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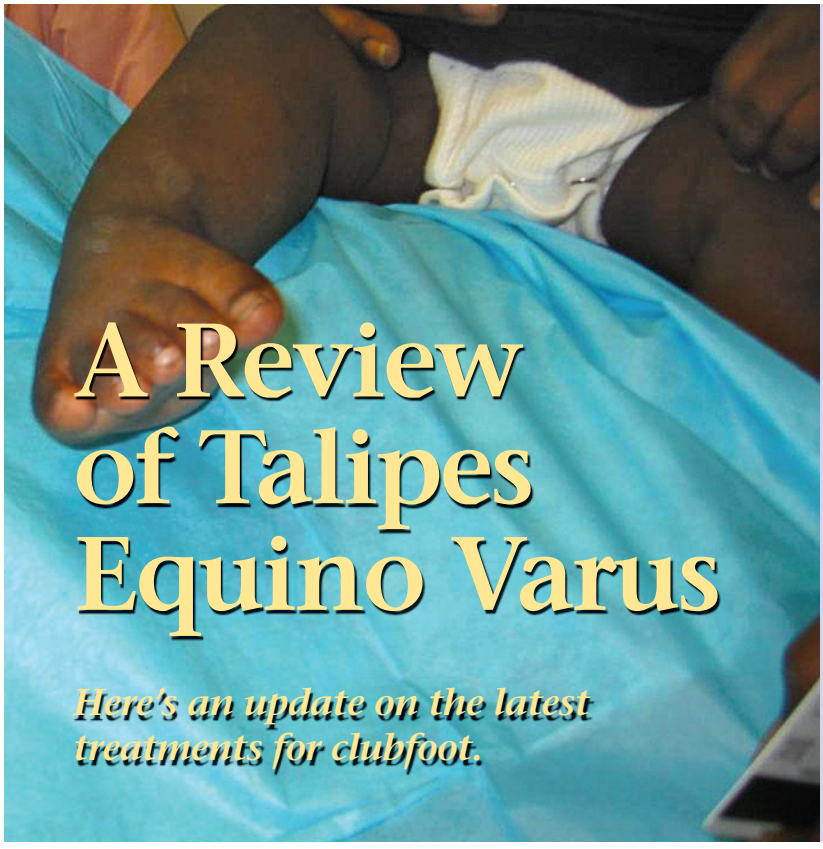

# A Review of Talipes Equino Varus

*Here's an update on the latest treatments for clubfoot.*

## Objectives

1) To recognize the multiple proposed etiologies of Talipes Equino Varus.

2) To learn how to classify a clubfoot according to its flexibility and rigidity.

3) To understand the pathoanatomy in the clubfoot deformity including which joints are involved and the inherent components of TEV.

4) To recognize the clinical features when examining a patient with clubfoot.

5) To be able to interpret and understand specific radiographic findings relevant to a clubfoot.

6) Appreciate the history and development of the non-surgical treatment of TEV.

7) To be able to contrast Ponseti and Kite's method of serial casting.

8) To understand the indications for surgical treatment of the clubfoot, including the neglected clubfoot.

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*Following this article, an answer sheet and full set of instructions are provided (p. 176).—**Editor***

By Robert J. Stabile, DPM
and Renato J. Giorgini, DPM

Talipes equino varus (TEV), universally known as clubfoot, is a deformity that the foot and ankle surgeon will likely encounter in the course of his/her career. It is recognized as the 'down and in' foot, often resembling a club-like appearance. All ranges of patients may present with clubfoot, including infants to adults that have been untreated or have failed treatment. Clubfoot may also present in all different shapes and sizes, demonstrating variations around a similar deformity, but at the same time maintaining the basic elements native to it. The reported incidence of clubfoot is 1:1,000 live births, and is considered one of the most common musculoskeletal birth defects in the Western population, and most treatable.[1,2] In this article, we

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will review the proposed etiologies, pathoanatomy, and treatment options pertaining to the congenital and neglected clubfoot.

### Etiology

The etiology of congenital clubfoot may best be considered multifactorial, since many considerations have been proposed for its development. These include an array of genetic, intrauterine, and environmental factors. Some theories seem to have more credence than others, but the entire pathology is not totally understood. Historically, Hippocrates believed clubfoot to develop from external uterine compression and oligohydramnios. More recently, Turco disputed this by saying that there is plenty of room during the first trimester as well as equal left to right side deformity, indicating positioning may not be a factor in its development.

