Correction of Vertical Talus Using Multiple Percutaneous Tenotomies and Mini-open Reduction of Talonavicular Joint

Protocol of thesis submitted for partial fulfillment of the requirements for MD in Orthopedic surgery

BY

SHERIF MOHAMED ISMAIL

(MBBCH. Orthopedic surgery)

Under the supervision of

PROF. NAGUIB YOUSEF BASHA

Professor of orthopedic surgery

Faculty of medicine (Cairo University)

PROF. MOHAMED MAHMOUD HEGAZY

Assisstant. Professor of orthopedic surgery

Faculty of medicine (Cairo University)

DR. AHMED MAMDOUH DOHEIM

Lecturer of orthopedic surgery

Faculty of medicine (Cairo University)

2014

First and fore most, thanks to ALLAH,
whose magnificent help is the first factor
in everything we can do in our life.

A

Abstract

Study showed that the younger the age at time of operation the better the result.This technique has the advantages of reducing the pre and post-operative patient attendanc, short operative time and decrease incidence of complications.This study includes 20 feet in 11 patients, 6 of them were diagnosed to have idiopathic congenital vertical talus (5 have bilateral involvement and one has unilateral involvement), 4 were diagnosed to have arthrogryposis multiplex congenita (all of them have bilateral involvement but one of them has a foot that was operated by a different technique, and one case that was diagnosed to have Escobar syndrome and has a bilateral involvement. All feet were operated by the same technique. This technique gave good results in correcting hind-foot and mid-foot deformities, the forefoot deformity was corrected immediately post- operative but the correction was lost with follow-up (which is detected by the difference in the talar axis – first metatarsal base angle in the lateral view in standing and non-standing position) which is attributed to the hypermobility in the tarso-metatarsal joints.

Keywords: Talonavicular, Multiple Percutaneous, Orthopedic, Aetiology

Acknowledgement

My deep appreciation to Prof. Dr. Naguib Youssef Basha Professor of orthopedic surgery, faculty of medicine, Cairo University, for his experienced guidance and helpful suggestions that made the completion of this work possible.

I would like to express my deep indebtedness, gratitude and sincere appreciation to Prof. Dr. Mohamed Mahmoud Hegazy Assistant Professor of orthopedic surgery, faculty of medicine, Cairo University, for selection of the subject, sustained support, close supervision, continued encouragement, valuable instructions, meticulous revision, unlimited help, his endless patience with me and wise opinions, and for his precious time and effort that made this essay possible. It was great honor to me to do this research under his supervision.

I owe special feelings of gratitude to Dr. Ahmed Mamdouh Dohim Lecturer of orthopedic surgery, faculty of medicine, Cairo University, for his help, guidance and revision of the text and his continuous encouragement.

I extend my gratitude and thanks to all staff member of orthopedic surgery department for their help and encouragement.

CONTENTS

List of Tables

List of Figures

Introduction

The human foot is a complex structure capable of supporting body weight, accelerating the body in running, and changing position for uneven floor (1,2).

The major articulation of the hindfoot is the joint between the talus and the complex of the navicular, calcaneus, and cuboid. The calcaneocuboid–navicular complex has been called the acetabulum of the foot, with the talus being the figurative femoral head. The "acetabular" configuration allows motion in several planes a more complex conceptualization than the older description of an oblique hinge (1,2).

Movements of the foot are often described in confusing terms. The hindfoot inverts and everts into varus and valgus positions. When the hindfoot inverts, the rest of the foot rolls onto the outer border of the foot as it supinates. When the heel everts into valgus, the forefoot pronates, thereby increasing weight bearing on the first ray. Smaller arc movements occur in the midfoot between the cuneiforms, navicular, cuboid, and metatarsals (3,4).

Vertical talus is a condition that produces a rocker-bottom deformity of the foot. It has an incidence of 1 in 10.000. The term *vertical* talus should be reserved for feet with fixed equinus of the calcaneus and dorsal dislocation of the navicular on the talus. It has also been called *congenital convex pes* valgus. The most appropriate name for the condition is *teratologic dorsolateral dislocation of the talocalcaneonavicular joint*. The first description was by Henken in 1914 and the characteristic features were well defined by Lamy and Weissman (5,6,7,8,29,51)

The exact etiology of vertical talus is unknown. Possible causes include muscle imbalance, especially over-pull of the anterior tibial tendon in paralytic disorders, and intrauterine compression, particularly when coupled with arthrogryposis. Autosomal dominant transmission through three generations has been reported, as well as transmission from parent to child. It has been suggested that the deformity represents an arrest in fetal development of the foot occurring between the 7th and 12th weeks of gestation (5,6,9).

Vertical talus may be present alone but more commonly is accompanied by other neuromuscular conditions. It is most often present in association with myelomeningocele and arthrogryposis, it also has been found in spinal muscular atrophy, neurofibromatosis, congenital dislocation of the hip, Rasmussen's syndrome, and trisomy 13-15 and 18 (10,11,29).

The classic appearance is a rocker-bottom foot, which is a foot with a convex plantar surface and the apex of the convexity at the talar head. The calcaneus is fixed in equinus and the Achilles tendon is contracted. The peronei and anterior tibialis tendons are taut, and the foot is everted into a valgus, externally rotated position. The navicular is palpable as it lies on the talar neck, where it abuts the anterior tibial surface at the front of the ankle joint. There may be some flexibility of the foot, but passive correction of the deformity is not possible (5).

