

CONGENITAL OVERLAPPING FIFTH TOE DEFORMITY: A Consolidated Surgical Approach

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The congenital overlapping fifth toe deformity, also known as congenital digitus minimus varus or congenital digitus quinti varus, is a complex and challenging condition which requires equally complex and challenging treatment. There are three primary components to the overlapping fifth toe which make it a triplane deformity. Adduction in the transverse plane, dorsiflexion in the sagittal plane, and varus rotation (i.e., external rotation) in the frontal plane all occur at the fifth metatarsophalangeal joint. Rarely, contracture will also occur within the fifth toe itself. Due to the toe's position, the deformity has shortening or contracture of the medial collateral ligament, the medial aspect of the metatarsophalangeal joint, the extensor digitorum longus tendon slip, and the skin of the dorsomedial aspect of the fourth interdigital web space. With time, osseous adaption of the proximal phalanx or fifth metatarsal head can also develop. Due to its position, the overlapping fifth toe will often appear smaller and flattened, losing its cylindrical appearance and taking on a paddle-like shape (Figure 1). The deformity may be unilateral or bilateral, and appears to occur equally in males and females.¹



Figure 1. Classic appearance of congenital overlapping fifth toe deformity in an adult. Note the flattened or paddle-like appearance of the toe.

ETIOLOGY

It is generally agreed that the overlapping fifth toe deformity is congenital and usually hereditary (Figure 2). Several authors have attempted to explain the possible etiology. Lantzounis² felt that the deformity was secondary to a prolonged malposition of the fifth toe in utero. Others have suggested that the deformity may be secondary to the failure of proper development of the articular surfaces of the fifth metatarsophalangeal joint. Dobbs³ suggested that there may be a biomechanical role for the various components of the deformity. He described a displacement of the insertion of the flexor digitorum longus as the forefoot abducts on the rearfoot, especially in a pronated foot. This displacement leads to an abnormal medial force at the insertion of the long flexor into the distal phalanx. According to Dobbs, this leads to varus rotation of the fifth toe and adduction of the intermediate and distal phalanges. As the flexor tendon displaces, a stable plantarflexory force is lost, allowing dorsiflexory contracture at the fifth metatarsophalangeal joint. This biomechanical rationale may explain the deformity in some adults, or the progression of the



Figure 2. Congenital overlapping fifth toe deformity in a newborn. The presence of the deformity in a newborn strongly supports intrauterine or developmental factors as potential etiologies of the deformity.

deformity in some individuals, but does not appear to be the only etiology. As already noted, the deformity is often present at birth and clearly has developed before any weight-bearing force has been applied to the foot.

CLINICAL PRESENTATION

The congenital overlapping fifth toe deformity is usually asymptomatic in infancy and early childhood, but typically becomes symptomatic as the child matures and approaches adulthood. In some instances, the deformity does not become painful until later in life. Approximately 50% of overlapping fifth toe deformities remain asymptomatic throughout the patient's life. Of those who develop symptoms, most will report dorsal digital irritation to the fifth toe or a painful heloma durum on the top of the toe. Conventional shoes often aggravate the toe. Less frequently, a heloma molle in the fourth web space or an onychoclavus (a corn or callous along the nail groove) will be the cause. Often, even when the deformity is asymptomatic, the patient or the parents may be concerned over the cosmetic appearance of the toe and the potential for future problems.

Careful evaluation of the overlapping fifth toe deformity will allow the clinician to determine its flexibility and the status of the fifth metatarsophalangeal joint. The tautness of the extensor digitorum longus tendon slip to the fifth toe and the dorsal-medial skin can be assessed by plantarflexing the fifth metatarsophalangeal joint. Palpation of the fifth metatarsophalangeal joint will generally allow an estimation as to the amount of joint subluxation or dislocation. Radiographs will confirm the status of the fifth metatarsophalangeal joint and reveal any osseous adaption of the fifth ray components. Although not mentioned in the literature, the author has found that more aggressive treatment for the deformity is necessary if the deformity is more rigid in nature; associated with an irreducible or dislocated fifth metatarsophalangeal joint; or associated with congenital or adaptive osseous changes.

CONSERVATIVE TREATMENT

Most authors contend that conservative treatment is ineffective in the treatment of the congenital overlapping fifth toe deformity. In very mild cases

or in the very young patient, stretching or strapping of the toe in abduction and plantarflexion can be attempted. Jordan and Caselli⁴ advocated a simple adhesive splint, which they applied at as young an age as possible (but not younger than 4 or 5 months of age, because the digit is not long enough until then). They stated that "Alignment of the deformed digits may be expected within 4 to 6 weeks depending upon the age of the patient and the severity of the deformity. Complete correction is then achieved by retaining the properly aligned digit for an additional 2 to 8 weeks in its corrected attitude."⁴ In the older patient, accommodation is the only reliable non-surgical treatment available. The use of padding, digital shields or molds, and extra-depth shoes or sandals may alleviate digital irritation in some patients.

When conservative treatment fails or when symptoms warrant, surgical intervention is indicated. Occasionally, a patient will request correction of an overlapping fifth toe deformity for cosmetic reasons alone and debate continues as to whether a surgeon should consider such a request. Those in favor of cosmetic correction suggest that most patients develop symptoms later in life and that early treatment of the deformity may help prevent later disability.⁵ Those against correction for cosmetic reasons alone argue that because approximately 50% of all cases remain asymptomatic, the risks of surgery do not merit the repair of the deformity when symptoms are not present. Hulman⁶ reported good cosmetic results and patient satisfaction when a soft tissue repair of the deformity was performed primarily for cosmetic reasons. However, other authors have reported less than desirable results when operations for the correction of the overlapping fifth toe are performed primarily for cosmetic reasons.^{7,8} Dyal et al⁹ suggested that before performing surgery on a patient who is interested in improved cosmesis, the surgeon should consider showing the patient photographs of a typical postoperative result so that the patient has realistic expectations.

