ULTRASOUND EVALUATION OF CLUBFOOT CORRECTION DURING PONSETI TREATMENT

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Study conducted at Wadia Children’s Hospital
Clinical scoring methods: Pirani, Dimeglio, International Clubfoot Study Group (ICFSG)

- Xrays: Unreliable, difficult to interpret as tarsal bones are unossified
- MRI: Expensive, cannot be used serially
AIMS OF STUDY

- Role of Dynamic Ultrasound to document serial correction of clubfeet during Ponseti manipulation
- Can USG detect presence of spurious correction?
Patients & Methods

- 26 consecutive children (32 clubfeet)
- < 3 months of age at presentation
- Only idiopathic clubfeet included
- Normal foot of unilateral cases as control
Patients & Methods

- Serial clinical scoring by Pirani score
- Weekly manipulation and casting as described by Ponseti was performed
- All feet underwent 3 serial ultrasounds
  - At start of treatment
  - When Pirani Midfoot Score was 0
  - At end of treatment
Ultrasound Technique

- 3 anatomical planes
- Coronal medial / coronal lateral / sagittal dorsal
- 2 probe sizes: 45mm; 26 mm for smaller feet
- Frequency 7.5 – 10 MHz
- Coronal medial plane is most important
Ultrasound Measurements In Coronal Medial Projection

- Identify
  - Tip of medial malleolus (MM)
  - Anterior surface of talus (T)
  - Navicular (N)
  - Cuneiform (C)
  - Base of 1\textsuperscript{st} Metatarsal (MT)
Ultrasound Measurements

- Distance between tip of medial malleolus and medial end of navicular (MMN) in mm.
- Talo-cuneiform angle (TC) in degrees
- Both measurements carried out at rest (STATIC) and during simulated Ponseti manuever (DYNAMIC)
Normal foot USG
• Navicular closely approximated to medial malleolus
• Positive Talo-cuneiform angle
NORMAL FOOT

At rest

Simulated Ponseti maneuver
CLUBFOOT

At rest

Simulated Ponseti maneuver
RESULTS

- Age at start of treatment: 12 days – 3 months
- Pre-treatment Pirani score: 4.5 (range 3-6)
- 24 out of 32 feet (75%) required TA tenotomy when Pirani MFCS was 0
- Study population divided into 2 groups by age
  - Group I: Age < 6 weeks
  - Group II: Age > 6 weeks
Medial malleolus to Navicular distance (MMN) in mm

NORMAL

CLUBFEET
EFFECT OF TREATMENT

GROUP I : Age < 6 weeks

**MMN (mm)**

- Pre-treatment: 26.5
- Post-treatment: 15.8

**MMNp (mm)**

- Pre-treatment: -4.5
- Post-treatment: 0

**TC (deg)**

- Pre-treatment: 26.5
- Post-treatment: 15.8

**TCp (deg)**

- Pre-treatment: -4.5
- Post-treatment: -8.1
EFFECT OF TREATMENT

GROUP II: Age > 6 weeks

[Graph showing the effect of treatment on MMN (mm) and TC (deg) pre-treatment and post-treatment.]
10 day old neonate, Pirani score 5/6

3 months old, Pirani score 0/6

USG at start of treatment

USG at end of treatment
SPURIOUS CORRECTION

- Seen in 5 feet (15%)-Detected easily on USG
- Break in naviculo-cuneiform joint on USG – ‘Horizontal breach’
- Pre-treatment USG showed a very little increase in MMN on manipulation
- Post treatment USG showed insignificant change in MMN distance but TC angle normalized
- Clinically feet appeared well corrected
SPURIOUS CORRECTION (N = 5)

- **MMN (mm)**
  - Pre-treatment: 5
  - Post-treatment: 6.7

- **MMNp (mm)**
  - Pre-treatment: 5.7
  - Post-treatment: 5.9

- **TC (deg)**
  - Pre-treatment: 30.2
  - Post-treatment: 18.8

- **TCp (deg)**
  - Pre-treatment: -8.6
  - Post-treatment: -12
Pre treatment sonography

Post treatment Sonography showing spurious correction
2 month old neonate, Pirani score 6/6
5 months old, Pirani score 0/6

USG at start of treatment
USG at end of treatment

SPURIOUS CORRECTION
in severe clubfeet, complete reduction of the extreme medial displacement and inversion of the navicular may not be possible with manipulation.....

relapses are common in severe cases of clubfoot for which a partial correction of the displaced navicular has been obtained
Advantages of Ultrasound in Clubfoot

- Readily available, inexpensive, non-invasive
- Objective documentation about tarsal bone relationships
- Objective scoring of severity of deformity
- Can complement clinical scoring systems
- Role in planning limited release
- More widespread use similar to the role of USG in DDH
Advanced uses of USG in clubfoot

- Dynamic evaluation of clubfoot correction during serial manipulation
- Provides real-time view of effect of manipulation
- Static measurements of medial malleolus – navicular distance (MMN) and talo-cuneiform angle (TC)
- Provide reliable and objective method of documenting gradual response to serial casting
- Can detect occurrence of spurious correction
CONCLUSIONS

- Established normative data for sonographic measurement of clubfeet: MMN distance & TC angle
- Cartilagenous tarsal bones can be easily identified & their inter-relationships can be studied
- USG can demonstrate accurate realignment of tarsal bones during Ponseti manipulation
- Spurious correction can be detected early & avoided
Normal foot

Clubfoot

Dynamic Evaluation

THANK YOU