

Guideline Title

Clinical Practice Guidelines for the Management of Clubfoot Deformity Using the Ponseti Method

Bibliographic Source(s)

Ponseti International Association, Publication Date: November 1, 2015

Guideline Status

This is the current release of the guidelines.

Scope

Disease/Condition

Children or young adults with clubfoot (Talipes Equinovarus) deformity

Guideline Category

Diagnosis
Classification
Evaluation
Counseling
Management
Treatment

Clinical Specialty

Orthopedic Surgery
Pediatrics
Obstetrics and Gynecology
Physical Therapy
Orthotics
Radiology

Intended Users

Orthopaedic Surgeons
Pediatricians
Obstetricians and Gynecologists
Radiologists
Physical Therapists

Nurses

Advance Practice Nurses
Physician Assistants
Orthopaedic Officers
Cast Technicians
Orthotists
Community Health Workers
Health Care Administrators
Health Plan Managers
Parents and Families

Guideline Objectives(s)

To provide best practice recommendations on management of patients with clubfoot deformity using the Ponseti Method.

Guideline Classification

Developer: Ponseti International Association, The University of Iowa, Iowa City, IA, USA

Age of Target Population: Newborn (to 1 month); Infant (1 to 23 months); Child (2 to 12 years); Adolescent (13 to 18 years); and Young Adults (up to 25 years)

UMLS Concepts

ICD9CM: Talipes Equinovarus (754.51)
MSH: Talipes Equinovarus; Clubfoot; Ponseti Method
MTH: Talipes Equinovarus; Clubfoot; Ponseti Method
SNOMEDCT_US: Talipes Equinovarus; Clubfoot; Ponseti Method

Target Population

Patients with clubfoot deformity

Inclusions: Children or young adults:

- with untreated clubfoot (Talipes Equinovarus) deformity
- with atypical or complex clubfoot deformity
- with residual or relapsed clubfoot deformity after treatment by physical therapy, casting and/ or surgery
- with clubfoot deformity associated with syndromes such as spina bifida and arthrogryposis

Exclusions: Children or young adults:

- With other congenital foot deformities such as calcaneovalgus deformity, vertical talus, metatarsus adductus, or flatfoot
- With idiopathic toe walking
- With a central nervous system disorder such as Cerebral Palsy
- With a myopathy such as Duchenne Muscular Dystrophy
- With a peripheral neuropathy such as Charcot Marie Tooth
- With a neuromuscular disorder such as Spinal Muscular Atrophy

Interventions and Practices Considered

1. Screening for clubfoot deformity at birth
2. Diagnosis and classification of different types of clubfoot deformity
3. Screening for other congenital anomalies
4. Manipulation, casting, and tenotomy techniques
5. Monitoring of patients during brace treatment
6. Management of relapses

Major Outcomes Considered

- Accurate classification of the clubfoot deformity
- Detection of late-presenting cases
- Treatment effectiveness
- Relapses
- Surgical treatment

Methodology

Methods Used to Collect/Select the Evidence

Search of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

- **Date Range:** January 1950 to December 2014
- **Keywords:** Talipes Equinovarus, Clubfoot, Ponseti Method
- **Limits:** English
- **Databases:**
 - The National Library of Medicine's MEDLARS database (Medline) (www.nlm.nih.gov  - EBM Online (www.bmjjournals.com  - The Cochrane Central Register of Controlled Trials (<http://www.thecochranelibrary.com/view/0/index.html>  - TRIP Database (www.tripdatabase.com  - CINAHL (nursing, allied health, physical therapy, occupational therapy, social services: <http://www.cinahl.com/wpages/login.htm>  - EMBASE (www.embase.com/  - PEDro (www.pedro.fhs.usyd.edu.au/ 

Number of Source Documents

Not Stated

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme given)

Rating Scheme for the Strength of the Evidence

Strength of Evidence Ratings

A = Strong evidence-base: Two or more high-quality studies.

B = Moderate evidence-base: At least one high-quality study or multiple moderate-quality studies relevant to the topic and the working population.

C = Limited evidence-base: At least one study of moderate quality.

I = Insufficient evidence: Evidence is insufficient or irreconcilable.

Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Methods Used to Formulate the Recommendations

Expert Consensus

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Internal Peer Review

External Peer Review

Description of Method of Guideline Validation

A Working Group was established in 2012, consisting of Pediatric Orthopaedic Surgeons from six countries, each with extensive experience in treating patients with clubfoot deformity. The group was supported by the staff of the Ponseti International Association along with partial financial support from the US Agency for International Development and the Leadership, Management, and Governance Group of Management Sciences for Health (AID-OAA-A-11-00015). Work Group members are listed at the end of this document. Over a two-year time period, the Work Group activities included ten web-conferences and two face-to-face meetings. Three web-conferences with participation of international professionals were performed for external peer review validation.

Recommendations

General Recommendations

- **Early identification and referral**

Although foot deformities often occur in newborns, they most commonly are positional equinovarus, metatarsus adductus or calcaneovalgus and they usually resolve with little (e.g., stretching exercises) or no intervention. Whenever prenatal or postnatal examination reveals a possible structural foot deformity, information should be provided to the parents and arrangements made for the family to see an orthopedic surgeon who will confirm the diagnosis, screen for associated conditions, and facilitate arrangements for ongoing care. The baby's spine, upper extremities and hips should be examined with both passive and active ranges of motion to detect any other abnormalities.

- **Parent/caregiver involvement and counseling**

Parents play a key role in the management of clubfoot deformity and should be informed, advised, and encouraged to:

- Understand the type of their child's clubfoot and that it is treatable;
- Understand all aspects of the upcoming treatment including the reasons for relapses;
- Communicate regularly and openly with clinical staff throughout all phases of treatment;
- Openly discuss social, cultural, and financial constraints to corrective casting treatment;
- Comply strictly with the bracing protocol and follow-up appointments;
- Openly discuss social, cultural, and financial issues regarding brace use;
- Seek support from family, community, health workers, and others, as needed.

- **Diagnosis and classification**

Patients presenting at a clubfoot clinical unit may include infants, older patients who have never been treated, some with previous casting or surgery, and some with other pathologies. Although clubfoot is a deformity defined by having cavus, adductus, varus, and equinus (CAVE), different types of clubfeet require different treatment options and have different prognoses. Therefore, the first step is to diagnose clubfoot and then classify it into categories that will help guide effective treatment.

- **Scoring**

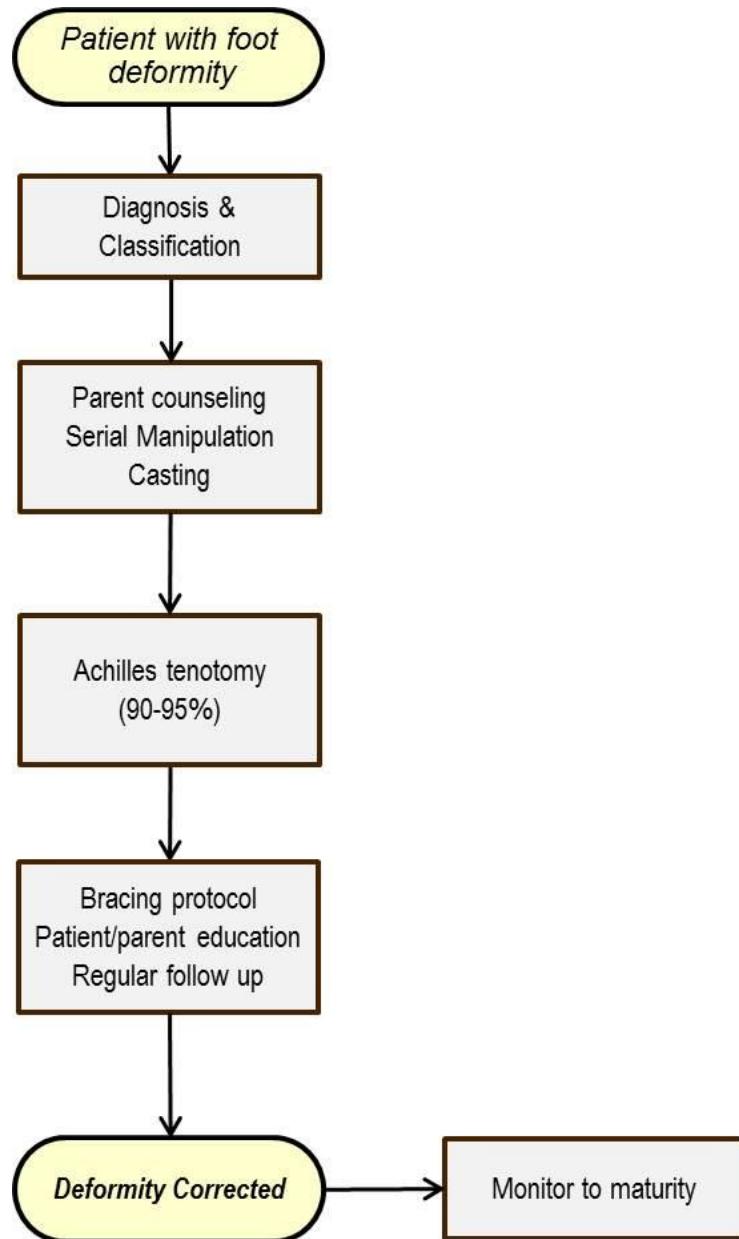
The Pirani scoring system can be used to monitor improvement during the initial casting phase. It is a 0-6 point scale; the higher the score, the more severe the deformity. The Dimeglio scoring is a 0-20 points scale comprising range of movement measures and four observational features; the higher the score, the more severe the deformity.