*The etiology of congenital clubfoot may best be considered multifactorial.*

Bohm suggested interruption in foot development during the ninth week of gestation.[3] During this period of gestation the foot normally resembles a clubfoot appearance, but eventually de-rotates into a more anatomical external position. It has been postulated that normal fetal development might be delayed or halted by some mechanism, and held in that position. If this is the case, the development of the foot will continue to mature in a clubfoot position.

Handelsman and Badalmente suggested an abnormal muscle ratio in the clubfoot. Histologically, they demonstrated an imbalance between slow and fast twitch muscle fiber groups resulting in a more rigid foot.[4] Other reported etiologies have been genetic predisposition, intrauterine enterovirus, early amniocentesis altering intrauterine pressures, anatomical abnormalities including neurovascular malformations, primary osseous deformation, as well as others.[3] Clubfoot may be secondary to other primary congenital diseases, such as arthrogryposis, amniotic band syndrome, and myelodysplasias, just to name a few.

### Classification

When classifying clubfoot, it is important to obtain a good history from the parents or patient. The congenital type (also referred to as idiopathic) usually involves cases of unknown origin in otherwise healthy patients. If the parent gives a history that the child was born with normal feet that began to develop into a clubfoot after birth, than the suspicion should be raised of a possible spinal tumor or lesion that will need immediate recognition and treatment.

It is important not to assume that every presenting deformity is congenital or idiopathic. Trauma may be another cause for an acquired clubfoot. Once affirming that you are dealing with a congenital origin of deformity, not associated with any underlying disease process, the determination of flexibility or lack of should be evaluated. If the foot is reducible to a corrected position with manual manipulation, it can be labeled a flexible or an extrinsic type of deformity. On the contrary, a nonreducible deformity will be termed rigid or an intrinsic type of clubfoot.

*A flexible-type clubfoot, if left untreated, will develop into a rigid clubfoot as a result of joint contractures and accommodation during skeletal maturity.*

Extrinsic and intrinsic simply refer to the tendinous and ligamentous influences that result in an abnormal position of the foot. Musculotendinous influences from the leg tend to create a more flexible deformity, whereas the intrinsic musculature, ligaments, and capsules create a more rigid-appearing foot, less responsive to correction following manipulation. It should be noted, however, that a flexible-type clubfoot, if left untreated, will develop into a rigid clubfoot as a result of joint contractures and accommodation during skeletal maturity.

### Pathoanatomy

TEV typically consists of four basic components.[5] As the name implies, there is an equinus and varus element in addition to adduction and forefoot cavus. These give way to the classic cavo-adducto-varus attitude that is commonly seen with clubfoot. However, planal dominance of any of these components may result in a foot that shows a completely different attitude. This becomes important concerning the reduction and surgical treatment of the deformity.

When describing the pathoanatomy of clubfoot, a lot of the focus seems to be on the talus. Inspection of the deformity shows that the forefoot and Chopart's joint are medially displaced around the talus, contrasting this to metatarsus adductus, which involves the deformity at the level of Lisfranc's joint. A supinated position of the rear foot is present which inheritantly locks the midtarsal joints. The talo-calcaneal joint is parallel in orientation as a result of supination and most times showing a calcaneal varus attitude, although this is not absolute.

The anterior aspect of the calca-

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neus is displaced medially and plantarly due to the ligamentous attachments to the midfoot. The talo-calcaneal-navicular complex becomes subluxed in all planes, with the talar head no longer part of the medial column, and the navicular medially and dorsally with minimal talar articulation. In addition, the talus is locked in equinus within the ankle by a tight Achilles tendon.[4]

As one of the proposed etiologies, the talar head is often deformed and irregular. Normal talar head and neck adduction is 15-20° and in the clubfoot, 80-90°. Sagittal plane head and neck plantar-flexion is normally 25-30°, and in clubfoot has been shown to be 45-65°. These pathologic values may accentuate the adducted and plantar-flexed position of the foot. Inspection of the forefoot reveals a plantar-flexed first ray giving way to the cavus component.

