Management of congenital vertical talus: comparison between mini invasive reduction and extensive surgical technique in early age

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ABSTRACT

Background: About one baby in 10,000 is born with the foot deformity known as vertical talus. In about half of those cases, both feet are affected. The disorder occurs with equal frequency in boys and girls. Vertical talus is a rare deformity of the foot which is diagnosed at the time of birth.

Methods: Present study was performed at Department of Orthopedics, Gujarat Adani Institute of Medical Science, Bhuj, Kutch, Gujarat. In the study 40 patients who were treated for unilateral or bilateral congenital vertical talus at a single institution which lead to 60 treated feet in the study. Patient with bilateral symptoms were randomly selected for one foot in the study.

Results: The mean normative pain score was found to be 58.0 in the minimally invasive group compared with 28 in the extensive release group (p =0.032). There was no difference between the two groups in the transfer and basic mobility domain. The normative global function domain was higher in the minimally invasive group (48.3) compared with the extensive soft-tissue release group (34.3, p =0.03).

Conclusions: Longer-term follow up and studies with large sample size are still necessary to determine whether the improved outcomes are maintained into the adulthood and whether the superior outcome is related to the reduce scarring in the patient.

Keywords: Vertical talus, Congenital, Invasive group, Extensive surgery

INTRODUCTION

About one baby in 10,000 is born with the foot deformity known as vertical talus. In about half of those cases, both feet are affected. The disorder occurs with equal frequency in boys and girls.¹ Vertical talus is a rare deformity of the foot which is diagnosed at the time of birth. Because babies are born with the condition, it is also known as congenital vertical talus. It is one of the causes of a flatfoot in the new born. One foot, or both feet, may be affected. Although it is not painful for the new born or even the toddler, if it is left untreated, vertical talus can lead to serious disability and discomfort later in life.²

The talus (TAY-lus) is a small bone that sits between the heel bone (calcaneus) and the two bones of the lower leg (tibia and fibula). The tibia and fibula sit on top and around the sides of the talus to form the ankle joint. The talus is an important connector between the foot and the leg, helping to transfer weight across the ankle joint.²

In vertical talus, the talus bone has formed in the wrong position and other foot bones to the front of the talus have
shifted on top of it. As a result, the front of the foot points up and may even rest against the front of the shin. The bottom of the foot is stiff and has no arch — in fact, it usually curves out — and is often described as "rocker bottom."

Vertical talus is usually diagnosed at birth (perhaps even before birth if an ultrasound is performed during the pregnancy). Other foot deformities in the new born are more common and vertical talus is often initially misdiagnosed as some other type of new born flatfoot, or even as a clubfoot.

The exact cause of vertical talus in not known. Many cases of vertical talus, however, are associated with a neuromuscular disease or other disorder, such as arthrogryposis, spina bifida, neurofibromatosis, and numerous syndromes. Your doctor may decide to perform additional tests to discover whether your infant has any of these other conditions. Most cases of vertical talus are idiopathic, meaning the cause is unknown. Sometimes it is associated with abnormalities in the chromosomes. These abnormalities result in a syndrome or neuromuscular disorder that in turn disrupts the foot’s structure. A medical examination or blood test usually determines whether or not the condition is idiopathic. However, there is increasing evidence that these unknown causes are related to defects in genes involved in early limb development.

Prevention of vertical talus is not possible. It is unlikely that anything you did during pregnancy could have caused the disorder. Although the most common treatment for vertical talus is surgery, your doctor may recommend a trial of nonsurgical treatment. This includes a series of stretching and casting designed to increase the flexibility of the foot and even in some cases correct the deformity all together. Some doctors also recommend continued physical therapy exercises to stretch the foot and improve flexibility.

Several authors beginning with Osmond-Clark in 1956, Herndon and Heyman in 1963, and Coleman in 1970, described a staged, 2-incision reconstructive surgery. After noting a high rate of complications with the two staged procedure, Ogata and Hoenecker recommended a single stage procedure with a medial approach. In 1987, Seimon described a single stage dorsal approach with the talonavicular joint reduced and held with k-wire and the Achillis tendon lengthened percutaneously. Stricker and Rosen, have published their experience with this technique, as have Mazzocca and Thomson, and both groups have noted excellent results with minimal complications. Dunanc and Fixsen transferred tibialis anterior to the neck of talus and claimed good results.