SURGICAL TREATMENT

Numerous procedures have been described in the literature for the correction of the congenital overlapping fifth toe deformity. The oldest surgery for the deformity is amputation. However, following simple amputation of the fifth toe, it became recognized that painful callouses developed around

the head of the remaining fifth metatarsal.¹⁰ Other deformities, such as hammertoes, lesser digital drift, irritation to the fourth toe, or lesser metatarsalgia have also frequently resulted after amputation¹ (Figure 3).

In the 1940s, owing to the stigma associated with an amputation, and in some areas stimulated by the need for an alternative surgery in Civil Service applicants (who could not obtain Civil Service employment with either an overlapping fifth toe deformity or an amputated fifth toe), other procedures were developed. Most of these procedures emphasized soft tissue correction, but some also included osseous procedures. The objective of each technique was to reduce the three primary components of the deformity (the dorsiflexion, adduction, and varus rotation present at the fifth metatarsophalangeal joint).

In 1940, Lantzounis² described his proposed procedure. Through a dorsal longitudinal incision centered over the fifth metatarsophalangeal joint, he isolated the extensor digitorum longus tendon slip to the fifth toe and sectioned it at the distal end of the incision. He then longitudinally incised the periosteum over the distal end of the fifth metatarsal, the joint capsule, and the periosteum over the base of the proximal phalanx of the fifth toe. Lantzounis then created what he termed a "periosteocapsular flap" by elevating the incised periosteum and capsule dorsally, laterally, and medially. A drill hole was then created at the distal end of the fifth metatarsal and the proximal end of the severed tendon slip was threaded through the drill hole and sutured back onto itself. A horizontal mattress suture was placed into the "periosteocapsular flap" plantarly and tied with the toe held in a corrected position. Simply stated, the procedure was a modified Joneis suspension of the extensor digitorum longus tendon, a dorsal capsulotomy, and a plantar capsulorrhaphy. Lantzounis reported his results in 25 of the procedures in 19 patients. Patient age ranged from 2 to 25-years-old with an average age of 12 years old. One patient who had undergone correction for bilateral deformities was lost to follow-up, leaving a total of 23 operations that he reviewed from 8 months to 6 years post-operatively. Lantzounis found excellent results in 16 cases (70%), good results in 4 cases (17%), and poor results in 3 cases (13%).

In 1942, Lapidus¹¹ described another unique procedure for the correction of the congenital over-

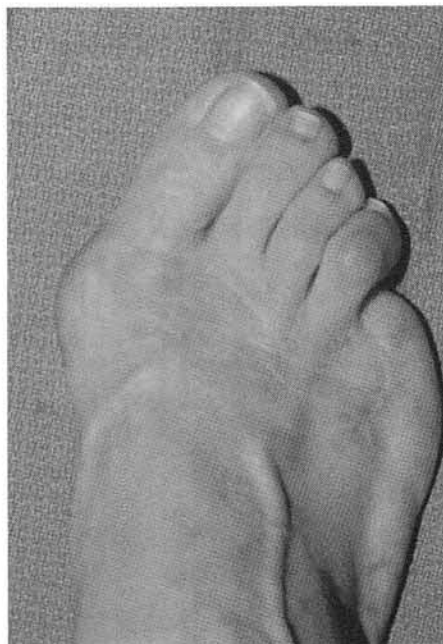


Figure 3. Patient who underwent amputation of a congenital overlapping fifth toe as a teenager. Note that the patient now has lateral drifting of her remaining lesser digits, a corn on the fourth toe, and a bunion deformity. The patient also complained of metatarsalgia under the fourth metatarsal.

lapping fifth toe deformity. He approached the deformity through a hockey-stick incision made along the dorsomedial border of the fifth toe, starting at the distal interphalangeal joint and running proximally to the fourth web space and then curving laterally over the dorsum of the fifth metatarsophalangeal joint and continuing dorso-laterally to the lateral aspect of the fifth metatarsal head. Next, a separate transverse incision was made over the extensor digitorum longus tendon at the midshaft of the fifth metatarsal. The extensor tendon slip to the fifth toe was identified and transected. The tendon was then gently pulled distally into the wound over the fifth toe. After the extensor tendon was harvested, a capsulotomy of the fifth metatarsophalangeal joint was performed. Next, an oblique subcutaneous channel was created from the distal interphalangeal joint of the fifth toe dorsomedially under the phalanges to the plantar-lateral aspect of the fifth metatarsophalangeal joint. The previously harvested extensor tendon was then rerouted through the channel created and sutured, under tension with the toe held in the corrected position, to the conjoined tendon of the abductor digiti quinti and flexor digitorum brevis to the fifth toe. Lapidus stated that

his results had been "quite satisfactory" in a "few cases", but did not give more specific details regarding the efficacy of his espoused procedure.

Whereas Lantzounis and Lapidus primarily dealt with the extensor tendon and joint capsule, in 1943, Goodwin and Swisher¹⁰ suggested release of the dorsal skin contracture as well. The authors advocated a Y-shaped incision over the dorsum of the fifth metatarsophalangeal joint with the stem of the "Y" extending proximally. The branches of the "Y" were situated diagonally distalward about halfway around the fifth toe. The incision was then carried deep and a Z-plasty lengthening of the extensor digitorum longus tendon and a dorsal or dorsomedial capsulotomy of the fifth metatarsophalangeal joint was performed. The toe was held in the corrected position and closure was accomplished. The proximal arm of the "Y" is progressively closed distalward allowing the triangular flap of skin to slip distally as far as is necessary to allow closure of the skin without tension. In this sense, the authors' incision is closed in typical V-Y skin plasty fashion. Postoperatively, the authors stressed the need for maintenance of the corrected position for up to 6 weeks with either a plaster-of-Paris cast or an adhesive strapping. In reporting their results, the authors were brief in stating that their "technique has been highly successful in 100 percent of a series of about twenty cases, including males and females, children and adults, and patients in both private and institutional practice."¹⁰

Similar to Goodwin and Swisher, Stamm,¹² and Wilson¹³ described a V-Y skin plasty for part of the correction of the congenital overlapping fifth toe deformity. They created a V-shaped skin incision over the fourth web space with the base oriented distal-lateral and the apex proximal-medial. The skin flap was then elevated and a tenotomy of the extensor tendon and capsulotomy of the fifth metatarsophalangeal joint performed. Closure was then accomplished with the toe held in a corrected position and the incision closed in V-Y skin plasty fashion. Like Goodwin and Swisher, Wilson emphasized the need for postoperative maintenance of the correction with a plaster-of-Paris cast for several weeks. Wilson felt the procedure was best suited for patients under the age of 30, and reported his results in 7 cases followed over a 2-year period. He described "very satisfactory" functional results in all of the cases with 1 slight recurrence due to an error in operative technique.

