ULTRASOUND EVALUATION OF CLUBFOOT CORRECTION DURING PONSETI TREATMENT

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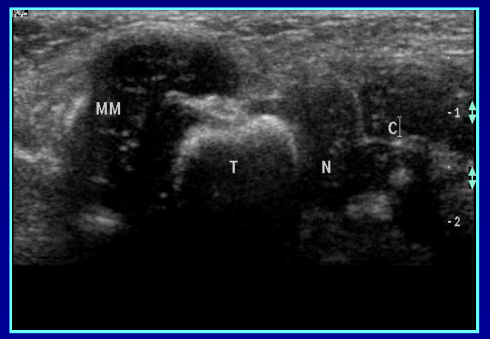
Study conducted at
Wadia Children's Hospital



SERIAL DOCUMENTATION

- 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

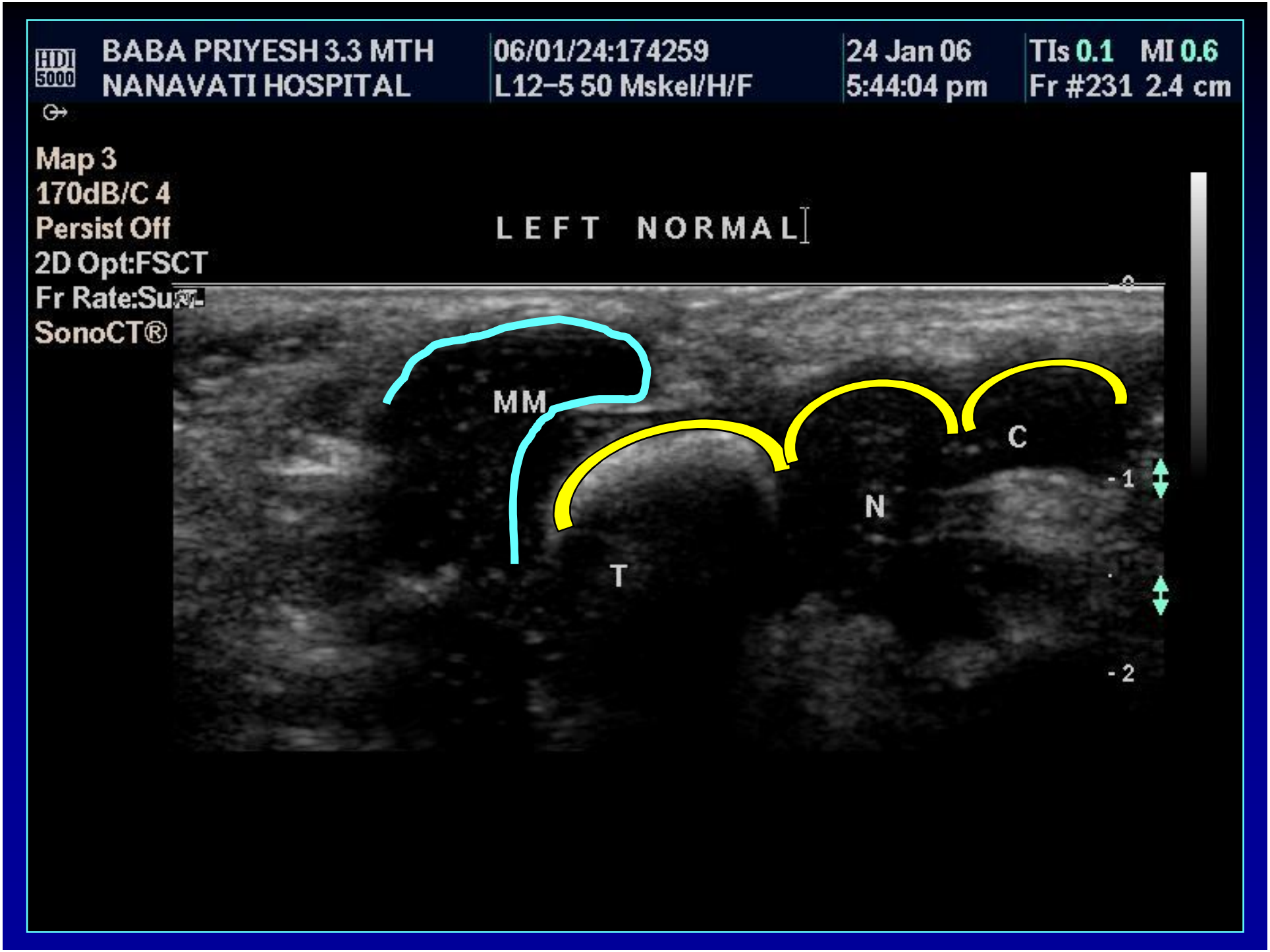
- Serial clinical scoring by Pirani score
- Weekly manipulation and casting as described by Ponseti was performed
- All feet underwent 3 serial ultrasounds
  - At start of treatment
  - When Pirani Midfoot Score was 0
  - At end of treatment

