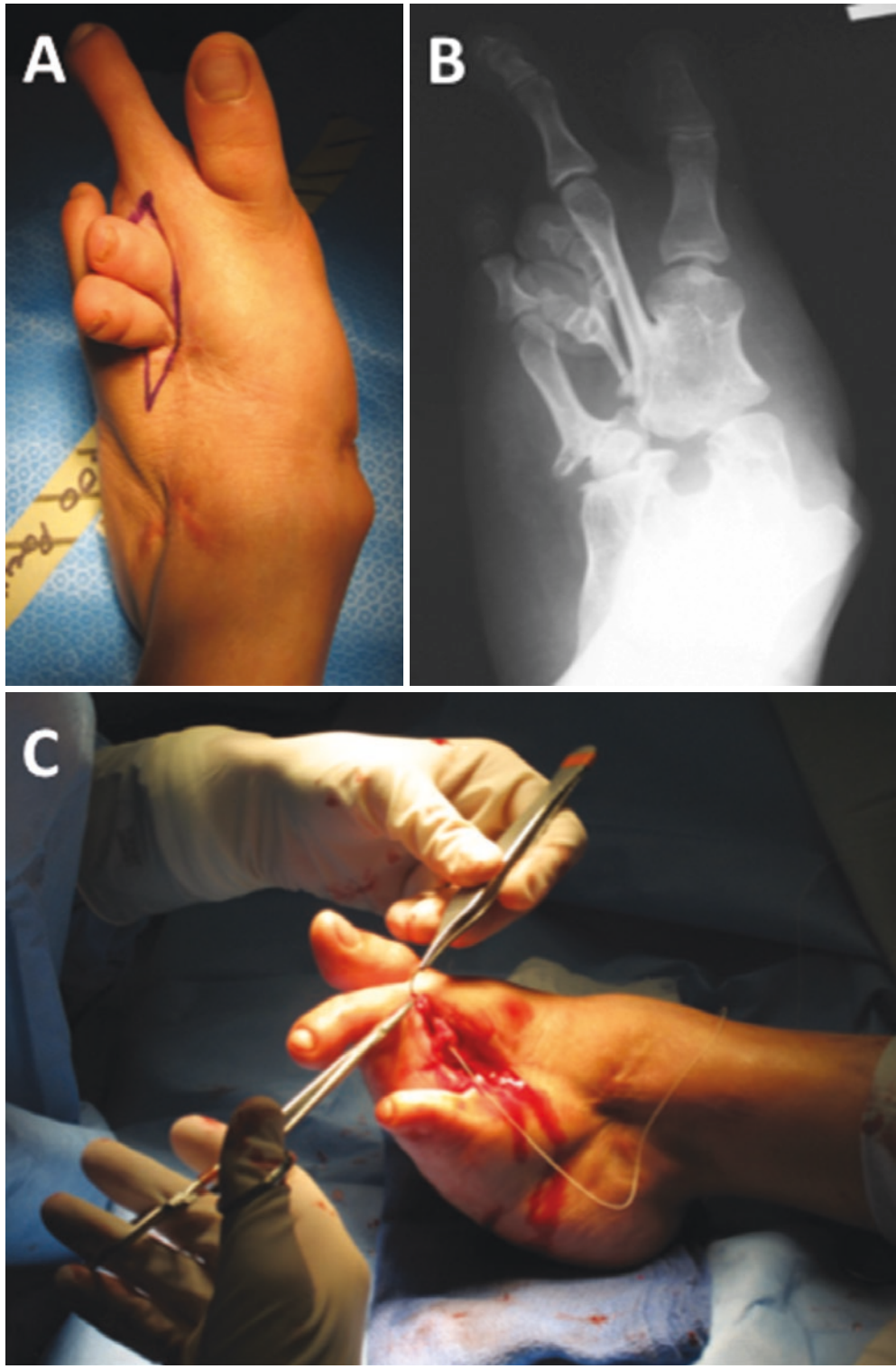

Fig. 4.7 (**a**) Clinical presentation of Apert's syndrome. (**b**) Abnormal configuration of forefoot and tarsal bones. (**c**) Amputation of digits

a stable pain-free platform for walking. Release of syndactylies is not recommended unless the syndactyly is associated with polydactyly [50]. Osteotomies and amputations are used to address a fixed deformity. As with majority of syndromes, addressing the whole foot instead of its specific parts is recommended to provide more functional results and avoid additional surgery.

Premature birth and low birth weight is associated with cerebral palsy. With increased survival rates of premature infants among neonatal intensive care units, clinicians may see more digital deformities linked to cerebral palsy and the equinus, equinovarus, or valgus deformities which can arise. Early intervention is key to assist with developmental delays while deformities of the foot and digits require individual evaluation.

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