The challenge in treating vertical talus is how to best achieve the desired outcome of a mobile, plantigrade, pain free, and functional foot. Bracing and/or shoe modifications alone do not provide correction and often result in pain and long-term disability. The traditional surgical approach involving extensive soft-tissue release, while effective for gaining initial correction in many cases, is associated with several potential complications, including wound necrosis, osteonecrosis, inadequate correction of the deformity, stiffness of the ankle and subtalar joints, and amputation in extreme cases. A minimally invasive technique for correcting vertical talus that relies primarily on serial casting was introduced almost ten years ago. Multiple centers have reproduced the effectiveness of this technique in achieving initial correction (both radiographically and clinically), while maintaining excellent motion in the foot and ankle, for patients with both isolated and non-isolated vertical talus. In the present study, we compare the long-term outcomes of clinical and radiographic correction, foot function in patients with vertical talus treated with either the minimally invasive method or extensive soft-tissue release surgery.

**METHODS**

Present study was performed at Department of Orthopedics, Gujarat Adani Institute of Medical Science, Bhuj, Kutch, Gujarat between January 2014 to November 2014. Ethical clearance was taken from the institutional ethics board and informed consent was obtained from all the participants in the study 40 patients who were treated for unilateral or bilateral congenital vertical talus at a single institution which lead to 60 treated feet in the study. Patient with bilateral symptoms were randomly selected for one foot in the study. For the study following were kept the inclusion criteria which were as follows: 1) Diagnosis of vertical talus confirmed by lateral radiograph and 2) follow up period of three years was achieved after treatment. X-ray in maximum dorsiflexion and maximum planter flexion lateral view of foot was taken. Based on the criteria out of 40 patients we could include 30 patients only. Rest of the patients were lost in follow up period for some or the other reason. Exclusion criteria were as follows: 1) children with oblique talus deformity because they do not require any treatment, 2) postoperative radiograph lost, 3) patients lost on follow up parents did not signed the consent form and 4) Patients with neurological disorders (e.g. cerebral palsy, myelomeningocele, spinal dysmorphism, etc.)

In the present study the demographics of the patients were recorded. The patients were divided into two groups one is patients who underwent minimum invasive group and other is patient undergoing extensive release group. The choice of treatment was purely based on the decision of the surgeon only. The average age in the group of minimum invasive technique was found to be 8.4 months and that for extensive release group was found to be 18.9 months. The mean follow up period was found to be 3 years.

Radiographs of the feet were made at the time of clinical diagnosis and post treatment period. Later on the follow
up period the lateral radiograph were made. The examiner in
the study were not aware of the type of treatment
underwent by the patients. Radiographic angles were
measured twice by the same examiner and the mean of
the two measurements were recorded. With the help of
hand held goniometer ankle range of all patients was
measured by the examiner. Paediatric outcomes data
collection instrument questioner was completed by the
parents or guardian. Standardized scores are raw scores
on the range of 0 to 100, with 100 being the best possible
score; to make the scores comparable across various
scales, the normative score was calculated on the basis of
data from the general healthy population, which has a
mean normative score of 50. Thus, a patient scoring >50
is above the mean of the general healthy population.

RESULTS

On the basis of the demographic of the patients following
details were noted. Out of the 30 patients included in the
study, 16 were males and 14 were females. Eighteen
patients were included in the minimally invasive group
and twelve patients were included in the extensive soft-
tissue release group provided PODCI data. At the end
when the evaluation of the PODCI scores was done it was
found that PODCI scores for pain were better in
minimally invasive group as compared to extensive
surgical group. The mean normative pain score was
found to be 58.0 in the minimally invasive group
compared with 28 in the extensive release group (p
=0.032). There was no difference between the two groups
in the transfer and basic mobility domain. The normative
global function domain was higher in the minimally
invasive group (48.3) compared with the extensive soft-
tissue release group (34.3, p =0.03).