- **Rigorous adherence to the Ponseti Method**

A thorough understanding of the technical details for correction of the clubfoot deformity is critical for achieving successful results using the Ponseti Method. In brief, all the components of the deformity should be corrected simultaneously by elevating the first metatarsal to correct the cavus (not further supinating the foot) and gently and gradually abducting the foot with counter pressure over the lateral aspect of the head of the talus (preventing rotation of the talus in the ankle). Pressure should never be applied on the calcaneo-cuboid joint. A well-molded long-leg cast with the knee in 90 degrees of flexion should be applied to maintain the corrected position and should usually be changed every 4-7 days. In the majority of cases (90%-95%), a percutaneous Achilles tenotomy is performed to obtain the dorsiflexion needed for full correction of the deformity immediately before

applying the final cast. The final cast is maintained until the tendon is completely healed, based on the age of the patient (2 to 6 weeks). On average, 5-7 casts are usually required for full correction. A foot abduction brace should then be used to maintain the corrected foot at 60 degrees of abduction and 20 degrees of dorsiflexion. The brace is worn for three months, both day and night, and then while sleeping until the child's fourth birthday (usual the time when children can hop in one leg independently and with coordination).

The following figure illustrates the core elements of the Ponseti Method. However, the different types of clubfeet require tailored treatment protocols as outlined in the specific recommendations presented in more detail in the following sections.



Specific Recommendations

Diagnosis and Classification (Algorithm #1)

1. It is recommended that the following factors be considered when diagnosing and classifying a patient referred for treatment of clubfoot deformity using the Ponseti Method:

- a. History of clubfoot or the presence of CAVE

A complete history and physical examination for the presence of clubfoot includes:

Cavus - fixed plantar flexion deformity of the forefoot on the hind foot.

Adductus - fixed medial deviation deformity of the forefoot on the hind foot.

Varus - fixed medial deviation deformity of the hind foot.

Equinus - fixed plantar flexion deformity of the ankle.

History of clubfoot can be confirmed from medical records, which may include findings from antenatal ultrasound, records of previous examinations, and/or history of previous treatment.

- b. Presence of other congenital abnormalities

Congenital anomalies can be defined as structural or functional anomalies, including metabolic disorders, which are present at the time of birth. Syndromes sometimes associated with clubfoot include amniotic band syndrome, arthrogryposis, Mobius Syndrome, Spina bifida, and other conditions.

- c. Evidence of previous treatment

A complete history and thorough physical examination, along with review of medical records determines whether the child has had any prior treatment for clubfoot, and, if so, what was the nature of the prior treatment. A previously treated foot with any component of the deformity represents a residual or relapsed clubfoot. A clubfoot which has had prior surgery, apart from percutaneous Achilles tenotomy, may have scarring and other deformities that may alter the underlying pathology and prognosis.

- d. Presence of a complete transverse plantar crease

The presence of a complete, deep, transverse plantar crease indicates an atypical clubfoot deformity (no previous treatment) or a complex clubfoot deformity resulting from previous unsuccessful casting.

- e. Patient's walking status

Non-weight bearing and weight bearing clubfeet are subject to different forces, which affect growth and pathology.

Management of Idiopathic Clubfoot: Patient Not Walking Age (Algorithm #2)

2. It is recommended that the following factors be considered when treating patients with idiopathic clubfoot who are not of walking age:
 - a. A foot is fully corrected when all the components of the deformity are normalized and there are 60 degrees of abduction and 20 degrees of dorsiflexion.
 - b. Correction can usually be obtained with an average of 5-7 casts. A very limited number of cases require more casts.
 - c. Applying more than 8 casts may indicate severe pathology or inappropriate manipulation and casting, and additional consultation should be sought at a specialized clubfoot center.
 - d. Obtaining 20 degrees of ankle dorsiflexion is rarely accomplished entirely by casting and most commonly requires performing an Achilles tenotomy (90%-95% of the cases).
 - e. Performing the tenotomy before there is 60 degrees of abduction and 0 degrees of dorsiflexion may result in a rocker-bottom deformity and may increase pressure on the body of the talus leading to its flattening and reduced dorsiflexion in the future.
 - f. After the tenotomy, in rare very stiff cases, the dorsiflexion may not be 20 degrees and post-tenotomy casting may be performed to obtain the desired dorsiflexion (up to twice). Attempts at further casting or another tenotomy may lead to the development of a complex clubfoot deformity that is more difficult to treat and may result in long-term problems.
 - g. Failure to achieve correction of the deformity following repeated casting and tenotomy may indicate inappropriate manipulation and casting and/or incomplete tenotomy, and additional consultation should be sought at a specialized center.
 - h. Bracing can be discontinued after the age of 4 years since relapses are uncommon (5-10% of cases) after this age. However, if the child still has a relatively tight Achilles tendon (10 degrees of dorsiflexion), continuation of the brace for another year may be helpful as well as performing stretching exercises for the Achilles tendon.
 - i. In subsequent follow up visits, the foot should demonstrate maintenance of the correction with no cavus or varus and about 15 degrees of dorsiflexion. If any of the components of the deformity are present, a relapse may be present and further treatment may be required.

Management of Idiopathic Clubfoot: Patient Walking Age (Algorithm #3)

3. It is recommended that the following factors be considered when treating patients with idiopathic clubfoot who are walking:
 - a. A foot is fully corrected when all the components of the deformity are normalized, and there is 10 degrees of dorsiflexion and the talar head is fully covered laterally.
 - b. Positive progress on the correction of the deformity is a sign that the foot is responding to the treatment, even if it is relatively slow. Correction can usually be obtained with an average of 7-9 casts. Time between cast changes can be extended to two weeks, especially in children older than 4 years of age.
 - c. Except in very unusual cases, applying more than 10 casts may indicate very severe stiffness, other conditions, or inappropriate manipulation and casting, and additional consultation should be sought at a specialized clubfoot center.
 - d. Obtaining 10 degrees of ankle dorsiflexion is rarely accomplished entirely by casting and most commonly requires performing an Achilles tenotomy.
 - e. Before performing the tenotomy the foot should be adequately abducted so that the talar head is fully covered laterally and varus of the calcaneus is corrected.
 - f. After the tenotomy, in rare very stiff cases, the dorsiflexion may not be 10 degrees and post-tenotomy casting can be performed to obtain the desired dorsiflexion (up to twice). Attempts at further casting or another tenotomy may lead to the development of a complex clubfoot deformity that is very difficult to treat and may result in long-term problems.
 - g. Failure to achieve correction of the deformity following repeated casting and tenotomy may indicate inappropriate manipulation and casting and/or incomplete tenotomy, and additional consultation should be sought at a specialized center.
 - h. Bracing can be discontinued after age 4, or one year after correction of the deformity if the patient is older than four years when correction is achieved. In older children (> 5 - 6 years old) who have difficulty tolerating a foot abduction brace, an ankle-foot orthosis may be a useful option for maintaining the correction. In addition, if the child still has a relatively tight Achilles tendon (<10 degrees of dorsiflexion), performing stretching exercises for the Achilles tendon may be helpful.
 - i. In subsequent follow up visits, the foot should demonstrate maintenance of the correction with no cavus or varus and approximately 10 degrees of dorsiflexion. If any of the components of the deformity are present, a relapse may be present and further treatment may be required. In some of these patients, a slight amount of residual adductus and cavus could be compatible with good function.

Management of Atypical Clubfoot (Algorithm #4)

4. It is recommended that the following factors be considered when treating patients with atypical clubfoot:
 - a. A foot is fully corrected when all the components of the deformity are normalized and there are 40 degrees of abduction and 15 degrees of dorsiflexion.
 - b. Positive progress on the correction of the deformity is a sign that the foot is responding to the treatment, even if it is relatively slow. Correction can usually be obtained with an average of 5-6 casts.
 - c. To prevent the cast from slipping off, it is recommended to perform good molding of the cast above the heel and to bend the knee to 110-120 degrees.
 - d. The goal of obtaining 15 degrees of ankle dorsiflexion is rarely accomplished entirely by casting and most commonly requires performing an Achilles tenotomy.
 - e. Timing of the tenotomy is critical to get full correction of the atypical clubfoot without further complications. The foot is ready for tenotomy when the plantar crease is not present and the ankle is in neutral dorsiflexion (0 degrees). Performing the tenotomy earlier may result in a rocker-bottom deformity and increased pressure on the talus that may lead to flattening and reduced dorsiflexion in the future.
 - f. After the tenotomy, in rare very stiff cases, the dorsiflexion may not be 15 degrees and post-tenotomy casting may be performed to obtain the desired dorsiflexion (up to twice). Attempts at further casting or another tenotomy may lead to the development of a complex clubfoot deformity that is more difficult to treat and may result in long-term problems.
 - g. Failure to achieve correction of the deformity following repeated casting and tenotomy may indicate inappropriate manipulation and casting and/or incomplete tenotomy, and additional consultation should be sought at a specialized center.
 - h. Bracing can be discontinued after the age of 5 years since relapses are uncommon (5-10% of cases) after this age in this group of patients. However, if the child still has a relatively tight Achilles tendon (10 degrees of dorsiflexion), continuation of the brace for another year may be helpful as well as performing stretching exercises for the Achilles tendon.
 - i. In subsequent follow up visits, the foot should demonstrate maintenance of the correction with no cavus or varus and about 15 degrees of dorsiflexion. If any of the components of the deformity are present, a relapse may be present and further treatment may be required.