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 1st Metatarsal (MT)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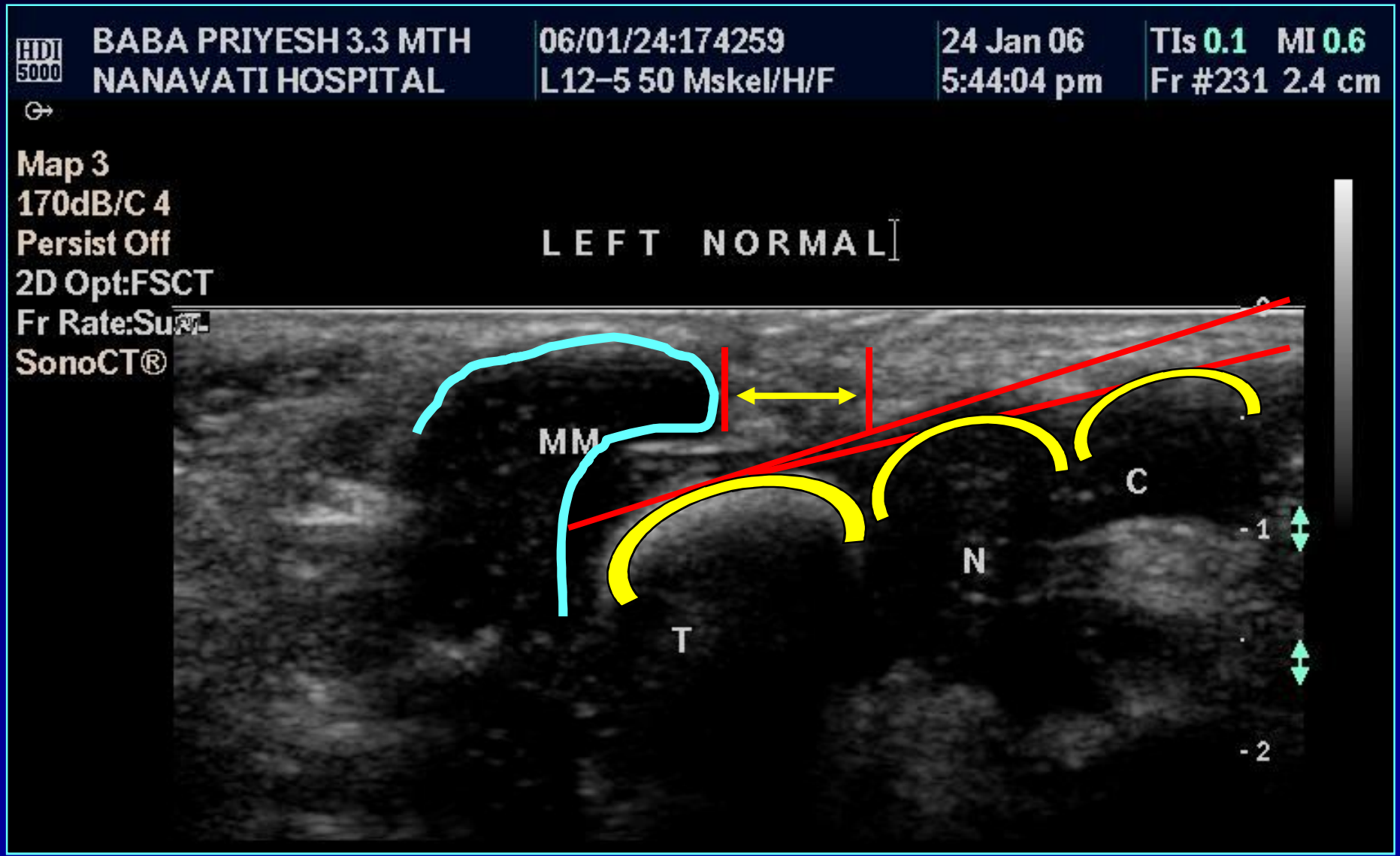
LEFT NORMAL
MM
C
N
T
-1
-2

