Clubfoot – the Ponseti Method

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• B: I do not intend to discuss an unapproved/investigative use of a commercial product/device in my presentation
Learning Objectives

• Describe the serial casting, manipulation, & bracing technique for clubfoot originated by Dr. Ponseti.
• Some practitioners are not aware of the standard of early conservative cast treatment
Practice Change

• The learner will be able to counsel parents who have a child with clubfoot deformity and refer to an expert in the Ponseti treatment method
What is a “clubfoot?”

• Idiopathic congenital talipes equinovarus deformity
Dislocation of the foot medially in relation to the ankle
Exam - Clubfoot

- CAVE
- Cavus - high arch
- Forefoot Adduction
- Hindfoot Varus
- Ankle Equinus
Exam - Clubfoot

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Metatarsus Adductus vs. Clubfoot

- It’s NOT a clubfoot:
  - If the ankle can be dorsiflexed (e.g. upward),
  - If the plane of the forefoot is perpendicular to the tibia
Clubfoot

• The foot and ankle did not develop normally
• Even with the best of treatment (and the avoidance of recurrent deformity), the foot and ankle will never be normal
• Degrees of abnormality
• Shorter
• Stiffer
• Weaker
Clubfoot: Etiology

- Genetics
Clubfoot: Etiology

• Genetics

• Environmental factors
  – In utero mechanical forces
  – In utero exposures
Clubfoot: Etiology

• Genetics
• Environmental factors
• Syndromal (non-idiopathic) clubfeet
  • Spina bifida
  • Amniotic band syndrome
  • Arthrogryposis
  • Diastrophic dysplasia
Clubfoot: Genetics

- Polygenetic inheritance: variability of expression
- PITX1 encodes a transcription factor ("on-off switch")
- PITX1-TBX4 transcriptional pathway: important in clubfoot etiology
- Both PITX1 & TBX4 uniquely expressed in the hindlimb
- Multifactorial model - “threshold for phenotypic expression”
Clubfoot: Genetics

• Twin studies:
  – 40 monozygotic (identical) and 134 dizygotic (fraternal) twin pairs in which at least one of the paired siblings had a clubfoot
  – 32.5%: Incidence of clubfoot in other monozygotic (identical) twin
  – 2.9%: Incidence of clubfoot in other dizygotic (fraternal) twin:

Idelberger K. Gesellschaft 1939;33:272-276
Clubfoot: Genetics

Other genetic(?) variabilities seen in clubfoot population studies:

- Male predisposition (male to female ratio is 2:1)
- Racial variability
  - ↑ incidence in Polynesians
  - ↓ incidence in Asians
Clubfoot: Environmental Factors

- Increased intrauterine pressure - Hippocrates
- Mid to late 90's “early” amniocentesis for fetal genetic screening between 10 - 14 weeks
- → dramatic increase in clubfoot deformities
  - Mechanism unproven, but:
    - ~15% of patients undergoing early amniocentesis: amniotic fluid leakage
    - <1% following 2nd trimester amniocentesis or CVS
CAUTION!

- Clubfoot deformity seen on early ultrasound can resolve during pregnancy
- Significant false + rate, especially for unilateral clubfeet (29% in unilateral clubfoot, 7% in bilateral)
Clubfoot: Treatment
Clubfoot: Treatment

• J. H. Kite: Kite’s method of manipulation
  – Treated >800 patients non-operatively with his method of casting (1924-1960)
  – If casting started before 1 year of age, the usual treatment ranged from 26-49 weeks
Clubfoot: Treatment

• Limitations with these techniques
  – Amount of correction possible (undercorrection)
  – Length of time required for adequate correction
  – Rate of recurrence of deformity
  – Led to frustrations for both parent and physician
Clubfoot: Treatment

- Surgical techniques developed to meet these limitations
  - Limited posterior release with capsulotomies
  - Posteromedial release (Turco)
  - Complete posterior release (McKay)
  - “A la carte” approach (Carroll)
Clubfoot: Treatment

- Aggressive surgical approaches ➔ number of new problems,
- Many more problematic than those seen with the non-operative or limited operative approach.
Clubfoot: Treatment

- Crawford and Gupta 1996

Clubfoot Controversies: Complications and Causes for Failure

- 5 associated with non-surgical treatment
- 26 associated with surgical treatment

Crawford and Gupta 1996
Clubfoot: Treatment

Amniotic band and clubfoot pre op and one week post op
Clubfoot: Treatment
Clubfoot: Treatment
Clubfoot: Treatment
Clubfoot: Treatment

• Complications associated with aggressive surgical approach of later 20th century → general disillusionment with operative treatment

• General disillusionment with serial casting and non-operative treatment
Ponseti Technique

• 1950: 2° complications seen from extensive surgical releases, Ignacio Ponseti initiated a treatment regimen of casting and limited surgical treatment
• First reported in 1963.
Ponseti Technique

- Excellent long term outcomes using Ponseti’s technique for closed manipulation/limited surgical treatment
- Retrospective studies have shown superior results to operative treatment

Ippolito et al. JBJS-A
2003
Ponseti Technique

• This technique has gained popularity over the past 15-20 years (internet/parent-driven)