Stamm did not give any results in his description of the procedure.

Many years later, in 1990, Paton¹¹ reported on the long-term results of Stamm's and Wilson's approach. He noted that advocates of the V-Y plasty felt that the procedure was a successful, technically straight-forward approach. Conversely, he noted that detractors of the operation insisted there was a high recurrence rate. Paton reviewed 20 V-Y plasty procedures in 16 children with a mean age of 9 years, 2 months. Early retrospective assessment of his cases demonstrated good results in 14 patients (70%), acceptable results in 3 patients (15%), and poor results in 3 patients (15%). Later follow-up at an average of 25 months postoperative revealed a marked deterioration in the reported success of the procedure. At the second follow-up, there were good results in 6 patients (30%), acceptable results in 2 patients (10%), and poor results in 12 patients (60%). In light of the poor long-term results, Paton recommended that the V-Y plasty approach for the correction of a congenital overlapping fifth toe deformity be abandoned.

In one of the most unique approaches, Cockin¹⁵ reported on an operation he attributed to Mr. R. Weeden Butler. He related that Butler had performed his operation since the early 1950's. Cockin described Butler's procedure as a double racquet incision with a circumferential incision around the toe (i.e., the racquet head) and a dorsal and plantar handle. The plantar handle was made slightly longer and was inclined laterally to allow improved position of the toe at closure. The skin flaps created were then raised with careful preservation of the neurovascular bundles. An extensor tenotomy and dorsal capsulotomy of the fifth metatarsophalangeal joint were performed. Next, the toe was swung downward and laterally into a corrected position and closure accomplished. After closure, the resultant dorsal incision would be longer than the plantar incision. Cockin reported on 70 cases in 55 patients (age range 5 months to 45 years). Follow-up evaluation was done from 1 to 10 years postoperative. Cockin reported 64 cases (91%) as having good results (i.e., satisfactory to both surgeon and patient with full correction of the deformity), 4 cases (6%) as fair results (i.e., satisfactory to the patient with an element of the deformity left uncorrected), and 2 cases (3%) as failures (i.e., recurrence of the deformity). Cockin reported 2 cases of wound infection, 3 cases of

delayed healing, but no cases of long-term neurovascular compromise.

In 1985, Black et al¹⁶ reported on their experience with the Butler procedure. They evaluated 36 procedures in 30 patients. Their patients ranged in age from 3 to 18 years of age and were assessed at an average of 28 months postoperative. They reported excellent results (i.e., satisfactory to both patient and surgeon with full correction of the deformity) in 28 cases (78%), good results (i.e., satisfactory to the patient in terms of pain relief and footwear, but did not show full correction and had excessive scar formation) in 6 cases (17%), and failure (i.e., recurrence of the deformity with pain and an unacceptable scar) in 2 cases (6%). These surgeons reported one significant dysvascular episode immediately postoperative, which ultimately resolved with no permanent damage to the toe. In 1993, DeBoeck¹⁷ reported that 16 of 17 patients had satisfactory results after the Butler procedure. The one unsatisfactory result was a mild recurrence.

As an alternative, surgical syndactylization (i.e., webbing of the fourth and fifth toes together) has been championed by several authors.¹⁸⁻²² In infancy and early childhood, syndactylization of the fourth and fifth toes alone is used to correct the deformity. As the deformity becomes more fixed later in life, the syndactylization is accompanied by either a partial or complete proximal phalangectomy. A dorsal fifth metatarsophalangeal joint capsulotomy and tenotomy of the extensor tendon are typically a part of the procedure. In 1950, McFarland¹⁸ was the first to discuss this surgical approach. He described his early results as "promising", but provided no further follow-up data. In 1954, Scrase¹⁹ reported on a series of syndactylization procedures combined with excision of the base of the proximal phalanx of the fifth toe. In his 42 cases, he reported 39 (93%) good results and 3 (7%) fair results. Scrase did not provide his criteria for what he termed a "good result" or a "fair result." In 1965, Leonard and Rising²¹ discussed their success in 8 cases of syndactylization performed on 6 patients with a congenital overlapping fifth toe deformity. They stated that "All have had satisfactory results except one in which the deformity was not completely corrected at the time of surgery." They noted follow-up for as long as 5 years with no recurrence of the deformity reported. Recognizing the results of McFarland, Tachdjian²² has espoused surgical syndactylization as his procedure of choice for congenital overlapping fifth toe deformities.

Conversely, Giannestras²³ condemned syndactylization for the overlapping fifth toe deformity as he felt "it produces a deformity in order to correct a deformity." Giannestras felt that the Lantzounis procedure or Butler procedure were better options which "have withstood the test of time both from a functional and cosmetic standpoint."