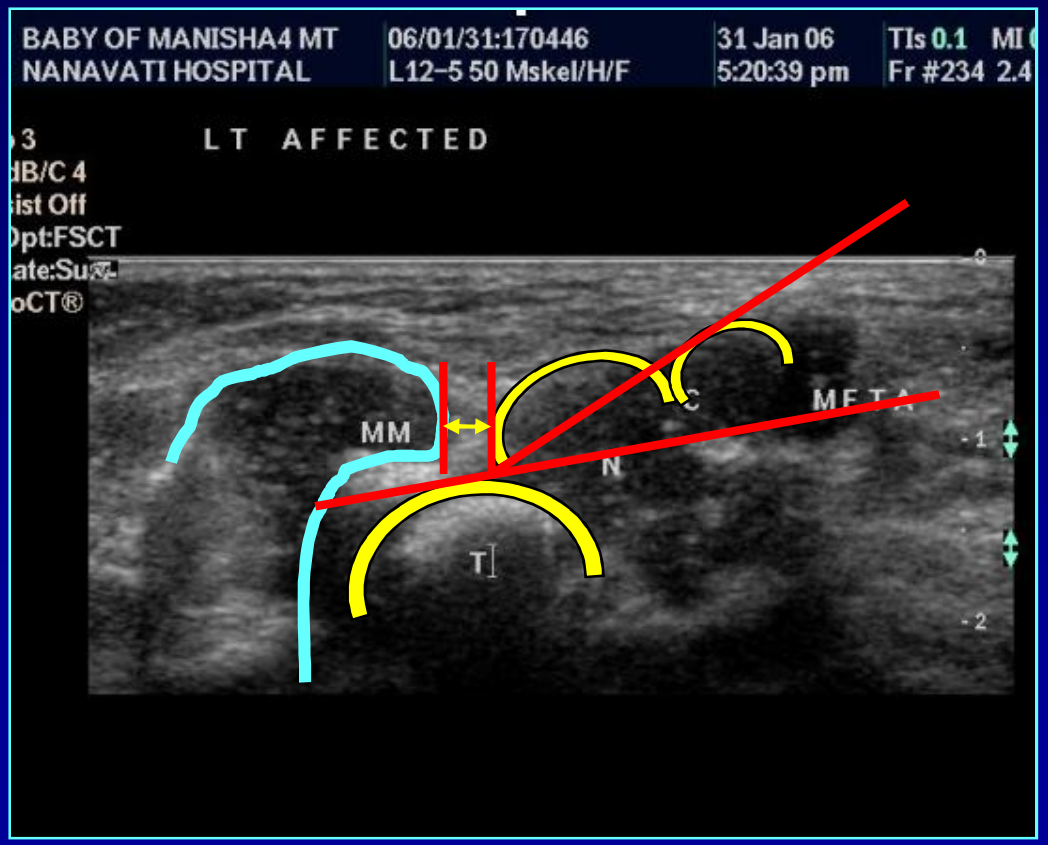
Ultrasound Measurements

- 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



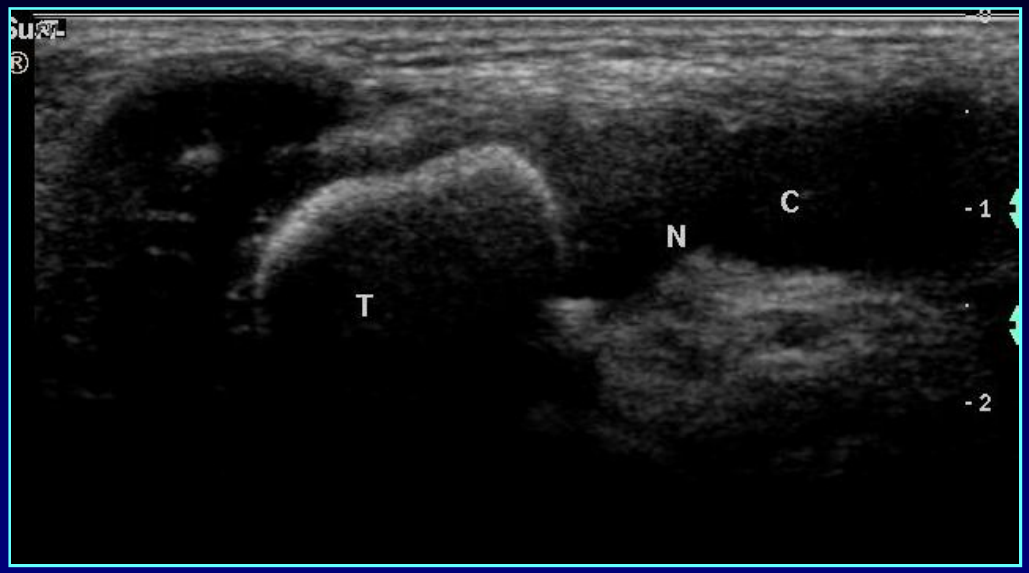
Clubfoot USG



- Navicular closely approximated to medial malleolus
- Positive Talo-cuneiform angle

