



MANAGEMENT OF CLUBFOOT INFANT WITH PONSETI TECHNIQUE

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ABSTRACT

Clubfoot is one of the most common disabilities in worldwide among infants. It is estimated that more than 35,000 children are born with clubfoot every year in India. Clubfoot refers to one or both feet rotated in or out from the midline position. Correction of clubfoot at an early stage, helps the child to walk normally, without correction, a child may walk on the lateral or dorsal side of the foot, which in turn causes an issue with walking. The most common clubfoot deformity is talipes eqvinovarus. Talipes eqvinovarus is a birth defect in which foot and ankle are rotated away from the normal position and foot is pointed downward. The treatment of clubfoot varies depending on the severity of condition. Gentle manipulation and casting is traditional approach to treat the clubfoot, in some cases minor surgery is done to correct the position of the foot. The widely accepted treatment for clubfoot deformity in infants is the Ponseti technique. In last 20 years many research studies across the world have proved that more than 90% of cases of idiopathic clubfoot deformities are treated effectively with the Ponseti technique. Ponseti technique is a simple, cost-effective treatment and now it has become treatment of choice for clubfoot.

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INTRODUCTION

Clubfoot

Clubfoot is a congenital deformity of lower limbs and it is characterized by complex poor alignment of the foot from the normal position that involves small bony parts and muscles, with hindfoot equinus and varus deformity commonly known as talipes equinovarus, besides to this there is a deformity of midfoot cavus and forefoot adduction.

Incidence of clubfoot

It is estimates that 1.2 billion children are living with clubfoot disabilities and it is estimated that around 35,000 children born every year with clubfoot in India. The incidence rate of clubfoot in India is 1.2/ 1000 live birth. If the baby boy has a clubfoot, there is a 2.5 percent chance that his next sibling will have clubfoot. If a girl baby has a clubfoot, there is a 6.5 percent chance that his next born sibling will have a clubfoot. Clubfoot is twice as

common in male as in female.

Risk factor for clubfoot

Risk factor which contribute to development of clubfoot defects are

- Family history of clubfoot
- Genetic syndrome such as trisomy 18
- Neuromuscular disorder such as cerebral palsy and spina bifida
- Oligohydramnios (a decreased amount of amniotic fluid around the foetus during pregnancy)
- Babies born with clubfoot has increased risk of having developmental dysplasia of hip (DDH)
- Early amniocentesis is believed to increase the rate of clubfoot [1]

Causes of clubfoot

The exact causes of clubfoot are unclear. There



are some theories which suggest the causes for the occurrence of clubfoot in new-born, though these are considered as causes of clubfoot, these theories not proved through research.

- **Genetic theory:** Mutation in gene involved in muscle development are risk factor for clubfoot. Gene mutation cause congenital contracture, clubfoot and distal arthrogyrosis
- **Neurogenic Theory:** This theory suggests that the distribution of the common peroneal nerve during embryonic development may be responsible for clinically demonstrable muscle weakness.
- **Myogenic Theory:** It suggests that the defect in muscles development such as accessory soleus muscle and flexor digitorum accessorius longus muscles can produce equinovarus deformity.
- **Vascular Theory:** Reduced blood flow in the anterior tibial artery and its derivatives may cause under developed muscles.
- **Embryonic Theory:** Developmental defect occurring up to 12 weeks of intrauterine life may leads to clubfoot.
- **Chromosomal Theory:** Chromosomal abnormality in germ cells may also cause clubfoot defect.
- **Osteogenic Theory:** Due to some unknown cause, developmental arrest occurs in the 7- to 8- week of embryonic period can lead to clubfoot or other deformities.
- **Mechanical Block Theory:** Due to some mechanical obstruction during the intrauterine period, e.g. intrauterine fibrotic bands, oligohydramnios, disproportionate uterine cavity, can cause talipes equinovarus.

Complication of clubfoot

Clubfoot is congenital defect, it can be treated if prompt treatment is initiated at an early stage. If clubfoot is not treated or managed successfully, it can progress to a severe deformity and leads to lifelong impairment affecting involvement in daily living activities and issue with walking. The clubfoot deformity progresses to become a ‘Neglected Clubfoot’ as the child eventually begins to walk if untreated. Due to the position of the foot the child weight-bears on the lateral and dorsal side of the affected foot, where a large bursa and callous form. A large callus of thickened skin forms on the weight-bearing surface and the deformed position causes pain and more prone to injury and infection.