### Clinical Examination

Clinically, when examining the rigid clubfoot, certain characteristics are usually present. On the medial side, the medial malleolus is poorly defined, the talar head is absent, and the navicular abuts the medial aspect of the ankle. On the lateral side, the fibula and sinus tarsi are obliterated, and the talar head now becomes prominent. A shorter foot and extremity is often noted in comparison to the contra-lateral side if it is a unilateral deformity. Deep-seated medial skin creases develop from the severe adducto-varus attitude, as well as the classic bean-shaped heel. Lower leg atrophy seems to be an expected component in the older child or adult.[3]

In a neglected clubfoot, an adventitial bursa will commonly form on the lateral aspect of the foot once the child begins ambulating. Although the neglected clubfoot appears with great deformity, patients are, in fact, able to ambulate and perform daily activities. Shoe fit often becomes a problem as well as the development of eventual pain secondary to arthritic changes, leading the patient to seek treatment.

It is important to keep in mind that the foot and ankle soft tissues are the main deforming forces in the neonate and infant. Osseous structures are very pliable and are susceptible to deformity from the relatively stronger soft tissue structures. The triceps complex, posterior ankle joint, and subtalar joint capsules are contracted, in addition to the deltoid, short and long plantar, talo-calcaneal interosseous, and calcaneal-navicular ligaments. The tendons within the tarsal tunnel are shortened. There is a relative elongation of the extensor and peroneal tendons. Surgical intervention in the infant for the neglected clubfoot will have to address the above-mentioned structures.

*The foot and ankle soft tissues are the main deforming forces in the neonate and infant.*

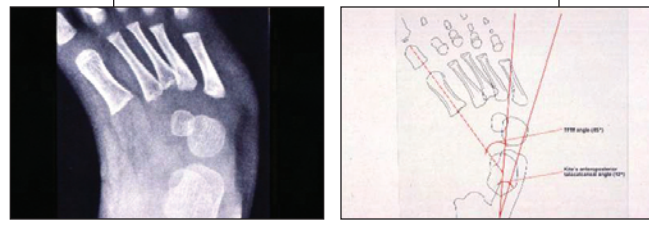

**Figure 1a, b: Dorsal-plantar view showing talo-calcaneal angle & talo-1st metatarsal angle**

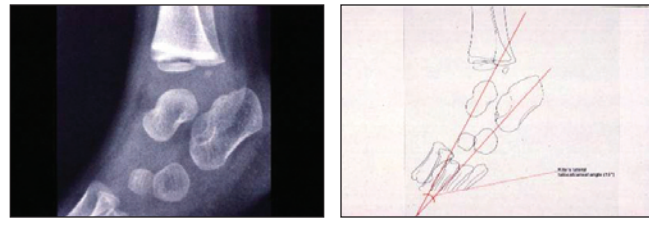

**Figure 1c, d: Lateral view showing lateral talo-calcaneal angle**

### Radiographic Evaluation

Radiographic evaluation is often difficult in the neonate due to patient positioning and lack of ossified structures often creating estimations of angular relationships. The calcaneus, talus, and cuboid are radiographically visible. The talus will show an eccentric ossification, making it difficult to achieve a true bisection. However, radiographic analysis of certain angles pertaining to clubfoot is necessary to differentiate clubfoot from other congenital foot deformities (Figures 1a-d).

On the dorsal-plantar view, evaluation of the talo-calcaneal (Kite's) angle and talo-first metatarsal angle will show a decrease in the former and increase in the latter. On the lateral view, the Kite's angle will also be decreased. These angular relationships represent Simon's rule of fifteen (i.e., Kite's angle less than 15° and the talo-first metatarsal angle greater than 15°). In the neglected clubfoot angular relationships are more difficult at times because of a rigid contracted foot not amenable to standard positioning. Arthrography, CT, MRI, and three-dimensional reconstructive modeling techniques can give a clear picture of the pathoanatomy of clubfoot including intra-articular relationships.

### Prenatal Imaging

Prenatal imaging has evolved over the last decade. It is now possible to visualize a fetus foot inutero with tremendous detail, utilizing three-dimensional ultrasound. The availability of this technology has provided a means for early diagnosis of deformity. Almost no false-negative predictions and a true positive predictive rate of 83% have been reported.[1] The main advantage of this is to allow the parents to prepare and understand about the deformity that their child will be born with, as well as learn about treatment op-

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tions. During this time, they may utilize resources, including physicians, counselors, and support groups, if needed. As will be discussed later, the parents play an integral role in the treatment plan, especially in the conservative management.