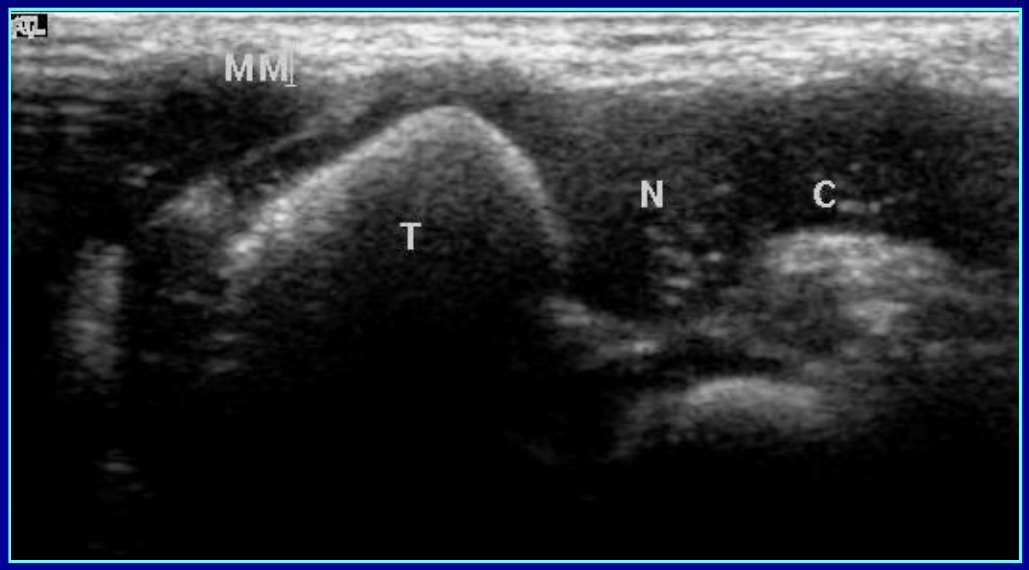
NORMAL FOOT

At rest



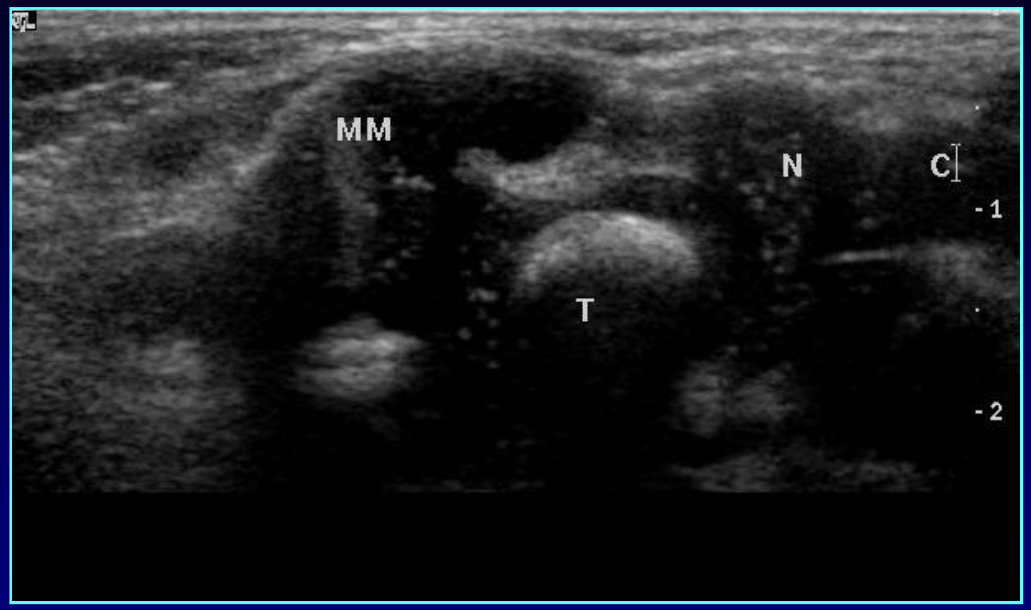
Simulated

Ponseti maneuver



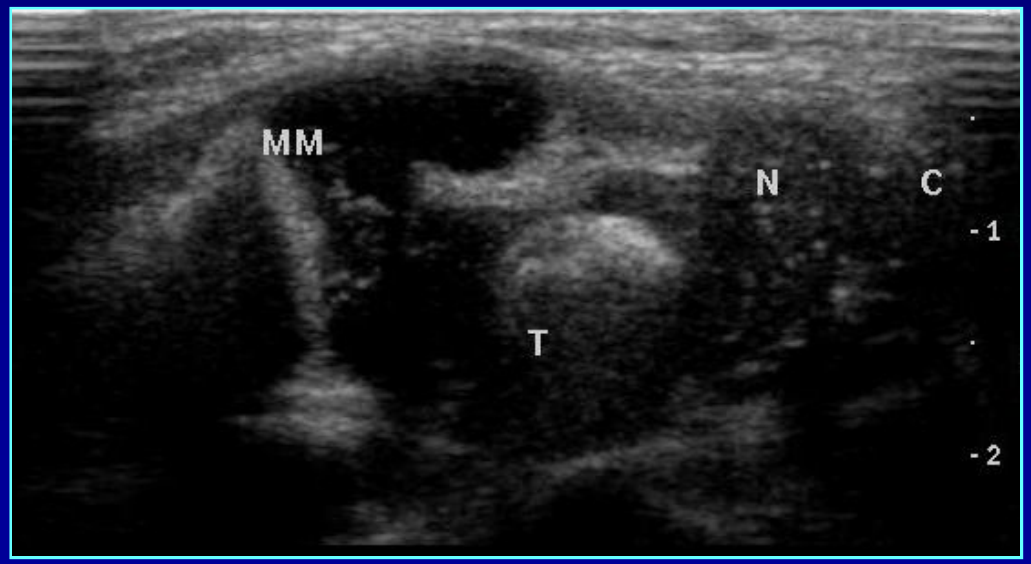