Management of Complex Clubfoot (Algorithm #5)

5. It is recommended that the following factors be considered when treating patients with complex clubfoot:
 - a. A complex foot is fully corrected when all the components of the deformity are normalized and there are 30 degrees of abduction and 15 degrees of dorsiflexion.
 - b. The presence of swelling or skin problems often makes the treatment of complex clubfoot very difficult. These two issues are better treated prior to beginning the casting and sometimes require stopping the casting for 3-6 weeks.
 - c. To prevent the cast from slipping off again, it is recommended to perform good molding of the cast above the heel and to bend the knee to 110-120 degrees.
 - d. The goal of obtaining 15 degrees of ankle dorsiflexion is rarely accomplished entirely by casting and most commonly requires performing an Achilles tenotomy.
 - e. The foot is ready for tenotomy when the plantar crease has improved and the ankle is in neutral (0 degrees dorsiflexion). Performing the tenotomy earlier may result in a rocker-bottom deformity and increased pressure on the talus which may lead to flattening and reduced dorsiflexion in the future.
 - f. Failure to achieve correction of the deformity following repeated casting and tenotomy may indicate inappropriate manipulation and casting and/or incomplete tenotomy, and additional consultation should be sought at a specialized center.
 - g. Shoe rotation in the brace is recommended to be at 30 degrees since many cases of complex clubfoot have an overcorrection of the midfoot (as represented by a lateral crease). Once the midfoot deformity gets corrected over time, the shoes can be rotated to 60 degrees for the remaining bracing period.
 - h. Bracing can be discontinued after the age of 5 years since relapses become less common after this age. However, if the child still has a relatively tight Achilles tendon (10 degrees of dorsiflexion), continuation of the brace for another year may be helpful as well as performing stretching exercises for the Achilles tendon.
 - i. In subsequent follow up visits, the foot should demonstrate maintenance of the correction with no cavus or varus and about 15 degrees of dorsiflexion. If any of the components of the deformity are present, a relapse may be present and further treatment may be required.

Management of Persistent / Relapsed Deformity (Algorithm #6)

6. It is recommended that the following factors be considered when treating patients with persistent/relapsed clubfoot deformity:
 - a. When evaluating a patient with persistent or relapsed clubfoot deformity, factors that may be especially important to examine include: difficulty in getting and using braces; the stability and function of the family; logistics related to transportation and housing; religious and cultural issues, etc. The family members/caregivers need to understand the importance of the bracing protocol. Education about bracing is critical. The brace should be inspected for evidence of use and appropriate fit and parents (caregivers) should be able to demonstrate proper application of the brace.
 - b. A foot is fully corrected when all the components of the deformity are normalized and there are 40-60 degrees of abduction and 15 degrees of dorsiflexion.
 - c. The goal of obtaining 15 degrees of ankle dorsiflexion may be accomplished entirely by casting in this group of patients. If this is not possible, performing an Achilles tenotomy is indicated.
 - d. Before performing the tenotomy the foot should be adequately abducted so that the talar head is fully covered laterally and varus of the calcaneus is corrected.
 - e. Failure to achieve correction of the deformity following repeated casting and tenotomy may indicate inappropriate manipulation and casting and/or incomplete tenotomy, and additional consultation should be sought at a specialized center.
 - f. Bracing can be discontinued after the age of 4 years because relapses are uncommon (5-10% of cases) after this age. However, if the child still has a relatively tight Achilles tendon (10 degrees of dorsiflexion), continuation of the brace for another year may be helpful as well as performing stretching exercises for the Achilles tendon.
 - g. The decision to perform a Tibialis Anterior Tendon Transfer (TATT) depends on the age of the patient (recommended older than 30-36 months of age) and the adherence to bracing by the parents/caregivers. The family should be aware that, if done too early, the surgery might not be as effective in preventing further relapses.
 - h. In subsequent follow-up visits the foot should demonstrate maintenance of the correction with no cavus or varus and about 15 degrees of dorsiflexion. If any of the components of the deformity are present, a new relapse may be present and further treatment may be required.

Management of Clubfoot With Relapse Following Surgical Releases (Algorithm #7)

7. It is recommended that the following factors be considered when treating patients with relapse following surgery for clubfoot:
 - a. Post-surgical relapsed clubfeet are stiffer than non-operated clubfeet due to scarring. Correction by the Ponseti Method usually succeeds in correcting cavus, adductus and varus. However, the equinus and supination may not fully correct and may require Tibialis Anterior Tendon transfer in some cases (recommended older than 30-36 months of age). This decision requires observational assessment of gait as well clinical examination to confirm that the patient has functioning tibialis anterior musculature.
 - b. Over-correction in valgus is a contraindication for the Ponseti Method. (A post-surgical valgus foot is one in which the entire foot is everted, pronated and positioned in valgus and there is no equinus or cavus.)
 - c. Radiographic evidence (weight-bearing AP and true lateral) of bony fusion around the subtalar and ankle joints is a contraindication for the Ponseti Method.
 - d. In many post-surgical cases it may not be possible to achieve 60 degrees of abduction. However, before performing the tenotomy, the foot should be adequately abducted (at least 20-30 degrees of abduction) so that the talar head is fully covered laterally and the varus of the calcaneus is corrected.
 - e. In many post-surgical clubfeet it may not be possible to achieve dorsiflexion beyond neutral, although the goal should be the maximum possible. In cases with extensive posterior scarring, a multiple level tenotomy will help in obtaining additional dorsiflexion. Performing another posterior release will increase scarring and may result in gradual loss of dorsiflexion as the foot grows.
 - f. Failure to achieve correction of the deformity following repeated casting and tenotomy may indicate inappropriate manipulation and casting and/or incomplete tenotomy, and additional consultation should be sought at a specialized center.
 - g. Bracing can be discontinued after the age of 4 years because relapses are uncommon (5-10% of cases) after this age. However, if the child still has a relatively tight Achilles tendon (10 degrees of dorsiflexion), continuation of the brace for another year may be helpful as well as performing stretching exercises for the Achilles tendon.
 - h. The decision to perform a Tibialis Anterior Tendon Transfer (TATT) depends on the age of the patient (recommended older than 30-36 months of age) and the future adherence to bracing by the parents/caregivers. The family should be aware that, if done too early, the surgery might not be as effective in preventing further relapses.
 - i. In subsequent follow up visits, the foot should demonstrate maintenance of the correction and at least neutral dorsiflexion. In some patients, a slight amount of residual adductus and cavus could be compatible with good function.

Management of Syndromic Clubfoot (Algorithm #8)

8. It is recommended that the following factors be considered when treating patients with syndromic clubfoot:
 - a. In this patient group, although the principles of the Ponseti Method are the same, the overall management of the patient is significantly different.
 - b. There is a need to account for associated clinical conditions like seizures, infections, dislocation of the hips and other joints, contractures, etc., and the complexities of treating all of these conditions at the same time. Clubfoot correction is often subordinate to the patient's other medical conditions.
 - c. Correction of a syndromic clubfoot is functionally important and allows for better bracing and fewer complications such as infections or ulcers.
 - d. Decisions in treating these patients are similar to those described in the other types of clubfoot, although each step of the treatment needs to be carefully adapted for the patient's concurrent medical and orthopedic issues.
 - e. Positive progress in correcting the deformity is a sign that the foot is responding to the treatment, even if it is relatively slow. Correction can usually be obtained with an average of 8-10 casts.
 - f. Many syndromic clubfeet may not achieve dorsiflexion beyond neutral, although the goal should be the maximum possible.
 - g. Timing of the tenotomy is critical to get full correction of syndromic clubfeet without further complications. Performing the tenotomy too early may result in a rocker-bottom deformity and increased pressure on the body of the talus that may lead to flattening and reduced dorsiflexion in the future.
 - h. Failure to achieve correction of the deformity following repeated casting and tenotomy may indicate inappropriate manipulation and casting and/or incomplete tenotomy, and additional consultation should be sought at a specialized center.
 - i. In some syndromic cases, 60 degrees of shoe rotation may lead to external rotation deformity of the tibia. In these cases, reducing shoe rotation to 30 degrees will help prevent or resolve this deformity.
 - j. Relapses are very common in this group of patients and bracing should be adjusted to the other concurrent medical and orthopedic issues. In general, it is recommended to use the foot abduction brace up to the age of 4 years.
 - k. In many syndromic cases, other type of braces (AFO, KAFO, etc.) may be required for support and ambulation.
 - j. In subsequent follow up visits, the foot should demonstrate maintenance of the correction and at least neutral dorsiflexion. In some patients, a slight amount of residual adductus and cavus can be compatible with good function.

Clinical Algorithms

The following algorithms are provided in the appendices:

- Diagnosis and Classification of Clubfoot
- Management of Idiopathic Clubfoot - Patient Not Walking Age
- Management of Idiopathic Clubfoot – Patient Walking
- Management of Atypical Clubfoot
- Management of Complex Clubfoot
- Management of Clubfoot with Persistent Deformity/Relapse
- Management of Clubfoot with Relapse Following Surgery
- Management of Syndromic Clubfoot

Evidence Supporting the Recommendations

The type of supporting evidence was identified and graded for each recommendation

Benefits/ Harms of Implementing the Guideline Recommendations

Potential Benefits

Management of clubfoot deformity by the Ponseti Method practically avoids the need for extensive surgical treatment, which will allow the patients to have a long-term pain-free, functional foot, without the need for special shoes or inserts, and with the same quality of life as people without the deformity.