Coleman and colleagues distinguished two types of vertical talus, the first with talonavicular dislocation and the second with concomitant dislocation of the cuboid on the calcaneus (12).

Treatment of congenital vertical talus is either non-operative using serial manipulation and casting or operative treatment that may be done as one-stage procedure or two-stage procedure. Most authors prefer one-stage procedures. (6).

Multiple percutaneous tenotomies is preferred than open tenotomies because of smaller wounds that decrease complications as wound dehiscence or infection and reduce the operative time (7).

Reduction and fixation of the talonavicular joint through mini-open approach without extensive release is preferred than the previous classic approach as it avoids many complications as avascular necrosis of the talus and joint stiffness (11).

Aim Of The Work

The aim of the work is to evaluate the management of congenial vertical talus by multiple percutaneous tenotomies plus open reduction & internal fixation of the talonavicular joint in one stage.

Aetiology

The exact cause of vertical talus in most cases is not known. Theories include increase in intrauterine pressure and resultant tendon contractures, or an arrest of fetal development occurring between the 7^{th} and 12^{th} weak of gestation (13).

Approximately one half of cases of vertical talus occur in association with neurologic abnormalities or genetic syndromes (14).

Associated neurological abnormalities can be divided into two broad categories: central nervous system defects or neuromuscular disorders. Though the reminder of vertical talus cases were once thought to be idiopathic in nature, there is increasing evidence for a genetic cause as many families demonstrate an autosomal dominant inheritance pattern (6,15) Table-1

Table-1 Etiology of congenital vertical talus (additional malformations, congenital anomalies, and genetic syndromes) (6)

Central nervous system/spinal cord:

Myelomeningeocele

Sacral agenesis

Spinal muscular atrophy

Diastematomyelia

Muscle:

Distal arthrogryposis

Arthrogryposis complex

Neurofibromatosis

Chromosomal abnormality:

Triosomy 18

Triosomy 15

Triosomy 13

Known genetic syndromes:

Neurofibromatosis

Rasmussen syndrome

Split hand and split foot

Prune Belly syndrome

Castello syndrome

De Barsy syndrome

Congenital vertical talus associated with neurological disorders tend to be more rigid and difficult to treat than idiopathic vertical talus (6).

Acquired Deformities:

An acquired vertical talus can develop secondarily in association with a variety of neuromuscular disorders, including cerebral palsy, poliomyelitis, and spinal muscular atrophy. Additionally, mal-correction of a clubfoot can create a vertical talus. More limited corrective soft tissue procedures frequently are successful for the restoration of a satisfactory weight-bearing position of the foot but muscle-balancing procedures may be required as part of the operative correction (16).

Genetics:

Genetic abnormalities associated with vertical talus include aneuploidy of chromosome 13, 15 and 18. A variety of syndromes were also described in which vertical talus is a congenital manifestation (6,22,49,53).

De Barsy syndrome is a rare congenital syndrome characterized by joint hypermobility, growth retardation, mental retardation and characteristic facies.

orthopedic manifestations include scoliosis, hip dislocation and congenital vertical talus (17).

Prune Belly syndrome is an uncommon syndrome characterized by intrauterine urinary obstruction associated with oligohydraminos and resultant intrauterine crowding that will result in some orthopedic manifestations as hip dislocation, metatarsus adduction, club feet, and vertical talus (18).

Castello orthopedic manifestations include club foot, brachydactyly, syndactyly, multiple upper and lower joint contractures, and vertical talus (19).

In addition vertical talus has been described in Rasmussen syndrome in association with external auditory canal atresia (20).

There have been many advances in understanding the rule of genetics in idiopathic vertical talus based on the observation of a positive family history in 12-20% of patients with idiopathic vertical talus, the deformity is inherited in an autosomal dominant manner with incomplete penetrance (15).

Through the study of many families with vertical talus a mutation in the HXOD 10 gene was recently found to be responsible on vertical talus in one of these families consisting of six individuals with isolated vertical talus (15).

However another series was done on patents with idiopathic vertical talus and they found no mutations in HXOD 10 gene suggesting that all idiopathic vertical talus cannot be explained by one gene defect (21).

Pathoanatomy

The gross anatomic and histologic features of congenital vertical talus have been described by several investigators. The anatomic abnormalities may be subdivided into those of the bones and joints, those of the ligaments, and those of the muscles and tendons (5).

Bone and joint changes:

The navicular articulates with the dorsal aspect of the neck of the talus and is locked there. The proximal articular surface of the navicular is tilted plantarward. The head of the talus is flattened superiorly and is ovoid in its length (23,24).

The calcaneus is displaced posterolaterally in relation to the talus, is in contact with the distal end of the fibula, and is tilted into equinus. The angle between the axes of the talus and calcaneus is markedly increased. The subtalar joint is abnormal, with the anterior facet usually absent and the middle facet hypoplastic. The articular facet of the calcaneus for the cuboid is inclined dorsally and laterally, and there is a variable degree of subluxation of the calcaneocuboid joint. These abnormalities result in elongation of the medial column and shortening of the lateral column of the foot (5)