CLUBFOOT

At rest



Simulated

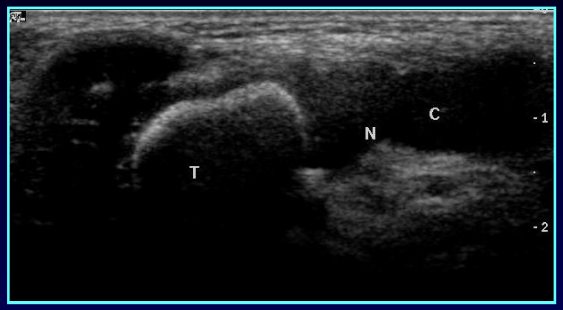
Ponseti maneuver



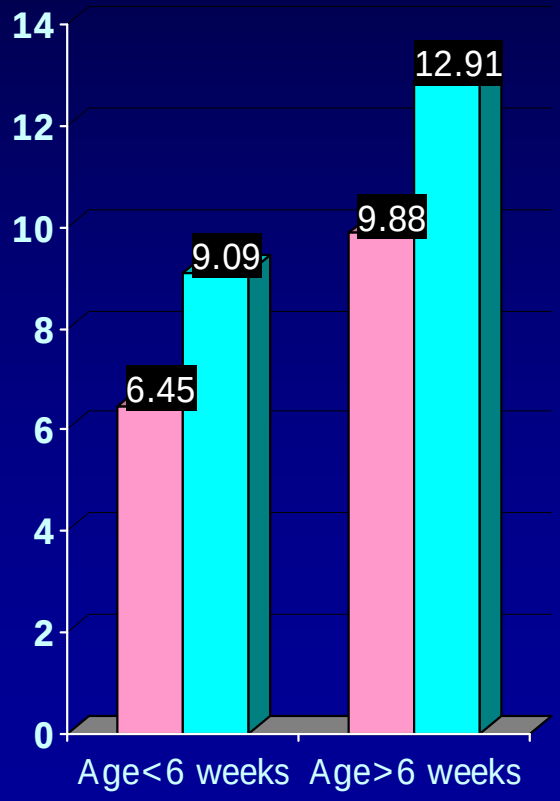
RESULTS

- 