In 1954, Ruiz-Mora²⁴ described yet another approach to the overlapping fifth toe deformity. His procedure consisted of a total proximal phalangectomy performed through a plantar longitudinal skin ellipse. Closure of the plantar skin ellipse aids in the prevention of recurrent deformity. Janecki and Wilde²⁵ reported on their experiences with the Ruiz-Mora procedure. They performed the procedure on 28 patients, but 6 were lost to follow-up. Subsequently, they followed 31 procedures in 22 patients for an average of 3.5 years postoperative. Their patients were older, averaging 48 years of age at the time of surgery. They reported that all of the patients had complete relief of their symptoms and correction of the deformity with a good cosmetic appearance of the shortened fifth toe. However, Janecki and Wilde noted two significant problems postoperatively in their patients. First, in 10 of their cases (32%) a hammertoe deformity of the adjacent fourth toe with a painful corn developed due to the excessive shortening of the fifth toe caused by the Ruiz-Mora technique (Figure 4). None of these patients had a pre-existing hammertoe deformity of the fourth toe. Second, in 7 of their series (23%) a painful prominence of the fifth metatarsal head or a tailor's bunion developed. Five of these 7 patients had both a bunionette and a painful corn on the fourth toe. Based upon their findings, Janecki and Wilde recommended less bone resection and suggested excision of only the head and neck of the proximal phalanx. They did not report any follow-up on their proposed modification. In 1997, Dyal et al.⁹ also reported the long-term results in their series of patients who underwent a Ruiz-Mora procedure. They performed the procedure 36 times on 29 patients, and were able to follow only 12 of the patients who underwent 13 procedures. The average age of their patients at the time of surgery was 54.3 years and their average follow-up was 4.4 years. They reported general improvement following the surgery, but related that a significant number (25%) of their patients were dissatisfied with the cosmetic result. These authors measured the fifth toe length on preoperative and postoperative radiographs and



Figure 4. Postoperative appearance approximately 2 years after a Ruiz-Mora procedure for a congenital overlapping fifth toe deformity. Note the significant shortening of the fifth toe. The patient presented complaining of digital irritation to her other lesser toes (toes 2,3,4).

found an average of 1.28 cm shortening following the procedure. Eight of the 12 patients (67%) related they would undergo the surgery again and 4 patients (33%) said they would not.

In 1964, Thompson²⁶ discussed his modification of the Ruiz-Mora procedure. He added a dorsal Z-plasty skin approach to the other components of the Ruiz-Mora procedure (the proximal phalangectomy and plantar skin ellipse). He felt that this helped maintain the correction, but did not give any specific results.

Kaplan²⁷ also offered a new procedure in 1964 which was very similar to that espoused by Janecki and Wilde in the 1970s. Through a dorsal longitudinal incision, Kaplan performed an extensor tendon transfer by sectioning the extensor tendon at the proximal interphalangeal joint and reinserting it into the base of the proximal phalanx. Next, he performed a capsulotomy of the dorsal, medial, and lateral aspects of the fifth metatarsophalangeal joint. The head of the proximal phalanx was then excised. Plantarly, two semi-elliptical incisions were made at the web of the fifth toe and the resulting wedge of skin excised. Closure was then accomplished. Kaplan reported performing the procedure in 59 cases with no failures.

A few other procedures have been described more recently, but have not become overly popular. In 1971, dissatisfied with earlier approaches, Anderson²⁸ accurately noted that a combined approach was necessary to correct the overlapping fifth toe deformity. He combined resection of the fifth metatarsal head and/or the head of the proximal phalanx with a dorsal V-Y skin plasty, dor-

sal fifth metatarsophalangeal joint capsulotomy, Z-plasty lengthening of the extensor tendon, and plantar skin ellipse. No results were given by Anderson in his paper. In 1978, Rosner et al.²⁹ described a procedure consisting of an abductory wedge osteotomy of the proximal phalanx, a dorsal and medial fifth metatarsophalangeal joint capsulotomy, and an extensor tenotomy. Their wedge osteotomy was made approximately 5 mm distal to the fifth metatarsophalangeal joint with the base lateral and the apex medial. The osteotomy was fixated with a Kirschner-wire (K-wire). Rosner et al reported performing the procedure in only 1 patient, and provided no long-term results. Most recently, Thordarsen³⁰ advocated a soft tissue approach with a Z-plasty of the skin, extensor tendon lengthening, and release of the fifth metatarsophalangeal joint capsule dorsally. He reported good results in 3 patients followed an average of 33 months.

Although numerous approaches have been endorsed for the congenital overlapping fifth toe deformity, none has been met with universal acceptance. This is most likely due to the recalcitrant nature of the deformity and the significant potential for recurrence following any surgical approach short of amputation. Further, those procedures that limit the likelihood of recurrence (amputation or the Ruiz-Mora procedure) tend to create new problems or deformities (Figures 3, 4). Most of the procedures described are effective for the mild deformity and even work in some cases for more severe deformity. Unfortunately, many of the procedures fail to correct at least one of the features of the deformity and therefore recurrence occurs.

In order to surgically correct a congenital overlapping fifth toe deformity, all aspects of the deformity must be corrected. Dorsally and medially, the contracted skin, extensor tendon, and fifth metatarsophalangeal joint capsule must be released or lengthened. Plantarly and laterally, redundant soft tissues such as the skin and fifth metatarsophalangeal joint capsule must be tightened. Finally, any osseous deformity must be addressed. Drawing upon the historical approaches for the deformity, the author proposes a "consolidated surgical approach" for the correction of the overlapping fifth toe deformity.

Consolidated Surgical Approach

The *consolidated surgical approach* attempts to address all of the components of the overlapping fifth

toe deformity. Generally, less aggressive correction will be required for the more flexible deformity or deformity present in the younger patient, while more aggressive correction will be necessary for the rigid deformity or deformity present in the adult. The components of the deformity are as follows:

1. Dorsal or dorsomedial skin contracture;
2. Extensor digitorum longus tendon contracture;
3. Dorsal or dorsomedial fifth metatarsophalangeal joint capsule contracture and plantar plate adherence;
4. Osseous adaption of the fifth metatarsal head, proximal phalanx, or other bony structures;
5. Plantar or plantar-lateral fifth metatarsophalangeal joint capsule redundancy;
6. Plantar or plantar-lateral skin redundancy.

The first component of the deformity to be addressed is the dorsal or dorsomedial skin contracture. A dorsal or dorsomedial Z-plasty skin approach is utilized. The central arm of the Z-plasty is placed directly in line with the skin contracture. If the contracture is dorsal, the central arm is placed longitudinally over the fifth metatarsophalangeal joint. If the contracture is dorsomedial, the central arm is placed diagonally from proximal-medial to distal-lateral over the fourth intermetatarsal space. The arms of the Z-plasty are then made with each arm forming a 60-degree angle with the central arm of the "Z" (Figure 5). After the Z-plasty has been planned, the incision can be carried distally onto the fifth toe by longitudinally extending the central arm of the "Z." In cases of severe deformity and skin contracture, a double Z-plasty incision may be necessary to achieve enough lengthening of the dorsally contracted skin (Figure 6A). Dissection is then carried deep through the subcutaneous tissues carefully preserving the subcutaneous tissues and vascular supply of the flaps created by the Z-plasty (Figure 6B). At the time of closure, the flaps of the "Z" are transposed and sutured in standard Z-plasty fashion, and the distal, longitudinal extension onto the toe is closed.

