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The Neglected Clubfoot

Cary Fletcher

Saint Ann's Bay Regional Hospital

Abstract- The neglected clubfoot is an uncommon condition in the developed world that has not been clearly defined in the literature. The condition is more common in the developing nations as a result of lower detection rates early in life for various economic and cultural reasons. In addition to the physical, social and financial burden which often occurs, there is a psychological component that must be addressed prior to commencing orthopaedic management. When left untreated beyond walking age, the weight bearing on the side of the foot worsens the deformity in addition to the worsened contractures due to increased contractile elements in the soft tissues. Treatment traditionally started with casting utilising the Ponseti technique followed by extensive open surgery which may entail soft tissue procedures plus or minus bony correction. Bony procedures involving osteotomies often result in an obviously shortened foot and may be associated with skin necrosis, psuedoarthrosis, infection and vascular damage. These procedures are also not uncommonly associated with pain, weakness, and stiffness of the foot and ankle postoperatively.

Keywords: clubfoot, neglected.

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I. INTRODUCTION

Congenital idiopathic club foot is a complex deformity occurring in a child that is otherwise normal [1]. There are four components to this deformity: forefoot adductus, cavus, hindfoot varus and ankle equinus [2]. The literature lacks of a formal definition for the neglected clubfoot, however it may be considered in any patient presenting for treatment after 3 years of age [3].

Patients often undergo extensive corrective surgery which results in complications and disturbing failures [2]. Revisions are required more commonly in this population [2]. Despite the foot improving cosmetically post surgery; it is commonly stiff, weak and painful especially after adolescence [2].

II. DISCUSSION

Congenital equinovarus (CTEV) or clubfoot is the commonest congenital anomaly which presents to a paediatric orthopaedic surgeon, and is the commonest congenital condition resulting in loco motor disability [3]. Clubfoot is a complex foot deformity which requires dedicated efforts from both the parents (of younger patients) and the surgeon to achieve correction [2]. The

anomaly occurs in the 3rd month of intrauterine life and is characterised by dysfunction of the posterior and medial aspects of the lower leg, ankle and foot [4]. The muscles are smaller and there is increased collagen synthesis resulting in fibrosis in the posteromedial tarsal ligaments, deep fascia, Achilles tendon and tibialis posterior tendon [4]. Treatment is ideally commenced as early as possible and the patient followed closely [2, 5].

Untreated CTEV beyond early childhood is rarely seen in developed countries [6, 7, 8], but is a common occurrence in developing nations [9, 10]. There are a number of reasons for its high prevalence in the third world. Delayed presentation may be due to a failure of detection in the first two years of life because of lack of Orthopaedic surgeons and technicians in the country [11, 12]. Shortage of materials during management and ethno cultural beliefs are other factors [11]. In these countries, patients often come from rural areas where they present late to the hospitals which are located in the city due to travelling distance [12, 13]. In this setting, patient disability may lead to worsening of poverty to the entire family, because the mother has less time to look after siblings and has less time for economic activities or domestic activities [14]. Lourenco and Morcuende [1] stated that in Brazil, many of these children are unable to socialise because of stigmatisation. He also noted very long waiting lists for elective surgery due to a limited health care budget hence causing several children to have this untreated beyond walking age.

In addition to the physical, social and financial burden, there is a psychological component which should be addressed prior to commencing orthopaedic management [10]. This includes a comprehensive discussion about the treatment and the expected results with the patient and family [10] as both parents and the patient are prone to psychological trauma [9].

In the normal foot and ankle, the tibiotalar joint is a hinge whereby the talar dome rotates in the sagittal plane within the mortise [7]. Talar movement is dependent on ligamentous attachments to the calcaneous and navicular as there are no muscular attachments [7].