Potential Harms

Complications

- Rocker-bottom foot deformity
- Complex clubfoot deformity
- Overcorrection of the deformity
- Flattening of the body of the talus
- Neurovascular damage
- Infection
- Relapse of the deformity
- Tendon transfer insufficiency or pull-out
- Stiffness and osteoarthritis of the foot and ankle

Qualifying Statement

This guideline has been developed by the *Ponseti International Association* in response to identified variability and uncertainty in applying the Ponseti treatment method. It is based on an assessment of current scientific and clinical information. It is not intended to include all possible methods of care for a patient with clubfoot deformity or all criteria for choosing to use a specific procedure. Nor is it intended to exclude any reasonable alternative methodologies. The information contained in this document is intended to serve as a tool to improve patient care and

does not replace the central role of clinical expertise and reasoning in determining appropriate patient care. Clinicians should apply these guidelines in the context of the individual patient and their family.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy is not provided

Institute of Medicine (IOM) National Healthcare Quality Report categories

IOM Care Next

IOM Domain

Effectiveness
Patient-Centeredness
Long-term outcomes
Quality of Life

Identifying Information and Availability

Bibliographic Source(s)

Adaptation

Not applicable: The guideline was not adapted from another source

Date released

2015 November 1

Guidelines developer (s)

Ponseti International Association, The University of Iowa, 118 CMAB, Iowa City, IA 52242 USA

Source(s) of Funding

Funding for this publication was provided primarily by the *Ponseti International Association* along with partial support from the United States Agency for International Development (grant: AID-OAA-A-11-00015).

Guideline Committee

Best Practice Work Group

Composition of Group That Authored the Guideline

The Work Group consisted of nine members who were Board Certified in Orthopaedic Surgery and had a minimum of ten years of clinical practice in pediatric orthopaedics. In addition, two professors in Public Health and a parent of a patient with clubfoot were members of the group. The members were:

- *Olayinka Adegbekingbe, MD, Obafemi Awolowo University, Ile-Ife, Nigeria*
- *Hersey Barriga, MD, Hospital Nacional Infantil, Lima, Peru*
- *Anisuddin Bhatti, MD, JPMC, Karachi, Pakistan*
- *Muhammad Amin Chinoy, MD, Indus Hospital, Karachi, Pakistan*
- *Thomas Cook, PhD, PT, University of Iowa, Iowa City, Iowa, USA*
- *Amer Haider, parent*
- *Mansoor Khan, MD, Indus Hospital, Karachi, Pakistan*
- *Omolade Lasebikan, MD, MPH, Onobu University, Nigeria*
- *Jose A. Morcuende, MD, PhD, University of Iowa, Iowa City, Iowa, USA.*
- *Monica Nogueira, MD, Sao Paulo, Brasil*
- *Edith Parker, DrPH, University of Iowa, Iowa City, Iowa, USA*
- *Shafique Pirani, MD, University of British Columbia, Canada*

Financial Disclosures/ Conflict of Interest

Ponseti International Association is committed to producing independent, critical, and truthful clinical practice guidelines. Significant efforts were made to minimize the potential for conflicts of interest to influence the recommendations of this guideline. Conflict of interest forms were obtained from all authors. Drafts of the guidelines have been reviewed by all Work Group members and consensus was required to accept any modification.

Guideline Availability

Electronic copies: www.ponseti.info

Print copies: *Ponseti International Association*, 118 CMAB, The University of Iowa, Iowa City, Iowa 52242 USA

Availability of Companion Documents

Interventions for congenital talipes equinovarus (clubfoot). Cochrane Collaboration. Gray K, Pacey V, Gibbons P, Little D, Burns J. John Wiley & Sons Ltd., August, 2014, DOI: 10.1002/14651858.CD008602.pub3

Management Guidelines - Primary Idiopathic Clubfoot (translated from Dutch). Orthopaedic Association Netherlands, 2012. <http://www.orthopeden.org/>

Management of Infants and Children with Congenital Talipes Equinovarus. Ministry of Health, NSW, Australia, 2014. http://www.health.nsw.gov.au/policies/gl/2014/pdf/GL2014_014.pdf

Ponseti IV. *Fundamentals of Clubfoot Treatment*. Oxford Press, 1996. <http://www.ponseti.info>

Clubfoot: Ponseti Management. 2009. <http://global-help.org/category/categories/clubfoot/>

Patient Resources

Clubfoot (Interactive Tutorial)

Medline Plus, U.S. National Library of Medicine.

<http://www.nlm.nih.gov/medlineplus/tutorials/clubfootoverview/htm/index.htm>

Clubfoot Treatment: Ponseti Method (Interactive Tutorial)

Medline Plus, U.S. National Library of Medicine.

<http://www.nlm.nih.gov/medlineplus/tutorials/treatingclubfoot/htm/index.htm>

Clubfoot Guide For Parents

Vincent S. Mosca

English, 2010.

ISBN-13 #978-1-60189-107-5

<http://global-help.org/category/categories/clubfoot/>

Bo's Cherub Feet

Kim DeLeon. Illustrated by Katy Anderson.

English, 2012.

ISBN-13 #978-1-60189-126-6

<http://global-help.org/category/categories/clubfoot/>

Bo's Straight & Strong Feet

Kim DeLeon. Illustrated by Katy Anderson.

English, 2012.

ISBN-13 #978-1-60189-131-0

<http://global-help.org/category/categories/clubfoot/>

The Parents' Guide to Clubfoot

Betsy Miller

English, 2012

ISBN 987-0-89793-614-9

NGC Status

Previous Reviews and Published Guidelines

Interventions for congenital talipes equinovarus (clubfoot). Cochrane Collaboration. Gray K, Pacey V, Gibbons P, Little D, Burns J. John Wiley & Sons Ltd., August, 2014, DOI: 10.1002/14651858.CD008602.pub3

Management Guidelines - Primary Idiopathic Clubfoot (translated from Dutch). Orthopaedic Association Netherlands, 2012. <http://www.orthopeden.org/>

Management of Infants and Children with Congenital Talipes Equinovarus. Ministry of Health, NSW, Australia, 2014. http://www.health.nsw.gov.au/policies/gl/2014/pdf/GL2014_014.pdf

References

- Adegbehingbe OO, Oginni LM, Ogundele OJ, Ariyibi AK, Abiola PO, Ojo OD. *Ponseti Clubfoot Management: Changing Surgical Trends in Nigeria*, Iowa Orthopaedic Journal 30:7-14, 2010.
- Avilucea et al. *Effect of Cultural Factors on Outcome of Ponseti Treatment of Clubfeet in Rural America*, J Bone Joint Surg Am. 91:530-540, 2009.
- Banskota B, Banskota AK, Regmi R, Rajbhandary T, Shrestha OP, Spiegel DA. *The Ponseti method in the treatment of children with idiopathic clubfoot presenting between five and ten years of age*. Bone Joint J. 95-B(12):1721-5, Dec 2013.
- Bhaskar A, Patni P. *Classification of relapse pattern in clubfoot treated with Ponseti technique*. Indian J Orthop; 47(4):370-376.
- Bor N, Coplan JA, Herzenberg JE. *Ponseti treatment for idiopathic clubfoot: Minimum 5-year followup*. Clin Orthop 2009; 467(5):1263-70.
- Canavese F, Vargas-Barreto B, Kaelin A, de Coulon G. *Onset of developmental dysplasia of the hip during clubfoot treatment: report of two cases and review of patients with both deformities followed at a single institution*. J Pediatr Orthop B. 2011; 20(3):152-6.
- Carney BT, Vanek EA. *Incidence of hip dysplasia in idiopathic clubfoot*. J Surg Orthop Adv. 2006 Summer; 15(2):71-3.
- Changulani M, Garg NK, Rajagopal TS, Bass A, Nayagam SN, Sampath J, Bruce CE. *Treatment of idiopathic club foot using the Ponseti method*. The Journal of Bone and Joint Surgery 88-B(10):1385-7, 2006.
- Church C, Coplan JA, Poljak D, et al. *A comprehensive outcome comparison of surgical and Ponseti clubfoot treatments with reference to pediatric norms*. Journal of Children's Orthopaedics 2012; 6(1):51-9.
- Cooper, D., & Dietz, F. *Treatment of Idiopathic Clubfoot: a thirty-year follow-up note*. The Journal of Bone and Joint Surgery, 77-A(10), 1477-1489. Cooper et al., 1995
- Dietz FR. *Treatment of a recurrent clubfoot deformity after initial correction with the Ponseti technique*. Instructional Course Lectures. 2006; 55:625-629.
- Dimeglio, A., Bensahel, H., Souchet, P., Mazeau, P., & Bonnet, F. *Classification of clubfoot*. Journal of Pediatric Orthopaedics. 1995;4:129-136.
- Dobbs MB, Rudzki JR, Purcell DB, Walton T, Porter KR, Gurnett CA. *Factors predictive of outcome after use of the Ponseti method for the treatment of idiopathic clubfeet*. J Bone Joint Surg Am 2004; 86-A(1):22-27.
- Dobbs, M. B., Nunley, R., & Schoenecker, P. L. (2006). *Long-term follow-up of patients with clubfeet treated with extensive soft-tissue release*. Journal of Bone & Joint Surgery - American Volume, 88(5), 986-996.
- Dobbs M, Garg S. *Use of the Ponseti method for recurrent clubfoot following posteromedial release*. Indian Journal of Orthopaedics 2008; 42(1):68.
- Edmondson MC, Oliver MC, Slack R, Tuson KW. *Long-term follow-up of the surgically corrected clubfoot*. J Pediatr Orthop B. 2007 May; 16(3):204-8.

Farsetti P, C. R., Mancini F, Potenza V, Ippolito E. (2006). Anterior tibial tendon tranfer in relapsing congenital clubfoot. Long-term follow-up study of two series treated with a different protocol. Journal of Pediatric Orthopaedics, 26(1), 83-90.

Garg S, Dobbs MB. Use of the Ponseti Method for recurrent clubfoot following posteromedial release Indian J Orthop 2008 Jan-Mar 42(1);68-72

Gerlach, DJ, Gurnett CA, Limpaphayom N, Alaee F, Zhang Z, Porter K, Kirchhofer M, Smyth. Early results of the Ponseti method for the treatment of clubfoot associated with myelomeningocele. J Bone Joint Surg Am. 2009 Jun; 91(6):1350-9.