### Treatment

The treatment options for TEV include conservative (non-surgical) and surgical approaches. These options depend on certain factors and characteristics of the presenting patient. Indications exist for both and are important to understand. The main goal in the treatment of these patients, whether conservative or surgical, is to create a plantigrade, functional, stable, and pain-free foot. These goals apply to the neonate as well as the adult. The physician must do no harm in creating a foot worse than he or she started with.

### Non-Operative Treatment

Non-operative treatment has consisted of manipulation of the foot with splinting, as early as the days of Hippocrates. A famous quote by Lenoir stated, "Each day the foot remains deformed is a day of golden opportunity lost forever." In the 1930's Kite suggested gentle manipulation with serial casting. Kite's method became the mainstay of conservative treatment for many decades. However, correction, after utilizing Kite's method, was less than optimal with rates ranging from 15-61%.[5-7] As a result of this, a strong trend towards surgery resulted.

The introduction of Ponseti's writing in 1996 sparked a new interest in the conservative management of clubfoot. Known as the Ponseti's method of clubfoot serial casting, excellent results have been reported, especially when compared to Kite's method.[5-7] The main indication for the Ponseti method is for idiopathic clubfeet, although it may be attempted in syndromatic, arthrogrypotic feet. As in Kite's method, serial casting must begin as soon as possible and is performed weekly. Casts are applied in an above-knee fashion in order to prevent the cast from falling off and to allow reduction of any internal tibial torsion that may be present.

*The main indication for the Ponseti method is for idiopathic clubfeet, although it may be attempted in syndromatic, arthrogrypotic feet.*

Serial casting works because of the principles of manipulation. Maximum correction of deformity is achieved by creating plastic deformation of the shortened tendons and contracted ligaments. Connective tissue possesses the property of stress relaxation, which is why serial casting after stressful manipulation will improve length as the tension of the tissues decrease over time.

### Ponseti's Method

Ponseti's method reduces the adduction and varus before the equinus deformity much like Kite's method, except without pronating the foot. Ponseti stresses to maintain the supinated position of the forefoot and midfoot while abducting them around the head of the talus at the same time as maintaining counterpressure on the head of the talus. Kite's method placed one hand on the calcaneocuboid joint to maintain counterpressure while the forefoot was manipulated. Ponseti referred to this as 'Kite's error.'[4] This would prevent the anterior calcaneus from moving into a more abducted position with the forefoot and midfoot.

*In the rigid infant clubfoot, soft tissue releases will predominate as compared to a residual or neglected clubfoot which will require a combination of osseous and soft tissue procedures.*

The Ponseti method basically leaves all hands off the rear foot and maintains only counterpressure on the head and neck of the talus. The rear foot varus is corrected by abduction of the joints distal to talus, thereby allowing the body of the talus to slide off the calcaneus into a relative pronated position and unlocking the subtalar joint, which will restore Kite's angle.

Finally, the equinus component is corrected utilizing a percutaneous Achilles tenotomy as described by Ponseti. This is corrected last in order to prevent an iatrogenic rocker bottom type foot. The casting is performed weekly until 70° of abduction of the deformed foot is present. According to Colburn and Williams, the average number of casts to correct the deformity was 4.8.[5]

### Maintaining Correction

After correction is obtained via conservative means, maintenance becomes as important as the method of correction. A Denis-Browne bar should be utilized to maintain the achieved abduction and prevent varus recurrence of the rear foot. It is recommended that the bar be utilized for the majority of the day for the first three months, and then tapered gradually. Straight-last shoes and orthoses are important as the child matures and begins ambulation.

### Recurrence

Recurrence of the deformity following conservative management has been reported. A study by Dobbs, et al. showed the main reason for recurrence was lack of compliance of bracing and orthoses.[7] As stated, this aspect of the treatment is as important as

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the serial casting with manipulation. Dobbs showed that recurrence was not dependent on severity of deformity, the number of casts utilized to obtain correction, or the age of the patient.[7] It is crucial that the parents are willing to participate in the treatment plan in order to prevent a recurrence.