The next component of the deformity to be addressed is the extensor digitorum longus tendon to the fifth toe. If the deformity is mild and/or flexible, an open Z-plasty lengthening of the tendon is performed. In such cases, after full correction is



Figure 5. Z-plasty skin incision oriented to correct dorsomedial skin contracture.

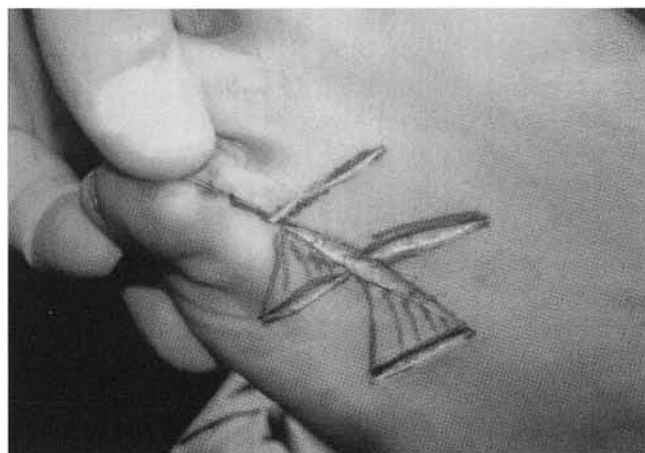


Figure 6A. Consolidated surgical approach for correction of severe congenital overlapping fifth toe deformity in a young adult. Dorsal double Z-plasty skin incision is planned.



Figure 6B. Skin incisions are made carefully preserving the blood supply to the Z-plasty skin flaps.

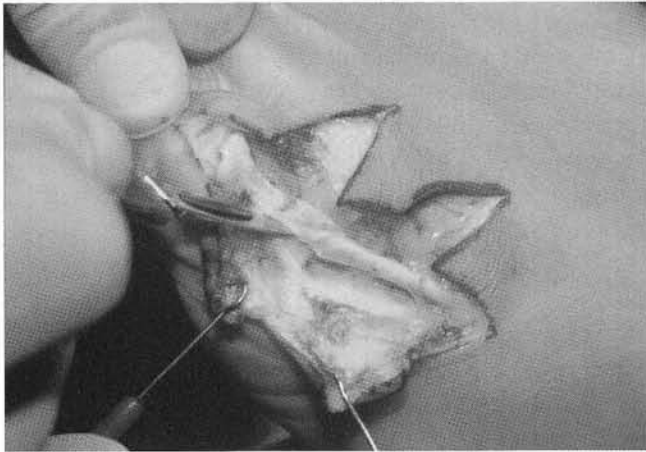


Figure 6C. Extensor digitorum longus tendon is identified and sectioned at the level of the PIPJ.

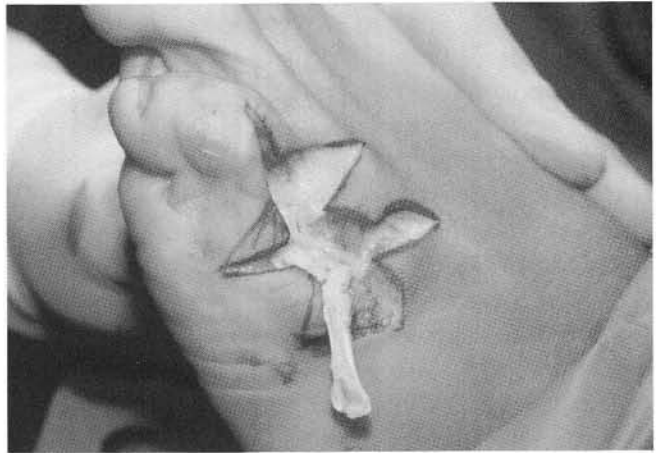


Figure 6D. Extensor hood recession is performed and the tendon is dissected free proximally to the fifth metatarsal head.

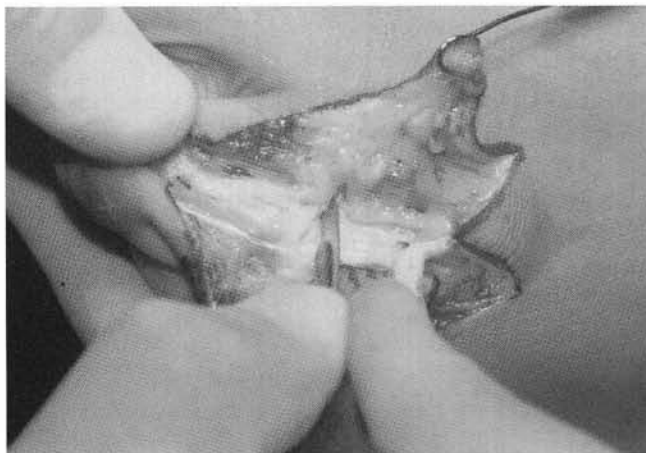


Figure 6E. Dorsal and dorsomedial capsulotomy are performed.

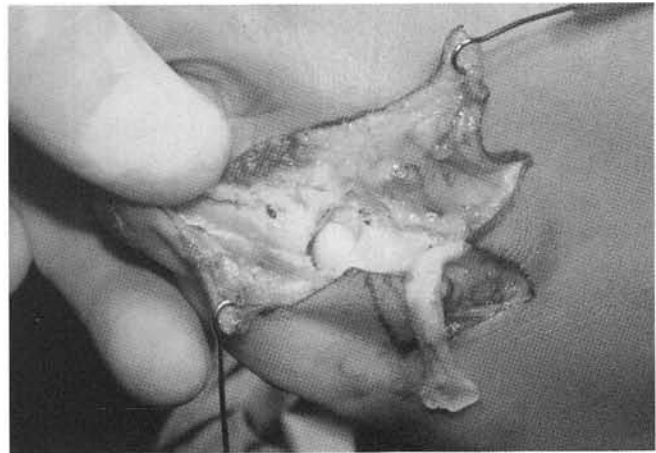


Figure 6F. Fifth metatarsophalangeal joint is exposed.