Graf A, Hassani S, Krzak J, Long J, Caudill A, Flanagan A, et al. Long-term outcome evaluation in young adults following clubfoot surgical release. Journal of Pediatric Orthopaedics 2010; 30(4):379–85.

Gray, K., Pacey, V., Gibbons, P., Little, D., Frost, C., & Burns, J. (2012). Interventions for congenital talipes equinovarus (clubfoot). Cochrane Database of Systematic Reviews, 4, CD008602.

Gurnett CA, Alaee F, Kruse LM, Desruisseau DM, Hecht JT, Wise CA, Bowcock AM, Dobbs MB. Asymmetric lower-limb malformations in individuals with homeobox PITX1 gene mutation. Am J Hum Genet. 2008;83:616–622.

Haft, G., Walker, C., & Crawford, H. (2007). Early clubfoot recurrence after use of the Ponseti method in a New Zealand population. The Journal of Bone and Joint Surgery, 89(3), 487-493.

Haje DP, Neglected idiopathic Bilateral Clubfoot Successfully Treated with the Ponseti Method, JBJS Case Connect, 3(1):e9, January 23, 2013.

Halanski MA, Maples DL, Davison JE, Huang JC, Crawford HA. Separating the chicken from the egg: an attempt to discern between clubfoot recurrences and incomplete corrections. Iowa Orthopaedic Journal 2010;20:29–34.

Harnett, P., Freeman, R., Harrison, W. J., Brown, L. C., & Beckles, V. (2011). An accelerated Ponseti versus the standard Ponseti method: a prospective randomised controlled trial. Journal of Bone & Joint Surgery – British Volume, 93(3), 404-408.

Harvey N, D. D., Mudge A, Sims S, Adams R, . (2012). Reliability of physiotherapists using the Pirani scoring system for clubfoot. International Journal of Therapy and Rehabilitation, 19(8), 439-445.

Herzenberg JE, Radler C, Bor N. Ponseti versus traditional methods of casting for idiopathic clubfoot. J Pediatr Orthop. 2002; 22(4):517-521.

Herzenberg, J. (2008). Pathoanatomy of congenital club foot. Paper presented at the 2nd Australiasian Ponseti Method Conference, Sydney, Australia.

Herzenberg, J. E., Carroll, N. C., Christofersen, M. R., Lee, E. H., White, S., & Munroe, R. (1988). Clubfoot Analysis with Three-Dimensional Computer Modeling. Journal of Pediatric Orthopaedics, 8(3), 257-262.

Janicki, J., Narayanan, U., Harvey, B., Roy, A., Ramseier, L., & Wright, J. (2009). Treatment of neuromuscular and syndrome-associated (non-idiopathic) clubfeet using the Ponseti method. Journal of Pediatric Orthopaedics, 29(4), 393 - 397.

- Janicki JA, Wright JG, Weir S, Narayanan UG. A comparison of ankle foot orthoses with foot abduction orthoses to prevent recurrence following correction of idiopathic clubfoot by the Ponseti method. *Journal of Bone and Joint Surgery. British Volume* 2011;93-B(5):700–4.
- Kaewpornsawan K, Khuntisuk S, Jatunarapit R. Comparison of modified posteromedial release and complete subtalar release in resistant congenital clubfoot:a randomized controlled trial. *Journal of the Medical Association of Thailand* 2007; 90(5):936–41.
- Khan SA, Kumar A. Ponseti's manipulation in neglected clubfoot in children more than 7 years of age: a prospective evaluation of 25 feet with long-term follow-up. *J Pediatr Orthop B*. 2010 Sep; 19(5):385-9.
- Lochmiller, C., Johnston, D., Scott, A., Risman, M., & Hecht, J. T. Genetic epidemiology study of idiopathic talipes equinovarus. *American Journal of Medical Genetics*, 1998;79(2), 90-96.
- Lorenco AF, Morcuende JA. Correction of neglected idiopathic clubfoot by the Ponseti method. *Journal of Bone and Joint Surgery (Br)* 89-B: 378-81, 2007.
- Lovell ME, Morcuende JA. Neuromuscular disease as the cause of late clubfoot relapses: report of 4 cases. *Iowa Orthopaedic Journal* 2007; 27:82–4.
- Miller NH, Carry PM, Mark BJ, Engleman GH, Georgopoulos G, Graham S, Dobbs MB. Does Strict Adherence to the Ponseti Method Improve Isolated Clubfoot Treatment Outcomes? A Two-institution Review. *Clin. Orthop.Relat.Res.* DOI 10.107/s11999-015-4559-4, 22 Sept, 2015.
- Morcunde JA, Dolan LA, Dietz FR, Ponseti IV. Radical reduction in the rate of extensive corrective surgery for clubfoot using the Ponseti method. *Pediatrics* 2004; 113(2):376–80.
- Morcunde JA, Abbasi D, Dolan LA, Ponseti, IV. Results of an Accelerated Ponseti Protocol for Clubfoot *J Pediatr Orthop* 2005; 25:623–626
- Morcunde JA, Vitale M. Non-invasive method is gold standard for treating clubfoot. *American Academy of Pediatrics News*. (www.aapnews.org), pg. 18, September 2006.
- Nogueira MP, Ey Battle AM, Alves CG. Is it possible to treat recurrent clubfoot with the Ponseti technique after posteromedial release?. *Clinical Orthopaedics and Related Research* 2009; 467(5):1298–305.
- Paton RW, Choudry Q. Neonatal foot deformities and their relationship to developmental dysplasia of the hip: a ten-year prospective study. *J Bone Joint Surg [Br]* 2009;91-B:655-8.
- Perry J, Anatomy and biomechanics of the hindfoot. *Clinical Orthopaedics and Related Research* 2010;177:9-15.
- Pirani, S., Outerbridge, H., Sawatzky, B., & Stothers, K. (1999). A reliable method of clinically evaluating a virgin clubfoot evaluation. Paper presented at the 21st SICOT Congress.
- Pirani S, Zeznik L, Hodges D. Magnetic resonance imaging study of the congenital clubfoot treated with the Ponseti method. *Journal of Pediatric Orthopaedics* 2001; 21(6):719–26.
- Pirani S, Hodges D, Sekeramayi F. A reliable and valid method of assessing the amount of deformity in the congenital clubfoot deformity. *The Journal of Bone and Joint Surgery. British Volume* 2008; 90-B(Supp:53).
- Pittner DE, Klingele KE, Beebe AC. Treatment of clubfoot with the Ponseti method: a comparison of casting materials. *Journal of Pediatric Orthopaedics* 2008;28(2):250–3.
- Ponseti, IV, Smoley EN. Congenital Club Foot: The Results of Treatment, *J Bone Joint Surg Am*. 1963; 45:261-344

Ponseti IV. Congenital Clubfoot; fundamentals of treatment. Oxford: Oxford University press, 1996.

Ponseti IV Relapsing Clubfoot: Causes, Prevention and treatment. Iowa Orthop J. 2002; 55-58.

Ponseti IV, Zhivkov M, Davis N, Sinclair M, Dobbs MB, Morcuende JA. Treatment of the complex idiopathic clubfoot. Clinical Orthopaedics and Related Research 2006; 451:171–6.

Ponseti I, Morcuende J, Mosca V, Pirani S, Dietz F, Herzenberg J, et al. Clubfoot: Ponseti Management. 2nd Edition. Global-HELP Organization, 2005.

Radler C, Suda R, Manner HM, Grill F. Early results of the Ponseti method for the treatment of idiopathic clubfoot. Z Orthop Ihre Grenzgeb 2006;144(1):80-86.

Radler C, Manner HM, Suda R, Burghardt R, Herzenberg JE, Ganger R, et al. Radiographic evaluation of idiopathic clubfeet undergoing Ponseti treatment. Journal of Bone and Joint Surgery. American Volume 2007;89(6):1177–83.

Ramirez N, Flynn JM, Fernández S, Seda W, Macchiavelli RE. Orthosis noncompliance after the Ponseti method for treatment of idiopathic clubfoot: A relevant problem that needs re-evaluation. J Pediatr Orthop. 2011;31:710–5.

Richards, B., Faulks, S., Rathjen, K., Karol, L., Johnston, C., & Jones, S. (2008). A comparison of two nonoperative methods of idiopathic clubfoot correction: the Ponseti method and the french functional (physiotherapy) method. The Journal of Bone and Joint Surgery, 90, 2313-2321.

Rijal R, Shrestha BP, Singh GK, Singh M, Nepal P, Khanal GP, et al. Comparison of Ponseti and Kite's method of treatment for idiopathic clubfoot. Indian Journal of Orthopaedics 2010;44(2):202–7.

Scher, D. M., Feldman, D. S., van Bosse, H. J. P., Sala, D. A., & Lehman, W. B. (2004). Predicting the Need for Tenotomy in the Ponseti Method for Correction of Clubfeet. Journal of Pediatric Orthopaedics, 24(4), 349-352.

Siapkara, A., & Duncan, R. (2007). Congenital talipes equinovarus: a review of current management. Journal of Bone & Joint Surgery - British Volume, 89(8), 995-1000.

Spiegel DA, Shrestha O P, Sitoula P, Rajbhandary T, Bijukachhe B, Banskota AK. Ponseti method for untreated idiopathic clubfeet in Napalese patients from 1 to 6 years of age. Clinical Orthopaedics and Related Research. 2009; 467(5):1164-70.

Tindall, A, et al,. Results of Manipulation of Idiopathic Clubfoot Deformity in Malawi by Orthopaedic Clinical Officers Using the Ponseti Method, J Pediatr Orthop 2005;25:627–629

Turco VJ. Clubfoot. New York: Churchill Livingstone; 1981.