*The neglected clubfoot becomes more difficult mainly because there have been years of accommodation and joint adaptation.*

### Surgical Correction

Surgical correction of the clubfoot is indicated when unsatisfactory clinical or radiographic correction is obtained in the rigid infant's foot or in the neglected clubfoot. Selection of the proper surgical procedure will depend on the type of deformity and skill of the surgeon. One-stage procedure is ideal and should be chosen to prevent recurrence. However, despite an adequate correction of the clubfoot deformity, a residual equinovarus, cavovarus, and forefoot adductus may require repeat surgery.[8]

According to Sobel, et al., a second operation should not be perceived as a failure of the first surgery, but more of the natural history or progression of clubfoot.[8] The patient and parents should be made aware of this. When contemplating any surgical intervention on clubfeet, the physician should evaluate the vascular status to the foot. Absence of the dorsalis pedis artery seems to be substantially more prevalent in clubfoot.[9]

In the rigid infant clubfoot, soft tissue releases will predominate as compared to a residual or neglected clubfoot, which will require a combination of osseous and soft tissue procedures. Typically, a posterior medial approach is initiated first. This was originally described by Turco in 1979.[10] The posterior medial release consists of sectioning of the capsules and ligaments on the medial column of the foot as well as the superficial deltoid ligament, the talo-calcaneal interosseous ligament, spring ligament, long and short plantar ligaments, and the master knot of Henry.

It is important not to release the deep deltoid ligament in order to prevent the ankle from going into valgus. The tendons within the tarsal tunnel will usually require a 'Z' lengthening as will the Achilles tendon and abductor hallucis. The posterior subtalar joint will sometimes require release as well, along with the calcaneofibular ligament if adequate dorsiflexion is not achieved with the Achilles lengthening. According to Henn, et al., extensive subtalar release is an effective treatment which eliminates under-correction and recurrence.[11]

Surgical release of the infant rigid clubfoot may not require release of every structure described. It is good surgical practice to perform a stepwise approach to achieve surgical reduction and section further as needed, much like that of a hammer toe reduction.

### Incisions

Classical incisions that have been employed are the Cincinnati (posterior transverse), Turco (posterior-medial), and two incisional approach of Carrol (medial and lateral incision). Modifications of these incisions have been utilized and are merely of surgeon preference. In the senior author's experience (RJG), a two incisional approach gives adequate exposure to all structures with minimal healing complications and scarring.

Once adequate reduction of the joints is achieved with soft-tissue releases, the correction needs to be maintained with the use of K-wire fixation. This is usually employed with insertion of a wire through the talo-navicular joint and occasionally the talo-calcaneal joint. These wires will provide temporary fixation and splintage as the soft-tissue structures fibrose into the corrected position. Additionally, casting must be employed to maintain the position and can be serially manipulated to obtain further correction, if needed.

### The Neglected Clubfoot

The neglected clubfoot becomes more difficult mainly because there have been years of accommodation and joint adaptation. The anatomy is often skewed

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**Figure 2: Pre-operative showing rigid forefoot supination & adductus**

**Figure 3: Pre-operative showing rigid forefoot cavus deformity**

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and very rigid. The main correction of the deformity will rely on osseous procedures in conjunction with soft-tissue releases. These feet tend to have the most problems and poorest results. The patient should be made aware that attaining a perfect foot is unlikely, but results should be improved from the current position into a more anatomical, plantigrade position. The concept of planal dominance is important to keep in mind when deciding the appropriate procedure. In the author's experience (RJG), a closing calcaneocuboid wedge fusion with an opening talo-navicular joint fusion seems to give consistent, good results when there is a transverse plane dominant deformity.

Soft-tissue release, including a plantar release, is also usually performed. Additionally, an Achilles lengthening will need to be performed. In a review of surgical results of the neglected clubfoot, it was found that removal of rear foot varus, minimal shortening, plantigrade position, and satisfactory cosmesis were achieved.[12]

Additionally, patients were able to wear commercial shoe gear, walk barefoot, were employed, and performed limited physical activity.[12] Salvage procedures that can be used in the neglected or residual clubfoot are triple arthrodesis with wedge resection, and talectomy (rare) if talo-navicular reduction is not possible utilizing other methods. As in the infant, the neglected clubfoot will need to be cast as well to maintain the corrected position. An advantage of casting is the ability to wedge the cast to allow further correction in any plane.