In a cadaveric study, Windisch et al [15] found that external tibial torsion was less in this population. The anterior and middle facets of the calcaneous are normal; however the posterior facet is in an anterolateral position in severe cases. The posterior facet is under severe biomechanical forces in that position [15]. The

Author: Orthopaedic Surgeon, Saint Ann's Bay Regional Hospital, Saint Ann. e-mail: c.fletch30@yahoo.com

talar head becomes conical; the neck is angulated medially, while the medial aspect of the head articulates with the navicular [6]. There is also medial subluxation of the calcaneocuboid joint [6]. The abnormal articulations of the talonavicular and calcaneocuboid joints are partially due to the abnormal talus head/shaft angle of less than 45° [6]. Tension in the triceps surae and absence of the close packed position of the subtalar joint allows the calcaneus to move laterally under the talus which changes the length of the calcaneofibular ligament [15]. Primary contractile forces acting on the soft tissues cause progressive worsening of bony deformities. The medial tissues in particular will undergo significant contraction and as the deformity progresses, there is decreased remodelling potential [6].

Beyond age two years, foot contractures tend to appreciably worsen [11]. The deformities of CTEV worsen when the child commences walking because weight bearing occurs on the side of the foot [6]. Herold and Torok [10] found that prolonged weight bearing accentuated mainly forefoot adduction and tibial torsion. Thickened callous and large bursa eventually develop over the prominent weight bearing talar head dorsolaterally which is often associated with deep fissures which are prone to breakdown and infection [6]. Walking on the dorsum of stiff deformed feet will also lead to chronic pain [11] and difficulty fitting shoes is often problematic [9]. Pain occurs in the skin and subcutaneous tissue on the dorsum of the foot [6]. Neglected CTEV in older children poses special challenges due to the rigidity of the deformities and a fixed altered gait pattern. After years of accommodation and joint adaptation, the skewed anatomy and the rigidity of the tissues make correction more difficult and a perfect foot is unlikely [1, 16]. Grill and Franke [8] stated that the limited ROM in the tarsometatarsal and midtarsal joints were characteristic of neglected CTEV and prevents perfect surgical correction.

Since CTEV is a complex deformity combining several components, treatment must be individualised [10, 17]. Thus in open treatment, structures to be lengthened and released must be determined intraoperatively [17].

Correction of various deformities may require individual variations in technique and a supplementary operation however; there is usually one dominant deformity [10].

Treatment of CTEV has evolved over the past few decades where there has been an increased interest in the minimally invasive Ponseti technique. The technique decreases the rates of stiffness and residual or recurrent deformities associated with extensive soft tissue release [12]. It has been used as the sole means of correcting neglected CTEV [3]. Serial manipulation and casting relies on the viscoelastic properties of connective tissue to achieve plastic deformation via stress relaxation [18]. During gentle stretching,

shortened tissues are placed under tension however the tension lessens over time which then allows for more correction [18]. Lourenco [1] retrospectively reviewed 17 patients (24 feet) ages 1.2 to nine years with neglected CTEV who were treated via a modification of the Ponseti technique. In anticipation of these patients having soft tissue which have decreased elasticity, the manipulations lasted five to ten minutes and the cast changed every two weeks to allow more time for remodelling. All wore shoes, did activities of daily living, had no pain and all were satisfied. Khan and Kumar [9] looked at 21 patients (25 neglected feet) with a mean age of 8.9 years, whereby 18 feet had full correction and six feet had recurrent deformity at four year follow up. Spiegel et al [12] avoided extensive soft tissue releases in 94% of his patients aged six years and less. The Ponseti technique is thus a cost effective, safe modality [9].