Van Bose HJ. Treatment of Neglected and Relapsed Clubfoot. Clinics in Podiatric Medicine and Surgery, 2013;30(4):513-530.

Van Gelder zkj. Van Ruiten AG, Visser JD, Maathuis PG. Long-term results of the posteromedial release in the treatment of idiopathic clubfoot. J Pediatric Orthopaedics. 2010; 30(7):700-704.

Verma A, Mehtani A, Sural S, Maini L, Gautam V K, Basran S S, Arora S. Management of idiopathic clubfoot in toddlers by Ponseti's method. J Pediatr Orthop B 2012; 21 (1): 79-84.,

Yagmurlu M F, Ermis M N, Akdeniz H E, Kesin E, Karakas E S. Ponseti management of clubfoot after walking age. Pediatr Int 2011; 53 (1): 85–9.

Zhang W, Richards BS, Faulks ST, Karol LA, Rathjen KA, Browne RH. *Initial severity rating of idiopathic clubfeet is an outcome predictor at age two years.* J Pediatr Orthop B. 2012 Jan;21(1):16-9.

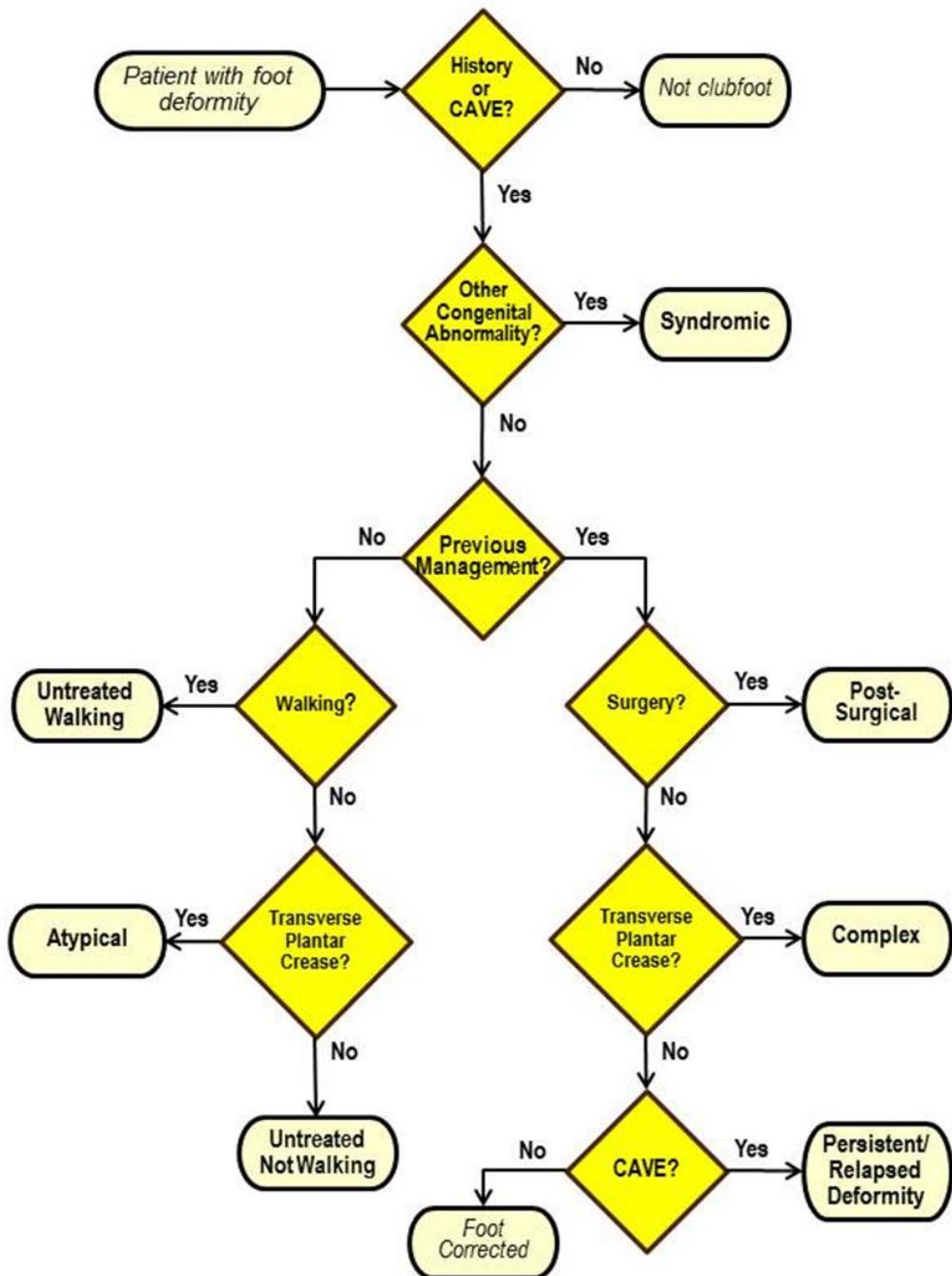
Zionts, L. E., Zhao, G., Hitchcock, K., Maewal, J., & Ebramzadeh, E. (2010). *Has the rate of extensive surgery to treat idiopathic clubfoot declined in the United States?* Journal of Bone & Joint Surgery American, 92(4), 882-889.

Zwick EB, Kraus T, Maizen C, Steinwender G, Linhart WE. *Comparison of Ponseti versus surgical treatment for idiopathic clubfoot: a short- term preliminary report.* Clinical Orthopaedics and Related Research 2009; 467(10):2668–76.

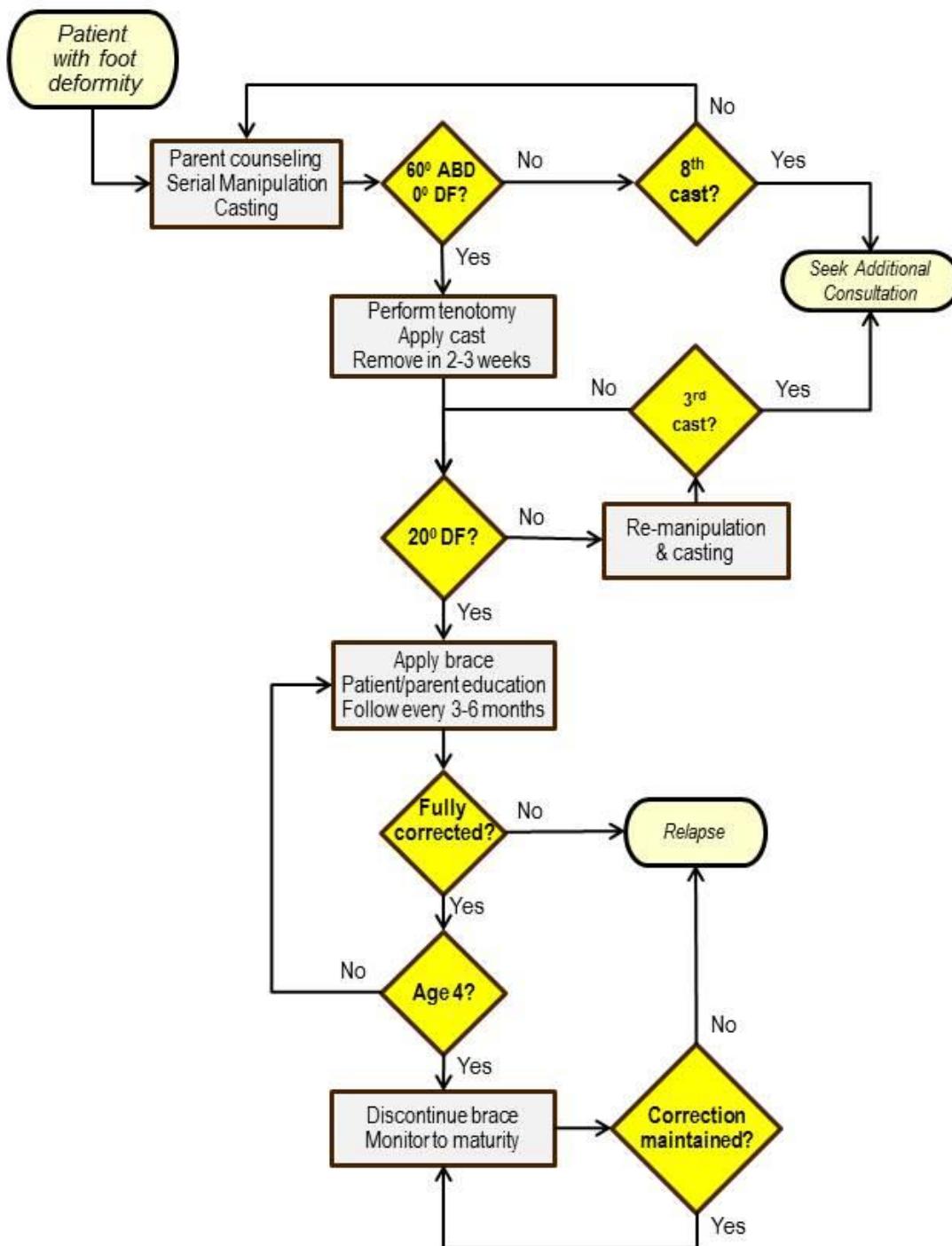
Appendix: Treatment Algorithms

See following pages.