***Salvage procedures that can be used in the neglected or residual clubfoot are triple arthrodesis with wedge resection, and talectomy (rare) if talo-navicular reduction is not possible utilizing other methods.***

Residual or neglected clubfoot can also be corrected utilizing the Ilizarov method, which has become popular over the past few years. The technique of gradual distraction osteogenesis and

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**Figure 4: Intra-operative showing plantar release approach**

**Figure 5: Intra-operative showing medial hockey stick incision for posterior-medial release**

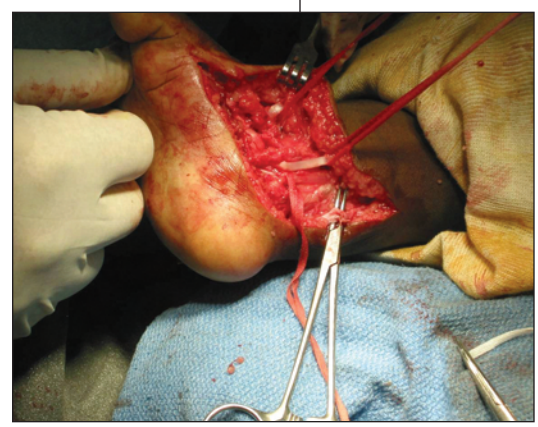

**Figure 6: Intra-operative showing dissection of posterior-medial structures**

**Figure 7: Reduced foot showing K-wire inserted through the talo-navicular joint**

**Figure 8: six weeks post-op showing good correction**

Figure 9: Pre-operative showing cavo-adducto-varus deformity

Figure 10: Pre-operative showing lateral view. Note the lower leg atrophy compared to contralateral side

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correction utilizing a ring fixator has become useful for recurrent or resistant feet.[13] Complications are possible as in any other procedure, and a learning curve is required. External fixation can also be employed with open procedures as described before and will help to maintain the corrected position as the structures heal. Finally, selecting the right patient is important when utilizing external fixation.

***Selecting the right patient is important when utilizing external fixation.***

Figure 11: Pre-operative X-ray showing abnormal alignment

Figure 12: Intra-operative showing plantar release approach

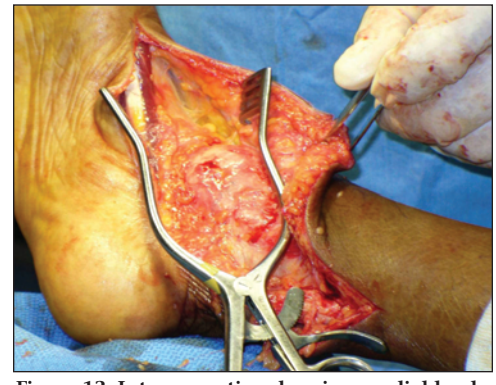

Figure 13: Intra-operative showing medial hockey stick incision for posterior-medial release

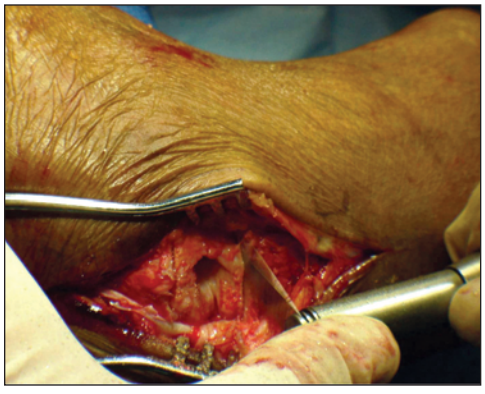

Figure 14: Lateral approach creating wedge resection of the calcaneo-cuboid joint

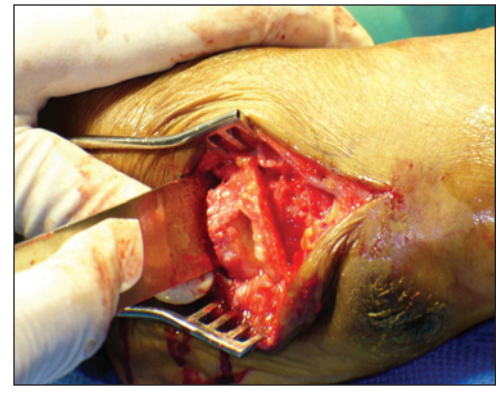

Figure 15: Removal of calcaneo-cuboid wedge for insertion into talo-navicular joint

**Case 1**

A two year old female presented with a residual clubfoot deformity to the right foot. Serial casting was performed when the child was an infant. Physical examination of the foot revealed a rigid, non-reducible deformity (Figure 2). There was cavus morphology to the longitudinal arch (Figure 3). Pre-operative work-up including vascular status was within normal limits. The patient underwent surgical reduction of the deformity utilizing a plantar muscle release (Figure 4) and posterior medial release with K-wire stabilization (Figures 5-7). Post-operatively, the patient will require six to eight weeks of casting and orthoses as the child begins to ambulate.