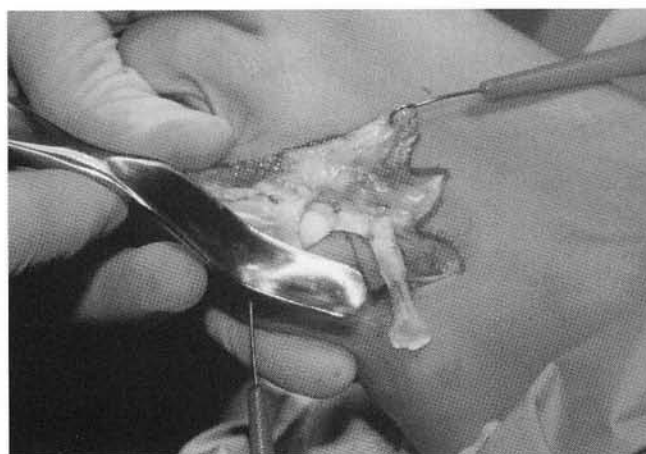


Figure 6G. McGlamry elevator is used to release the plantar plate of the fifth metatarsophalangeal joint.

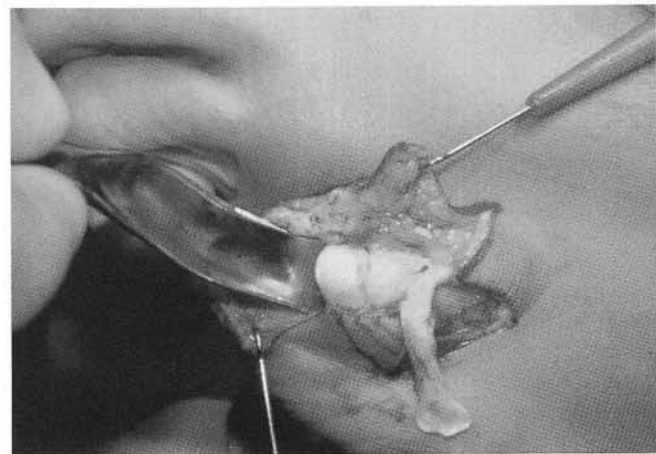


Figure 6H. McGlamry elevator being passed between the fifth metatarsal head and plantar plate to accomplish the release.

obtained, the tendon is reapproximated in a lengthened position. If the deformity is moderate to severe and/or fixed in nature, the tendon is transected at the proximal interphalangeal joint and later transferred to the fifth metatarsal neck creating a modified Jones' tenosuspension. In all cases, a complete release of the extensor hood apparatus is performed (Figures 6C, 6D).

The third component of the deformity is the fifth metatarsophalangeal joint contracture. Once the extensor tendon has been reflected, the joint can be directly addressed. A capsulotomy of the dorsal, medial, and occasionally the lateral aspects of the joint capsule is performed (Figures 6E, 6F). Release of the plantar plate is then accomplished by passing a McGlamry elevator or other blunt instrument into the capsulotomy incision and between the fifth metatarsal head and the plantar plate (Figures 6G, 6H). The capsule is not closed dorsally or medially.

After a complete soft tissue release has been achieved dorsally and medially, the osseous structures and adaption can be more readily assessed. If osseous deformity or adaption has occurred at the proximal interphalangeal joint, resection of the proximal phalangeal head is accomplished (Figures 6I, 6J). This is commonly needed in adults or in more rigid deformities. Rarely, in very severe deformities or following recurrence, a partial or total fifth metatarsal head resection or implantation of the fifth metatarsophalangeal joint is considered to aid in reduction of the fifth metatarsophalangeal joint deformity (Figure 6K).

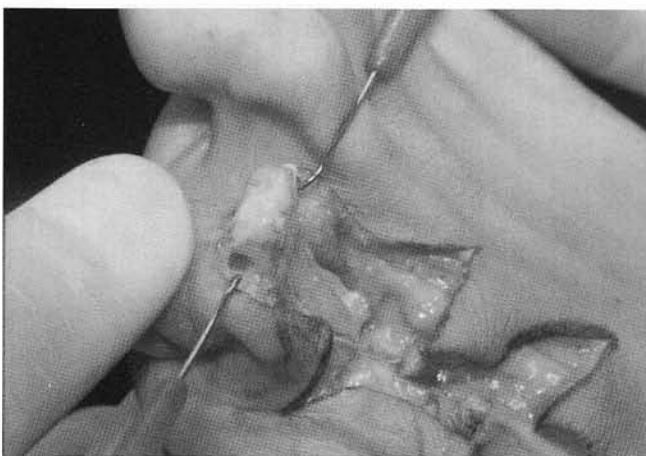


Figure 6I. Contracture at the PIPJ is noted with adaption of the proximal phalangeal head.

The fifth component to be addressed is the plantar or plantar-lateral fifth metatarsophalangeal joint capsular redundancy. In milder or more flexible deformities, no plantar capsulorrhaphy is performed. In moderate to severe deformities, a plantar capsulorrhaphy similar to that described by Lantzounis² is executed.

The sixth and final component is the plantar skin redundancy. An ovoid- or diamond-shaped skin ellipse is removed from the plantar web area of the fifth toe (Figure 6L). This skin wedge is designed to remove the redundant plantar skin and to aid in the maintenance of the correction. The skin ellipse can be angled slightly more laterally at its proximal end to further aid in achieving the desired position of correction. Careful dissection of the skin wedge is necessary. Only skin should be removed, and the deeper subcutaneous tissues containing the neurovascular elements should not be violated (Figure 6M). The plantar skin plasty is then closed with non-absorbable suture (Figure 6N).