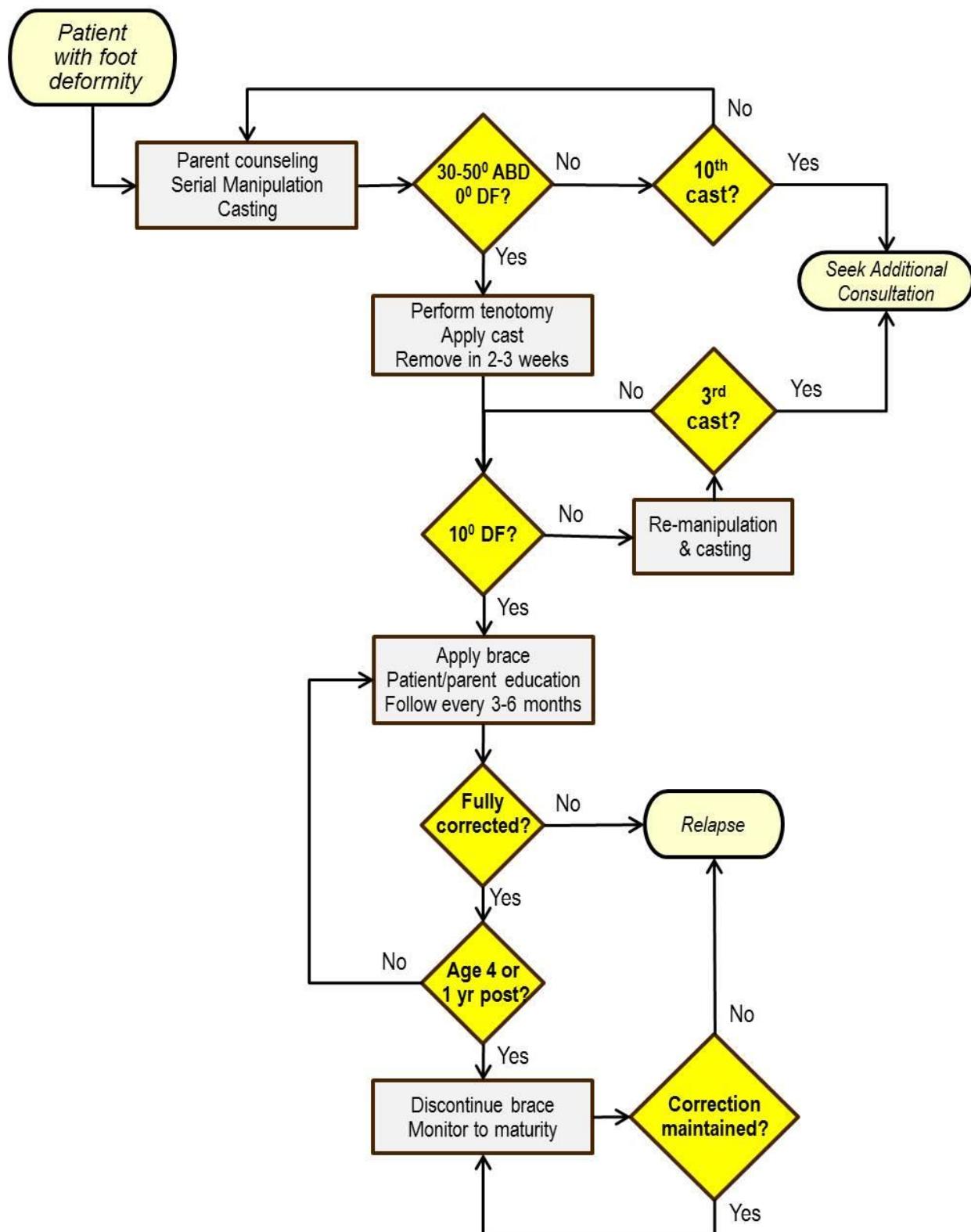
Algorithm #1
Diagnosis and Classification of Clubfoot



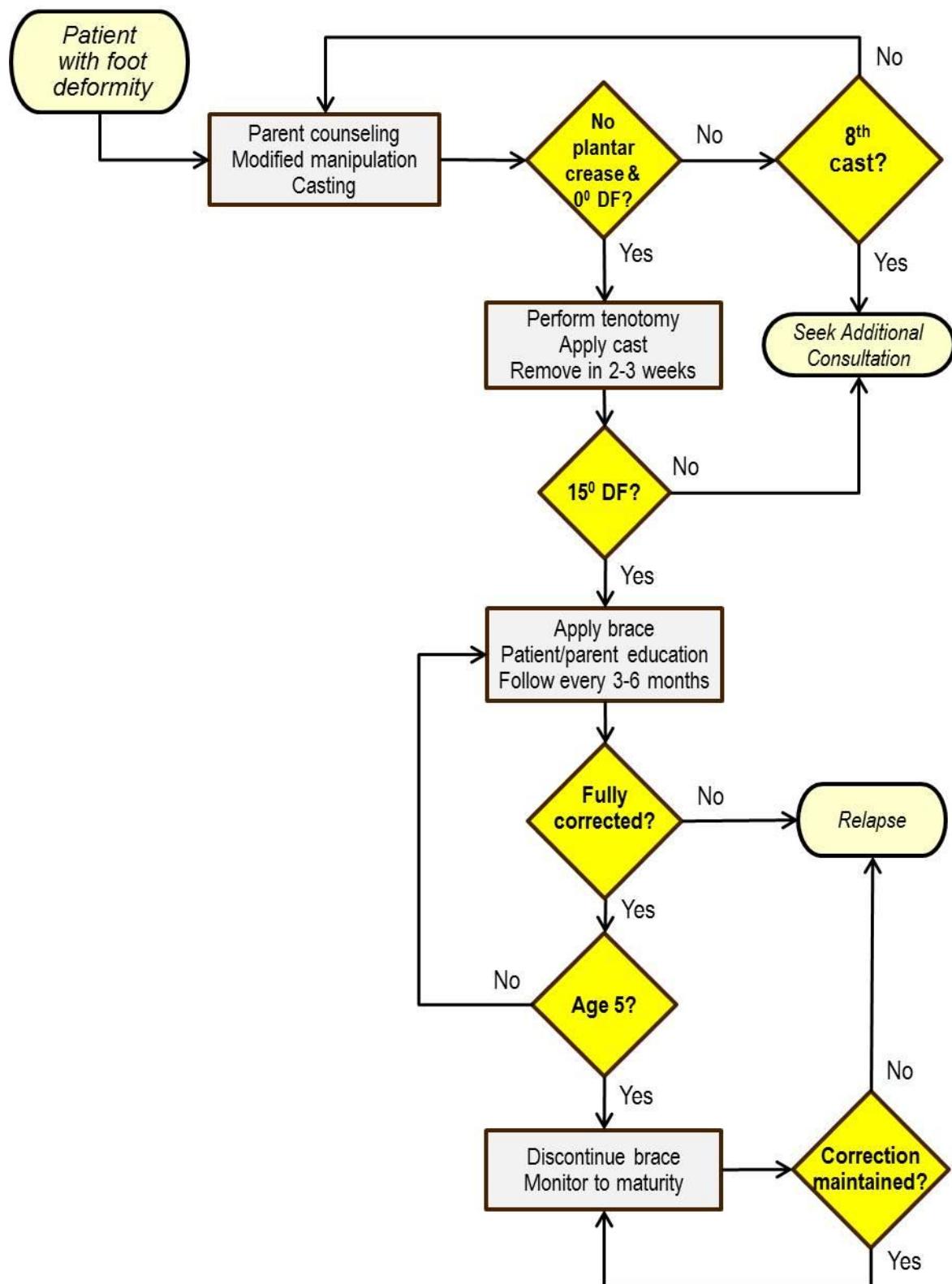
Algorithm #2
Management of Idiopathic Clubfoot
Patient Not Walking Age



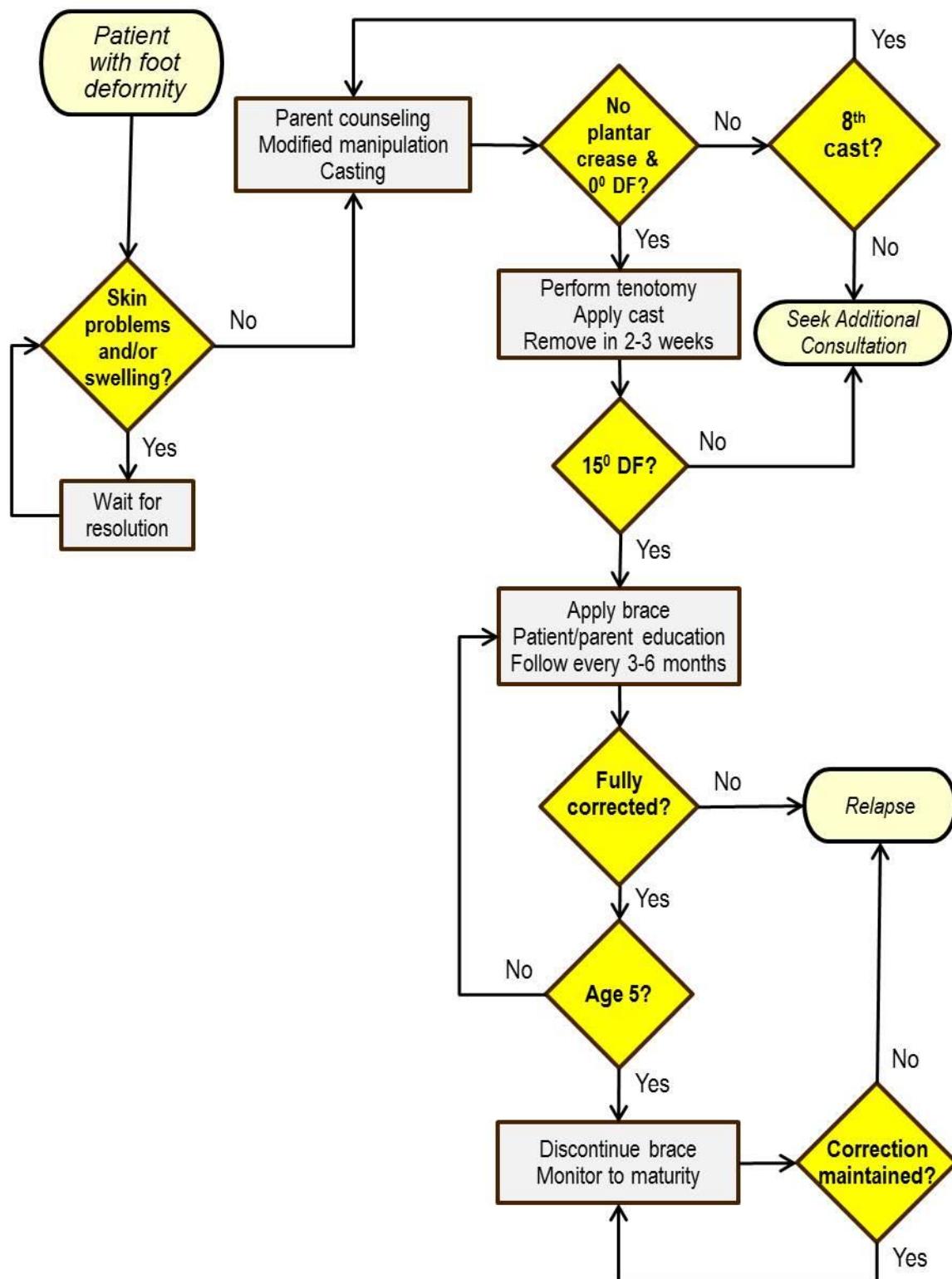
Algorithm #3
Management of Idiopathic Clubfoot
Patient Walking