Radiographic values

Preoperative radiographic values were similar between
the two treatment method groups (p >0.18 for all
variables). The correction of hind foot valgus
(anteroposterior talar axis-first metatarsal base angle) was
greater in the minimally invasive group (37.1° versus 25°,
p = 0.043). The correction of all other radiographic
values was similar for both treatment method groups (p
>0.1 for all variables). No other complications or
abnormality were found in the patients of both the
groups.

Table 1: Demographic distribution of the patients in
the study.

| Sex         | Number |
|-------------|--------|
| Male        | 18     |
| Females     | 12     |
| Total       | 30     |

Table 2: Mean age of the patients of individual
groups.

| Groups          | Means age |
|-----------------|-----------|
| Minimum invasive| 8.4 months|
| Extensive surgery| 18.1 months|

Table 3: Postoperative PODCI scores.

|                         | Minimally invasive | Extensive surgery | P value |
|-------------------------|--------------------|-------------------|---------|
| No. of patients         | 18                 | 12                |         |
| Pain                    | 58                 | 27                | 0.032*  |
| Transfer & basic mobility| 43.2              | 46.8              | 0.61    |
| Global function         | 46.4               | 30.2              | 0.035*  |

* indicates statistical significance at p ≤0.05

Statistical analysis

Preoperative and postoperative limb-specific range of
motion and preoperative radiographic measurements
were compared for the two combinations of treatment
method utilized using one-way analysis of variance
(ANOVA). When the overall model was significant (p
<0.05), least-squares means were used to perform all
pairwise between-group comparisons, with particular
interest in the comparison between the two treatments
for vertical talus. Within the ANOVA, a statistical contrast
was used to test the a priori hypothesis that values for the
minimally invasive method were similar to those for the
extensive-surgery group.
DISCUSSION
Congenital vertical talus, also known as congenital convex pes valgus, is an uncommon foot deformity that is present at birth and has an estimated incidence of 1 in 10,000. It is characterized by a fixed dorsal dislocation of the navicular on the talar head and neck resulting in a rigid flatfoot deformity. It occurs as an isolated deformity (idiopathic) in approximately half of all cases and is associated with neuromuscular and genetic disorders in the remaining cases. Fifty percent of children have bilateral involvement and there is no sex predilection. Left untreated a congenital vertical talus cause’s significant disability long term. Ambulation is usually not delayed but the gait is usually awkward with difficulty balancing.

The main purpose of the treatment of the vertical talus is to restore the normal anatomical relationships between the talus, navicular, & calcaneus. Most of the treatment protocols have been involving more complex reconstructive procedures that is either one-stage or two-stage procedures. However, these extensive procedures also been linked with a large number and variety of complications such as talus avascular necrosis, stiffness of ankle and subtalar joint, pseudoarthrosis, and under correction of the deformity that may require to undergo secondary procedures.

The minimally invasive method to treat vertical talus was developed to provide an alternative surgical approach so that a more mobile, functional foot could ultimately result. In the current study, we used clinical, radiographic, and functional outcomes to demonstrate the ability to achieve correction using the minimally invasive method for isolated and non-isolated vertical talus and to maintain it at a mean follow-up of seven years.

Since Seimon published his original article, there have been no further published studies assessing the efficacy of the technique, to our knowledge. Instead, more extensive soft tissue release procedures have been developed. Although good correction can be achieved with these extensive surgical procedures, long-term problems are reported, including stiffness of the ankle and subtalar joint. Patients with clubfoot treated with extensive soft-tissue releases have similar long term problems, and this recognition contributed to the popularity of the minimum invasive method of clubfoot management

Furthermore, we were able to show that patients treated with the minimally invasive method had better long-term foot flexibility and pain scores compared with those treated with extensive soft tissue release surgery. It would now be difficult to perform a prospective study, as the minimally invasive method has become the standard of care for initial treatment of vertical talus because of the more favourable short-term results.

CONCLUSION
The minimally invasive treatment method for vertical talus did provide with better long-term ankle range of motion and pain scores compared with extensive soft-tissue release surgery. Longer-term studies are still necessary to determine whether the improved outcomes are maintained into the adulthood and whether the superior outcome is related to the reduce scarring in the patient.

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