**Case 2**

A 33 year old male presented with a neglected clubfoot deformity to the right foot. The patient was complaining of pain on ambulation that has progressed over the past few years and requested surgical correction. Pre-operative work-up was within normal limits. Physical examination revealed a rigid non-reducible deformity. Vascular status was intact. On gait examination, the patient was walking on the lateral border of his foot with development of painful calluses (Figure 9-10). Minimal rear foot varus was present. The patient underwent surgical correction utilizing a plantar muscle release, closing calcaneo-cuboid, opening talo-navicular joint fusion,

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## Review...

and posterior-medial release (Figures 12-15). A two-incisional approach was utilized. Post-operatively, the patient was cast for six weeks and given a bone stimulator (Figure 18).

### Summary

We have reviewed the etiology, pathoanatomy, clinical and radiographic characteristics of talipes equino varus. A discussion of treatment, including conservative and surgical approaches, has been presented. The goals of treatment include creating a plantigrade, functional, and stable foot. Understanding the pathoanatomy and mechanism of deformity will aid in understanding the concept of proper manipulation when utilizing conservative treatment. The promise of a perfect foot should not be an expectation from the patient or parents. There exists expectation of improvement that affords the patient a better lifestyle as compared to before treatment. ■

*The promise of a perfect foot should not be an expectation from the patient or parents.*

Figure 18: Post-operative below-knee cast with application of external bone stimulator

Figure 16: Post-operative showing good correction with plantigrade position

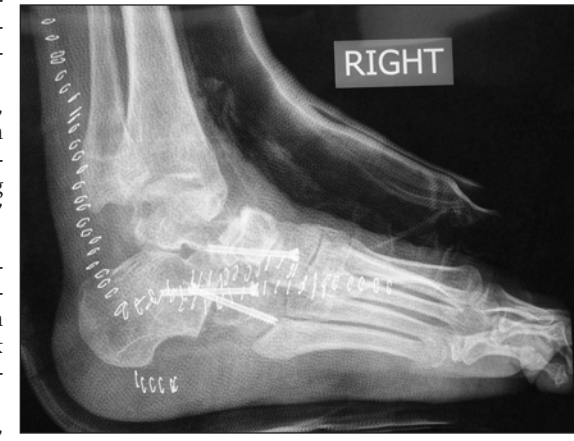


Figure 17: Post-operative X-ray showing wedge resection & screw insertion across fusion sites

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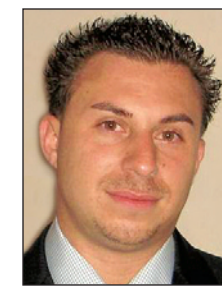

**Dr. Stabile is an attending physician in the Department of Surgery at the Nassau University Medical Center, East Meadow, NY and is an adjunct clinical instructor at the New York College of Podiatric Medicine.**

**Dr. Giorgini is Section Chief Podiatric Surgery, Good Samaritan Hospital Medical Center and Director of Podiatric Medical Education, Good Samaritan Hospital Medical Center & North General Hospital. He is Professor, Division of Surgical Sciences at the New York College of Podiatric Medicine.**

# EXAMINATION

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*See answer sheet on page 177.*

1) In the treatment of TEV, what is the main goal of treatment whether it is surgical or non-surgical?
- A) Create a stable foot
- B) Create a plantigrade foot
- C) Create a functional foot
- D) All are goals of treatment

2) Following conservative management of idiopathic TEV, recurrence of the deformity has been attributed to:
- A) Too few cast applications
- B) A child greater than seven months old
- C) Severe deformity
- D) Lack of compliance with bracing

3) When classifying clubfoot deformity, extrinsic and intrinsic means:
- A) Position and rigidity of the foot as a result of osseous malalignment
- B) Position and rigidity of the foot as a result of tendons and ligaments
- C) Position and rigidity of the foot as a result of suprastructural joint position
- D) Position and rigidity of the foot as a result of in-utero influences

4) Which of the following is NOT a basic component of clubfoot deformity?
- A) Equinus
- B) Dorsiflexion
- C) Adduction
- D) Varus