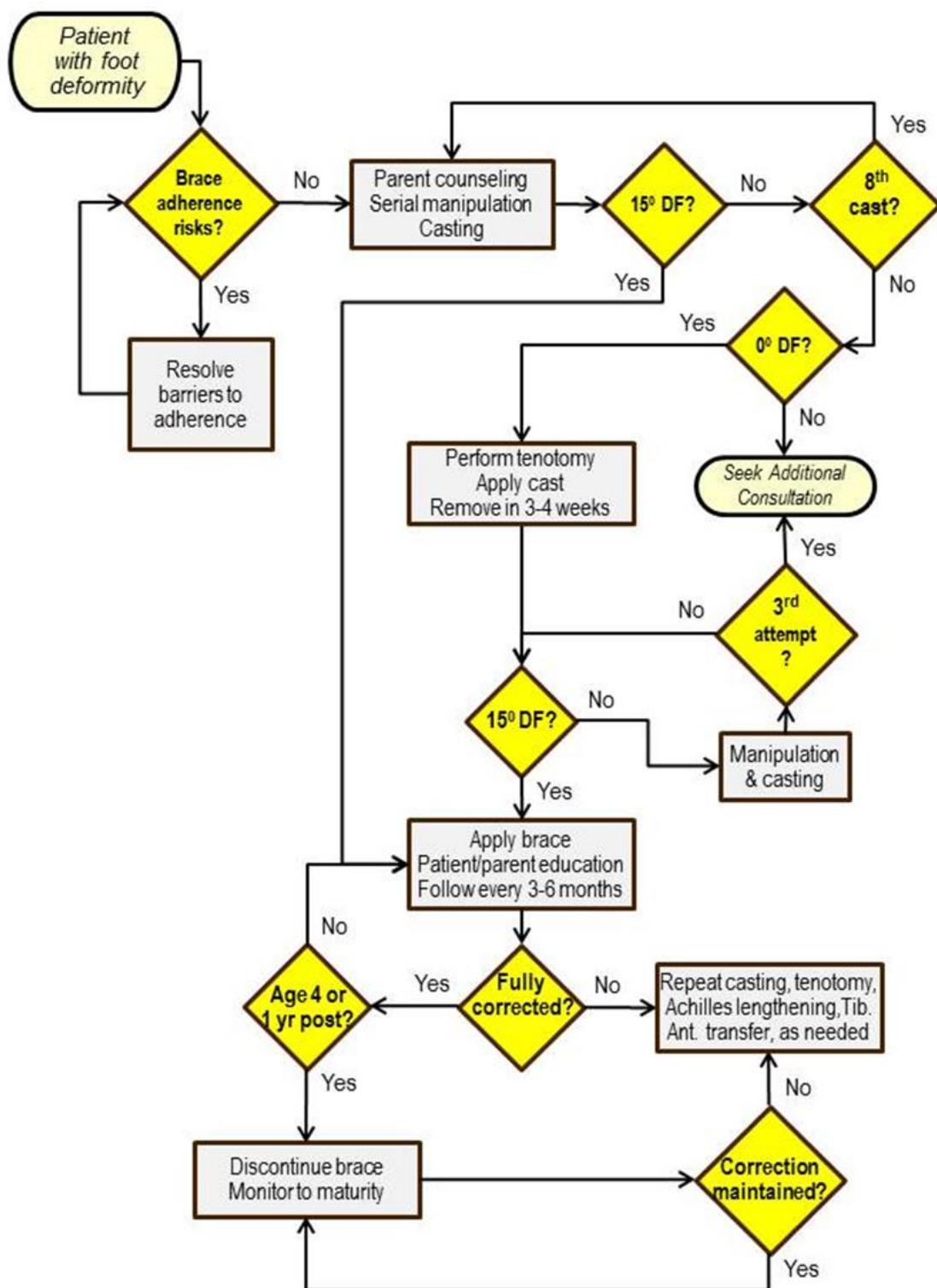
Algorithm #4
Management of Atypical Clubfoot



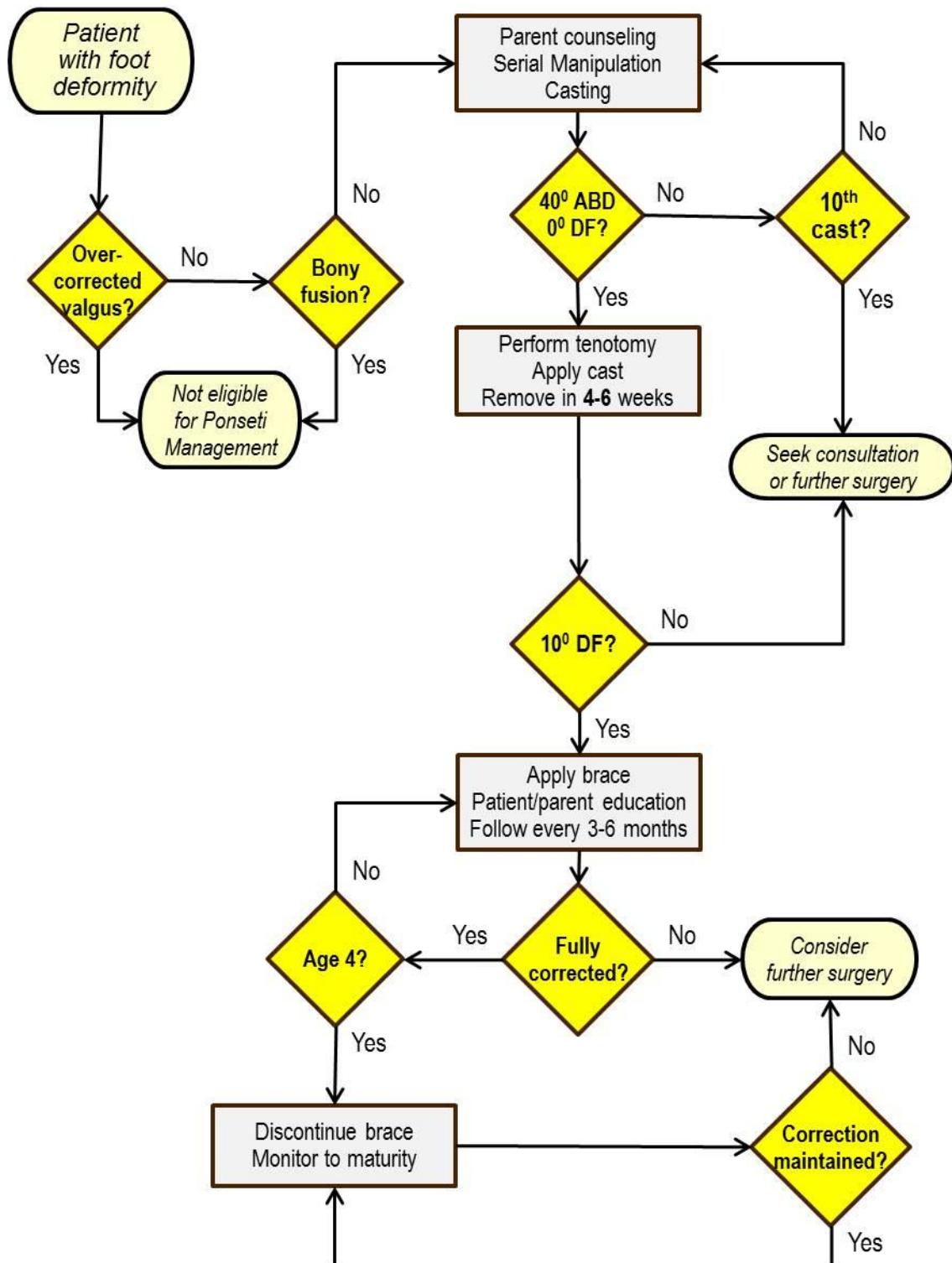
Algorithm #5
Management of Complex Clubfoot



Algorithm #6
Management of Clubfoot With Persistent Deformity/ Relapse



Algorithm #7
Management of Clubfoot with Relapse Following Surgery



Algorithm #8
Management of Syndromic Clubfoot