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

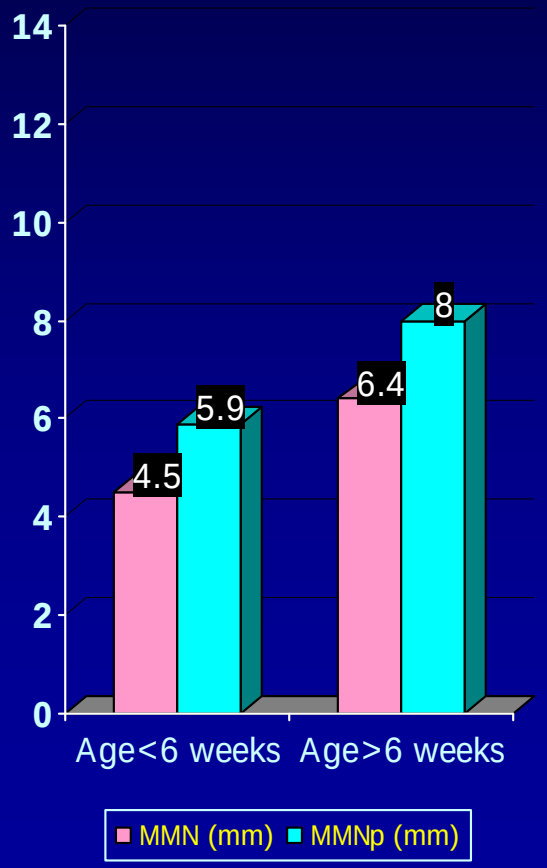
NORMAL



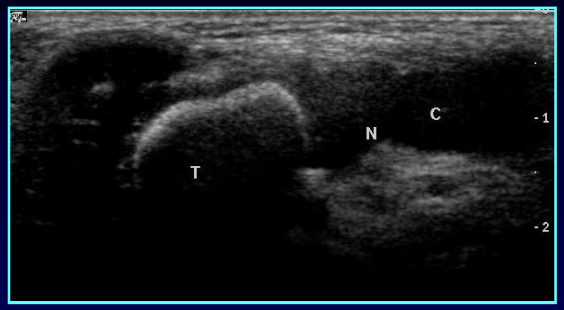
Medial malleolus to Navicular distance (MMN) in mm