Once full correction has been achieved, closure is accomplished. In more long-standing or rigid deformities, the extensor tendon is transferred to the neck of the fifth metatarsal. To accomplish this, a small (2 or 3 mm diameter) bone trephine is used to create a channel from lateral to medial through the fifth metatarsal (Figures 6O, 6P). Then, as described by Lantzounis,² the extensor tendon is routed through the trephine hole and sutured back upon itself (Figures 6Q, 6R). Otherwise, the extensor tendon is repaired in its lengthened position. If desired, a K-wire may be inserted to aid in

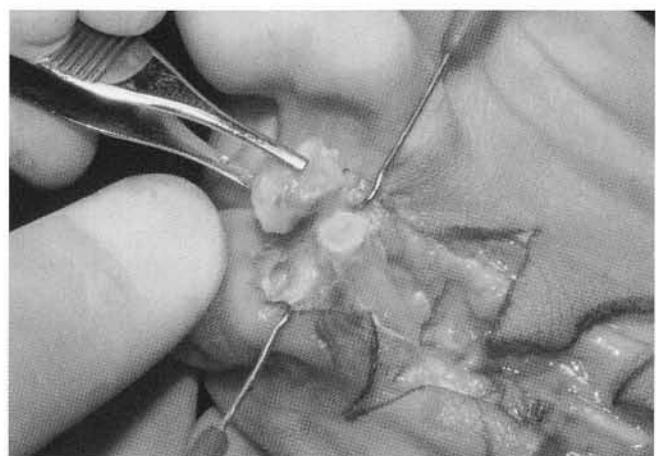


Figure 6J. Resection of the proximal phalangeal head to correct PIPJ contracture.

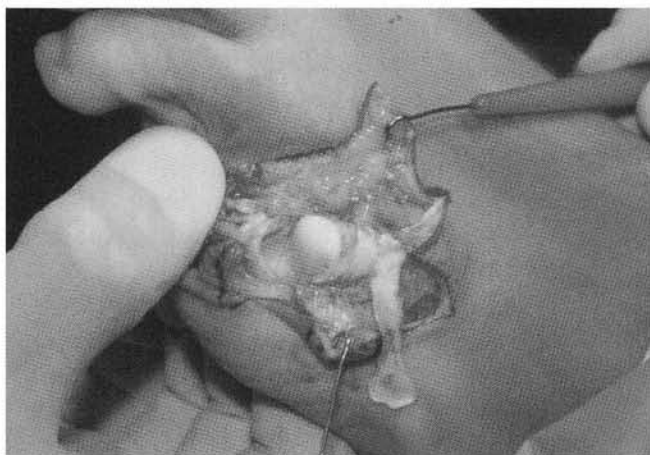


Figure 6K. Inspection of the fifth metatarsal head demonstrates no adaptive deformity in this case.



Figure 6L. Redundant plantar skin is ellipsed in diamond fashion.



Figure 6M. Redundant skin only is excised avoiding damage to neurovascular structures.

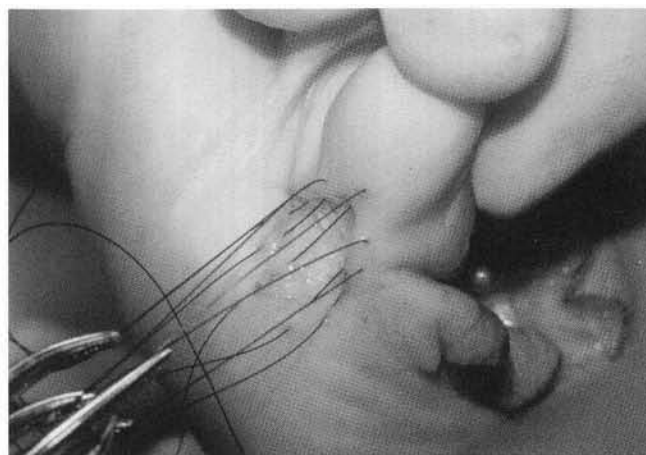


Figure 6N. Closure is accomplished with non-absorbable sutures. Sutures are all typically placed in position before any are tied. This allows easier visualization of suture placement.

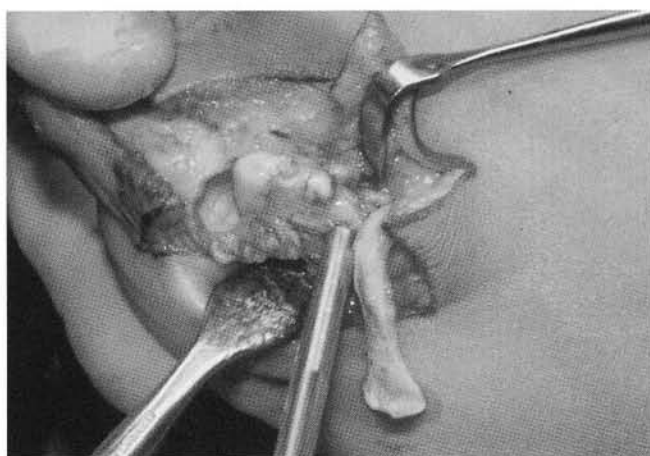


Figure 6O. A small bone trephine is used to create a lateral to medial hole in the fifth metatarsal neck.

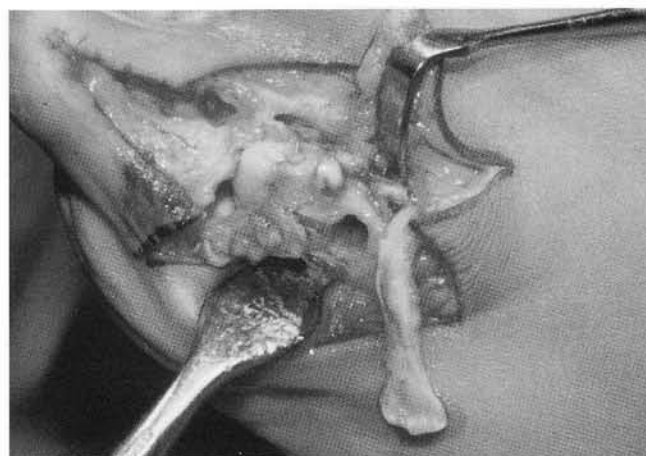


Figure 6P. Hole created in fifth metatarsal neck for modified Jones' tenosuspension.

the maintenance of the corrected position. The author typically uses either a 0.045" or 0.062" K-wire which is driven from the end of the toe across the fifth metatarsophalangeal joint and into the fifth metatarsal with the toe held in its corrected position (Figure 6S). Finally, skin closure is accomplished and closure of the Z-plasty completed (Figure 6T).