• Works best if the treating practitioner accepts a number of pre-conditions
Precondition #1:

- The goal of treatment is a “functional, pain free, plantigrade foot with good mobility and without calluses, that does not necessitate the wearing of modified shoes”

- The goal is not “to attain a perfect anatomical result”
Ponseti Technique

• Precondition #2
  – Outcome is not related to the radiographic appearance of the foot

Cooper and Deitz JBJS 1995
Ponseti Technique

• Precondition #3:
  – There is a “tolerance” of residual and compensatory deformity that the human foot can accept and will assist in accomplishing the goal of treatment

Ponseti et al CORR 1981
Ponseti Technique

• Precondition #4:
  – This is not a “non-operative” but a “limited operative” approach, as 50% of patients will require surgery in addition to the initial serial casting and Achilles tenotomy to accomplish the goal of treatment

Cooper and Deitz JBJS 1995
Ponseti Technique

• Best started 2-4 weeks of age
  – Regained birth weight
  – Family has “settled down”

• 5-6 casts, done weekly to achieve the correction

• Over 50% benefit from perc. Achilles tenotomy to complete the correction
Ponseti Technique
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Ponseti Technique

• Achilles Tenotomy
  • Can be done in office under local
  • Cast for 3 weeks in ~ 15° dorsiflexion and maximal external rotation (70 degrees)
Ponseti Technique
Ponseti Technique
Ponseti Technique
Ponseti Technique

• After Achilles tenotomy, immobilized for 3 weeks (initial phase of deformity correction completed)
Ponseti/Mitchell Orthosis
Dobbs Brace
Ponseti Technique

• Abduction/external rotation bracing is continued for three months full time, followed by 3-4 years of nighttime/naptime bracing.
Ponseti Technique

• Approximately 90% of cases will have some degree of recurrence without a retaining brace
Ponseti Technique

• Most patients with idiopathic clubfeet treated with the Ponseti technique do well

• Patients who are non-compliant with abduction bracing are at the highest risk of recurrence

• Patients whose parents have a high school education or less have been shown to be at higher risk for recurrence

Dobbs MB et al JBJS-A 2004
Born 1/2005 with right unilateral clubfoot, treated with Ponseti technique.
At 18 month follow up appointment
3 year old with good initial correction of right clubfoot but poor compliance with bracing regimen, leading to recurrent deformity
Recurrence of Deformity

• Early recurrence of deformity can be managed with repeat casting and resumption of bracing in younger age groups
Recurrence of Deformity
Recurrence of Deformity

• After age 3, tibialis anterior tendon transfer to lateral cuneiform is the standard procedure to correct recurrent deformity.
Recurrence of Deformity

- Parameters associated with a good to excellent long term functional result include:
  - Occupation
  - Body/mass index
  - Calf strength (active ankle plantarflexion)
  - Passive ankle dorsiflexion

Cooper and Deitz JBJS 1995
Recurrence of Deformity

• The original treatment, and treatment of recurrence of deformity, should therefore avoid:
  – Making the foot/ankle weaker
  – Making the foot/ankle stiffer
Special Circumstances

• Neglected Clubfoot
  – Lack of access to medical care
  – Overriding social issues
Neglected clubfeet

- Ponseti method works best for infants with idiopathic clubfeet
- Occasionally, children will present late (ambulatory) with untreated clubfeet
- Ponseti management with modifications can be very helpful in limiting the amount of aggressive surgery required to correct these deformities (and avoid further foot disasters)
Neglected Clubfeet

- Two manipulations/castings of clubfoot under anesthesia (two weeks apart)
- A plantar fasciotomy with the 3rd manipulation and casting under anesthesia
- A 4th manipulation/casting under anesthesia
- Percutaneous Achilles tenotomy with the 5th clubfoot cast under anesthesia
Neglected Clubfeet
Special Circumstances

• “Atypical clubfeet”
“Atypical clubfeet”

- A small percentage of clubfeet will become stiff and resistant to manipulation.
- These have been termed “atypical” or “complex” clubfeet.
“Atypical clubfeet”

- These feet will respond to manipulative treatment, but the technique must be altered to account for the cavus and equinus deformities.

At 5 months of age using atypical clubfoot treatment techniques.
Syndromic clubfeet

• Syndromic clubfeet can be managed successfully with Ponseti technique, though:
  – The initial number of casts will be greater than for idiopathic feet
  – Recurrence issues will occur, and the standard procedures used to manage recurrence in idiopathic feet may need to be modified to address the unique issues in the syndromic clubfoot

Syndromic clubfeet

• Syndromic clubfeet can be managed successfully with Ponseti technique, though:
  – There will still be a role for posteromedial releases and tectectomies in severely deformed feet, especially those that will require bracing to manage the weakness or stiffness associated with their syndrome
Syndromic clubfeet

Clubfoot deformity associated with type IV tibial hemimelia
Syndromic Clubfeet

Congenital knee dislocation and clubfoot
Change in Practice

• Identify clubfoot early (newborn period)
• Refer as soon as feasible to expert in Ponseti treatment
Thank You!