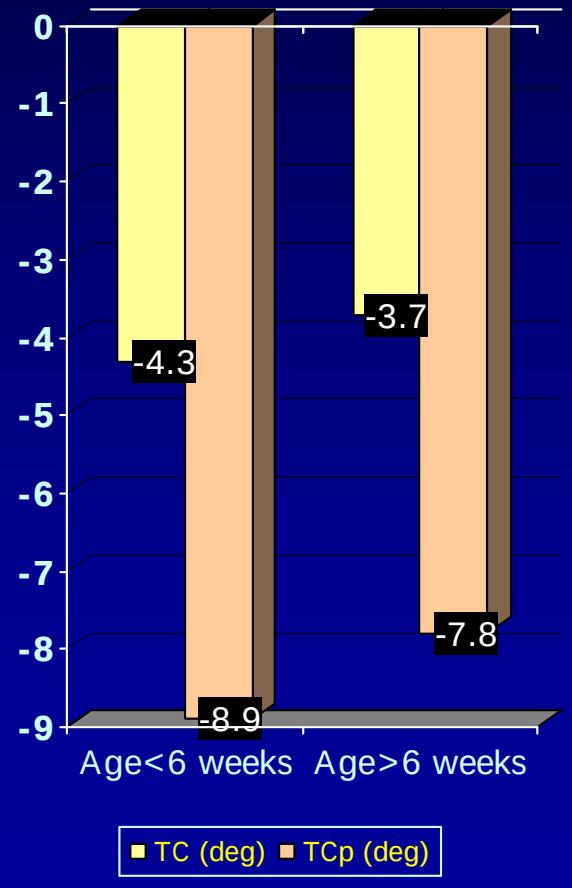
CLUBFEET



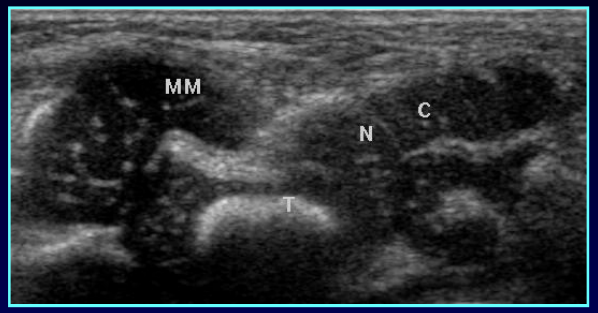
NORMAL

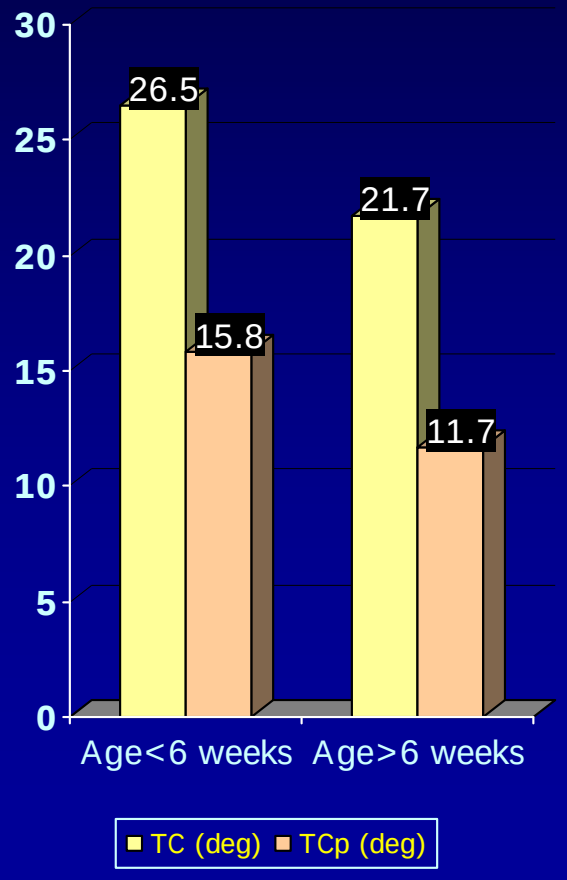