5) When evaluating a radiograph of a clubfoot deformity, which joint appears in an abnormal parallel orientation?
- A) Talo-navicular joint
- B) Tibio-talar joint
- C) Calcaneo-cuboid joint
- D) Talo-calcaneal joint

6) The main reason why serial casting improves lengths of tissues is due to:
- A) Property of stress relaxation
- B) Avascularity of ligaments
- C) Ligamentous laxity
- D) Pliability of osseous structures

7) Which of the following procedures can be used to correct a transverse plane dominant neglected clubfoot deformity?
- A) Dwyer osteotomy
- B) Opening talo-navicular joint, closing calcaneo-cuboid joint
- C) Talo-calcaneal fusion
- D) Plantar soft-tissue release

8) Which of the following angular relationships best represent Simon's rule when evaluating a clubfoot?
- A) Talo-calcaneal angle greater than 15°
- B) Talo-first metatarsal angle less than 15°
- C) Cuboid abduction angle greater than 15°
- D) Talo-calcaneal angle of 0°

9) Which is a fundamental difference between TEV and Metatarsus Adductus?
- A) Presence of rearfoot varus
- B) C-shape to medial aspect of foot
- C) Location of transverse plane deformity
- D) Presence of cavo-adductus deformity

10) When clinically examining a clubfoot, all of the following will be seen on the medial side of the foot, EXCEPT?
- A) Navicular abutting the medial malleolus
- B) Prominent talar head
- C) Deep seated skin creases
- D) Poorly defined medial malleolus

11) Which bone is intimately involved in the pathoanatomy of TEV as well as often showing deformation?
- A) Calcaneus
- B) Navicular
- C) Talus
- D) Cuboid

12) When contrasting Ponseti and Kite's method, Ponseti:
- A) Performed a series of manipulations with serial casting.
- B) Applied casts in an above knee fashion.
- C) Corrected the adduction and varus first.
- D) Maintains only counter-pressure on the talar head.

13) Maintenance following successful conservative treatment of clubfoot includes which of the following?
- A) Straight last shoes
- B) Denis-Browne bar
- C) Orthosis
- D) All of the above

14) When performing the Ponseti method of serial casting for TEV, which degree of abduction should be achieved in order to safely perform an Achilles tenotomy?
- A) 70°
- B) 60°
- C) 50°
- D) 40°

*Continued on page 176*

Continuing Medical Education

## EXAMINATION

(cont'd)

15) Which of the following are NOT true concerning the pathoanatomy of TEV?
- A) Talo-calcaneal-navicular complex is subluxed
- B) Talar head is not part of medial column
- C) Navicular is lateral and plantar
- D) Talus is in equinus

16) When evaluating the radiograph of a 3 month old baby, which structure is NOT visible?
- A) Navicular
- B) Talus
- C) Calcaneus
- D) Cuboid

17) All of the following incision-types have been classically described for surgical release of a clubfoot deformity, EXCEPT?
- A) Posterior-medial
- B) Plantar-lateral
- C) Posterior-transverse
- D) Medial and lateral

18) Which of the following can be considered a salvage procedure for the neglected clubfoot?
- A) Plantar stripping
- B) Opening talo-navicular closing calcaneo-cuboid joint fusions
- C) Talectomy
- D) Tendo-Achilles lengthening

19) When performing a vascular exam on a patient with clubfoot deformity, which structure shows a high incidence of absence?
- A) Dorsalis Pedis artery
- B) Posterior Tibial artery
- C) Anterior Tibial artery
- D) Peroneal artery

20) The etiology of idiopathic clubfoot may best be described as:
- A) Genetic in origin
- B) Environmental in origin
- C) Intrauterine in origin
- D) Multifactorial in origin

***See answer sheet on page 177.***

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# ENROLLMENT FORM & ANSWER SHEET (cont'd)

## EXAM #2/09
## A Review of Talipes Equino Varus (Stabile and Giorgini)

**Circle:**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1. | A | B | C | D | 11. | A | B | C | D |
| 2. | A | B | C | D | 12. | A | B | C | D |
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| 4. | A | B | C | D | 14. | A | B | C | D |
| 5. | A | B | C | D | 15. | A | B | C | D |
| 6. | A | B | C | D | 16. | A | B | C | D |
| 7. | A | B | C | D | 17. | A | B | C | D |
| 8. | A | B | C | D | 18. | A | B | C | D |
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