Classification of clubfoot

All clubfoot is not same, each type of clubfoot has unique characteristics and may need specific treatment. Early recognition of the type of clubfoot can help to guide appropriate treatment.

Positional clubfoot

Positional clubfoot refers to a foot that was held over time in an abnormal position in utero. Due to the prolonged positioning in utero, the baby may have born with one or both feet in an atypical resting position. Children with positional clubfoot shows unrestricted passive range of motion of forefoot and ankle. At the time of birth, the baby will have positional deformity of foot but bony alignment is normal. The foot position is corrected through conservative treatment such as stretching, range of motion, and weight bearing program [2].

Idiopathic clubfoot

It is true clubfoot since it is most common type of clubfoot and the causes of true clubfoot is unknown. In an idiopathic clubfoot there is a wide spectrum of impairment depending on severity. This type clubfoot is very rigid and hard to manipulate.

Secondary clubfoot

Secondary clubfoot occurs when there is secondary disease or condition that is associated with the development of clubfoot. Such conditions are Spina Bifida, arthrogyrosis, oligohydramnios and cerebral palsy. This type is more sever and difficult to treat.

Types of clubfoot

Types	Description
Talipes Varus	Heel is turned in from the midline. Child walk on lateral side of foot.
Talipes valgus	Heel is turned out from midline. Child walk on dorsal side of foot
Talipes equinus	Heel is above the toe, toes are pointed down. Child walk on toes
Talipes calcaneus	Toes are higher than the heel. Toes are pointed up. child walk on heel
Talipes cavus	High Midfoot curvature.
talipes equinovarus	Foot is fixed in a plantar flexion and deviated medially. If the condition is not corrected, the child walk on the toes and the outer border of the foot
Talipes equinovalgus	Heel is elevated and turned outwards from the midline. Only toes rest on the floor.
Talipes calcaneovarus	The heel is turned inward and anterior part of the foot is elevated. Only heel rest the floor
Talipes calcaneovalgus	The foot is dorsiflexed and deviated laterally, ie heel is turned outward from the midline and anterior of the foot is elevated on the outer border. If not corrected the child walk on the outwardly turned heel and inner border of the foot

Signs and symptoms

The signs and symptoms of clubfoot are as follows



- Earlier most of the clubfoot is painless
- Malposition of foot and ankle, later child may face issue with walking if not corrected.
- Shortened Achilles tendon.
- High and small heel.
- No creases behind heel.
- Abnormal crease in middle of the foot.
- Foot is smaller in unilateral defect
- Callosities at abnormal pressure areas.
- Internal torsion of the leg.
- Wasting of Calf muscles.

Diagnosis

clubfoot can be diagnosed antenatally by foetal ultrasound scan and careful newborn assessment at birth is important to screen the clubfoot defect. Later X ray and CT scan can be used in diagnosing different kind of clubfoot defect.

Treatment for clubfoot with ponseti technique

Ponseti technique

This method was introduced by Ignacio V. Ponseti for treating congenital clubfoot in the 1940s. This method is adopted based on the principle that the tissues of a newborn foot including tendons, ligament and joints capsules and bones can be gently manipulated to a desired position at an early developmental age. By this method clubfoot can successfully corrected within a few weeks without any reconstructive surgery. **The Ponseti technique** has become the most widely practiced method for initial treatment of infants born with clubfeet. It is an easy technique and it gives excellent results

Phases of Ponseti technique

- Treatment phase where defect is corrected completely
- Maintenance phase where brace is used to prevent the recurrence

The Treatment Phase

The treatment is initiated within the first week of life. Gentle manipulation and casting is done on weekly basis. Recasting of foot on every week helps to hold the foot in a correct position and regain the normal shape of the foot. For casting the foot, the soft cast material used because of its efficacy. Usually five to six casts are necessary to regain the normal alignment of the foot and ankle.

The steps of manipulation and casting

First manipulation and casting: In clubfoot, the foot and ankle is rotated away from midline and there is marked curvature of the foot, is called cavus deformity and it is characterized by a visible crease in the midsection of the foot. The foot is tilted down due to tightness of the Achilles tendon. Prior to first casting, a gentle manipulation is done. The emphasis is given on alignment

of forefoot with the hind foot and formation of normal curvature of midfoot. In ponseti method usually cast is applied in two stages; first short leg cast is applied to just below the knee and in second stage long leg cast is applied [3].