Postoperatively, the foot is placed into a sterile dressing which is continued, except for intermittent wound inspections, for approximately 2 to 3 weeks until suture removal. If a K-wire has been used, it is typically maintained for 4 to 6 weeks. If a K-wire has not been used, the dressing must be carefully applied to maintain the corrected position. The patient is allowed to ambulate on the

surgical foot in a surgical shoe with padding extending from the heel to the digital sulcus. Padding a shoe in this fashion eliminates most of the dorsiflexory propulsive forces at the fifth metatarsophalangeal joint. Alternatively, a short leg cast can be used. After dressing removal, a digital splint is dispensed to help maintain the correction for several more weeks.

The *consolidated surgical approach* draws upon many historic surgical procedures and combines many espoused approaches to create a comprehensive surgical technique that endeavors to completely correct the congenital overlapping fifth toe deformity. The author has found the *consolidated surgical approach* to result in predictable and effective correction of the congenital

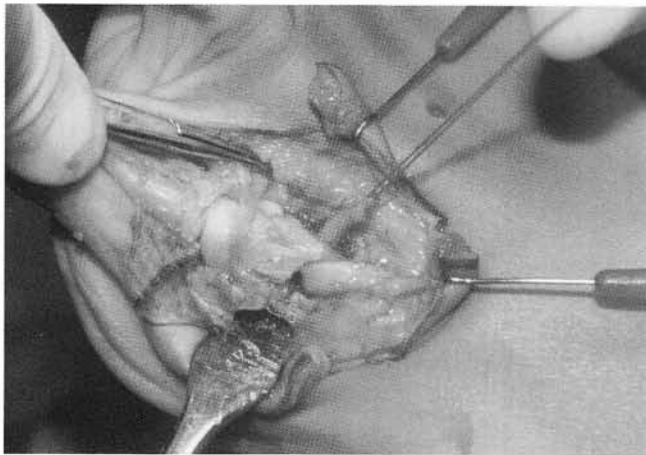


Figure 6Q. Previously harvested extensor digitorum longus tendon is routed through the trephine hole.

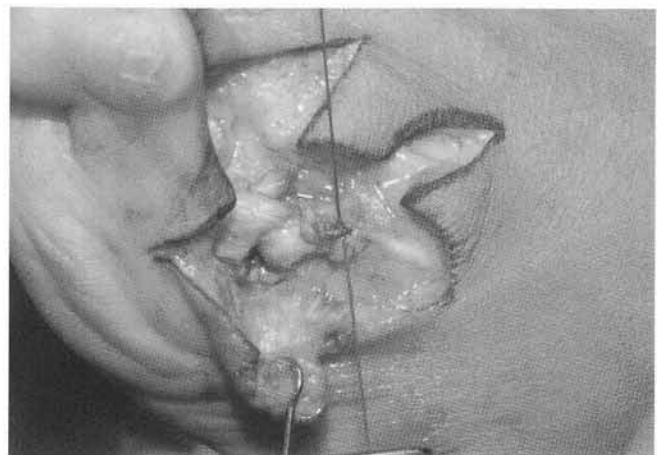


Figure 6R. The extensor tendon is sutured upon itself.

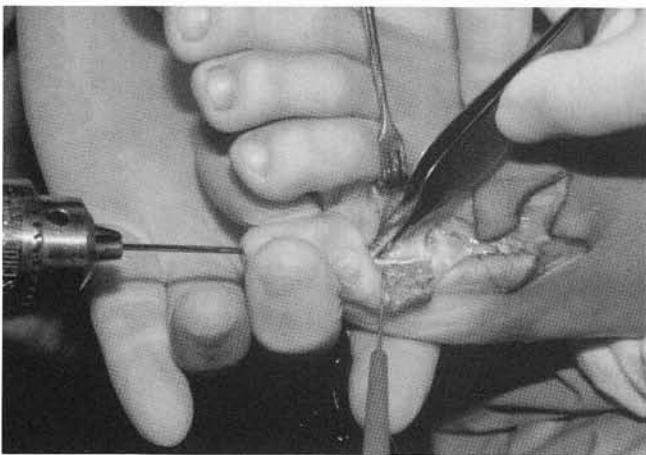


Figure 6S. A 0.062" (1.6mm) K-wire is inserted temporarily to aid in maintaining alignment of the corrected position.



Figure 6T. Immediate postoperative appearance after closure of all wounds.

overlapping fifth toe deformity, regardless of the severity of the deformity (Figures 6U, 6V). Full correction at the time of surgery, and maintenance of the correction during the immediate postoperative period with a K-wire and digital splinting are the key points to prevent recurrence of the deformity.

SUMMARY

The most common form of overlapping toe deformity is the congenital overlapping fifth toe deformity. Often, the deformity does not result in symptomatology until adolescence or adulthood. At this time, conservative measures are rarely successful in treating the condition. Many sophisticated surgical procedures have been advanced for the correction of the overlapping fifth toe deformity. Today, amputation and surgical syndactylization are less attractive approaches to both the patient and surgeon. Many other proposed procedures have been found to result in a high rate of recurrence of the deformity. Combining the “best” ideas from many different espoused procedures, the author has presented a *consolidated surgical approach* for the correction of the congenital overlapping fifth toe deformity. This approach has been described in detail and addresses each of the known elements of the deformity. Long-term results utilizing the *consolidated surgical approach* have been very good. Statistical analysis remains to confirm the clinical observations.



Figure 6U. Preoperative appearance of deformity.



Figure 6V. Postoperative appearance of correction at 6 weeks. (W) Postoperative appearance after 5 years. No evidence of recurrence noted.



Figure 6W.

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