In contrast to Khan and Kumar [9], Spiegel et al [12], Lourenco and Morcuende [1], and Hassan et al [19] felt that the neglected CTEV deformity had no further potential for manipulative correction and that soft tissue release was required to achieve manipulation. He performed surgery in two stages for 24 patients (35 feet) with neglected CTEV where the 1st stage was an extensive posteromedial releases including Achilles tendon lengthening, posterior capsulotomies of the ankle and subtalar joints and calcaneofibular ligament release. The 2nd stage was a triple arthrodesis followed by 16 weeks in plaster where the last eight weeks was in a walking plaster. Herold and Torok [10] who also utilised a similar two staged procedure treated 44 patients age 6-62 years. Manipulations and casting was performed between the two operations which allowed for skin closure without tension [10]. Hassan et al [19] slightly under corrected after stage 1 to decrease wound complications, then went for full correction after stage 2. Khan and Chinoy [20] proposed double zigzag incisions over the medial aspect of the foot and over the Achilles tendon in 21 feet with severe neglected clubfoot and found that this single operation allowed for full correction with no wound complications. Soft tissue release and Achilles tendon lengthening prior to triple arthrodesis has been advocated because bony resection alone increases the incidence of osteonecrosis of the talus, persistence of deformity and poor bony contact of midtarsal bones with subsequent psuedoarthrosis [19, 21]. Triple arthrodesis has been considered salvage [16] and intended to improve function [10]. It is recommended beyond age 12 [11].

In more resistant cases, soft tissue releases include complete release of posterior and medial subtalar joint capsule, talonavicular capsulotomy (including spring ligament and bifurcate y ligament), medial calcaneocuboid joint capsulotomy, knot of Henry and Abductor hallucis as well as tibial posterior lengthening [6].

Relapse rates especially in older children with neglected CTEV are higher because of the tendency of bones to revert to their deformed position [6]. Other factors include tight, thickened ligaments, and a significantly retracted tibialis posterior tendon [9]. Ponseti [4] stated CTEV had a strong tendency to relapse regardless of the mode of treatment, but stiff severe clubfoot with a small diameter calf are more prone to relapse. The components of clubfoot equinus and heel varus are most important relapses [4]. Although relapse of a deformity may be treated with manipulation and casting there are situations in which surgery is offered because of unreliability of follow up, that is, compliance with repeated sessions will be questionable [10]. Inadequate postoperative care, indelicate surgery and improper choice of technique are other reasons for high recurrence rates [2, 17].

Residual equinus is common in young children post full soft tissue releases [6]. Scott et al [22] found that a lateral tether including the posterolateral subtalar joint capsule, peroneal tendon sheath and the calcaneofibular ligament may prevent dorsiflexion and needs to be released in the presence of residual equinus. Posterior releases are favoured in patients older than three years whereas tenotomy (open or percutaneous) is favoured in the less than three year old patient in treating residual equinus [12].

Stabile and Giorgini [16] have advocated a closing calcaneocuboid wedge osteotomy with a talonavicular joint fusion as a procedure which gives consistently good results. Operations utilising closing wedge osteotomies and triple arthrodesis, results in a noticeably shortened foot [8]. Although bony procedures allow for a near normal foot correction, the results are often poor in terms of chronic pain and stiffness [11]. The Ilizarov method has been used to avoid the need to perform bony resection or arthrodesis while achieving a balance in the discrepancy in length between the medial and lateral sides of the foot via medial side lengthening in the form of continuous distraction by an external fixator [8]. The Ilizarov external fixator decreases the likelihood of skin necrosis, psuedoarthrosis, infection and vascular damage associated with osteotomies [8].

Ferreira et al [23] used the Ilizarov fixator in 30 patients (38 feet) with a mean age of 19 years. 78.9% of patients had complete correction with no pain, while 23.7% required arthrodesis for symptomatic arthritis; however minimal bone resection was required, due to correction of severe deformities [23].

Similar to the Ilizarov fixator the Joshi external stabilisation system (JESS) also avoids scarring, skin complications and neurovascular injuries associated with open techniques [24].

III. CONCLUSION

Many surgeons are now moving away from the Ponseti technique as well as soft tissue releases in favour of distraction techniques because of its ability to achieve deformity correction and produce a cosmetic foot with a near normal foot size.

Declaration of Conflict of Interest

There are no financial, institutional and personal relations that could potentially bias the information presented above.

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