Second manipulation and casting: After one week, the first cast is removed and short period of manipulation is done and then long leg cast is applied which is extended from the toe to groin. The Ponseti technique emphasizes on the importance of long leg cast to maintain adequate stretching of tendons and ligaments. The treatment phase is focused on straightening the foot, aligning the forefoot with the heel. Care is taken to maintain the downward tilt of the foot. The important point in the Ponseti technique, which is totally different from the other techniques is that the heel is never directly manipulated. The gradual correction of the hindfoot and midfoot makes the heel naturally move into a correct position.

Additional casting and Achilles tenotomy: on a weekly basis the Manipulation and casting is continued for the next five to six weeks in order to steadily straighten the forefoot and allowing the forefoot to move in line with the heel. After five to six casts the position of the foot is observed and in most of the cases Achilles tendon is shortened, which restricts the ankle from bending up. In order to lengthen the Achilles tendon a minor surgery is done to allow the free ankle movement; this surgery is known as percutaneous Achilles tenotomy. After the surgery the Achilles tendon is stretched further with the forefoot pointed upward and the final cast is applied.

The Maintenance Phase

The final cast is remained in place for minimum three weeks, once the final cast is removed, the infant is placed in to special orthosis device (Denis brown bar for external rotation) or brace which helps to maintain the foot in correct position. This brace or orthosis device has to wear full time for three months and then during nap time and night time for several years to prevent recurrence of the clubfoot. The brace consists of shoe mounted to a bar to maintain the correct position of foot. The research study done in 2005 by Thacker MM and Scher DM showed that there was no recurrence of clubfoot among the patient compliant with the abduction orthosis device compared with 57% recurrence among non-compliant patient.

A study was done to evaluate the effectiveness of Ponseti technique in treating congenital talipes equinovarus. A retrospective review was done on 28 children over a period of 12 years in a tertiary centre. The study result showed that 16 children had an average follow up of 7 years, the average age of child was 6 weeks, the deformities were severe with an average pirani score of 5 and initial correction was achieved in all children with an average 6 ponseti casts and a tenotomy was performed in 21 out of 28 children. A Satisfactory outcome at the final



follow-up was achieved in 23/28 (82%) feet. The result conclude that the Ponseti method is an effective first-line treatment for talipes equinovarus to achieve functional painless feet [4].

Pirani score system

The Pirani score is developed by Shaque Pirani an orthopaedic surgeon from Canada. It is an easy, simple and reliable system to determine the severity of the deformity and monitor the progress of treatment of clubfoot by using Ponseti technique. In this scoring system different views of foot is observed to determine the issue in the soft tissue and bony anatomy. The pirani score recorded during management of clubfoot with ponseti technique shows whether the deformity is correcting normally or any problem with the correction and it also shows the degree of correction of each component of clubfoot such as hindfoot, midfoot and forefoot correction. Pirani score helps to decide when to perform the tenotomy and how many additional cast is required to correct the position.

Nursing responsibility

1. Discuss the pathology, prognosis and future expectation with the parents so that they can make the informed choice about the treatment
2. Discuss the deformity and expected outcome to clear the misconception regarding the defect and to provide actual facts about defect
3. Encourage the parents cuddle and play with child and participate in the child treatment

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4. Assess and also teach the parents to assess the excessive pressure on the cast site, skin condition and distal pulse, because these signs need immediate intervention
5. Elevate the extremities to promote the venous return and prevent edema
6. Check the toes for colour, temperature, sensation, movement and capillary refilling time every often.
7. Stimulate the movement of toes to promote the circulation
8. Provide comfort measure to child
9. Provide play material to enhance the coping abilities
10. Promote elimination pattern if long cast is used
11. Discuss the importance of frequent visit to hospital every week
12. Discuss the importance of maintenance phase and compliance with wearing brace for several weeks and chances of recurrence of clubfoot.
13. Promote the growth and development of child by meeting the developmental needs of child during the treatment and maintenance phase [5,6].

CONCLUSION

clubfoot is common birth defect of lower limb. The causes of clubfoot are unknown. the untreated clubfoot result in issue with walking and daily living activities. The aim of the treatment is to obtain a plantigrade, painless and functional foot. The Ponseti technique is worldwide accepted treatment of choice for infant with clubfoot. Conservative treatment with Ponseti method of clubfoot is widely accepted and has been excellent in achieving in correction deformity.