Talo-cuneiform Angle (TC) in degrees



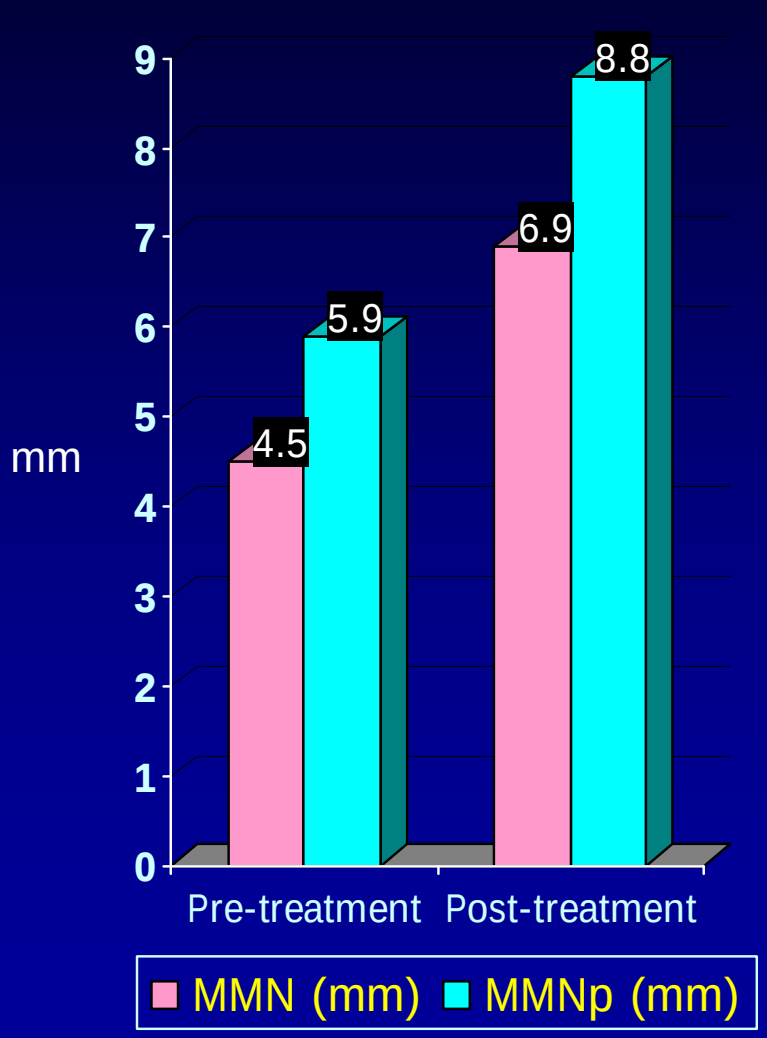
CLUBFEET

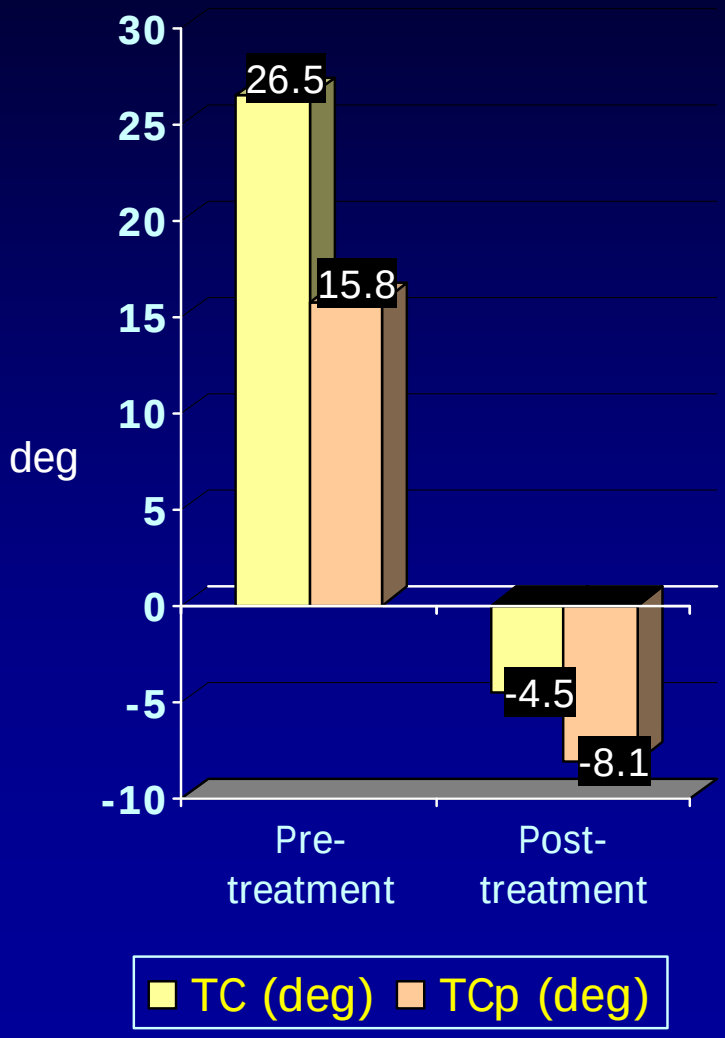




EFFECT OF TREATMENT

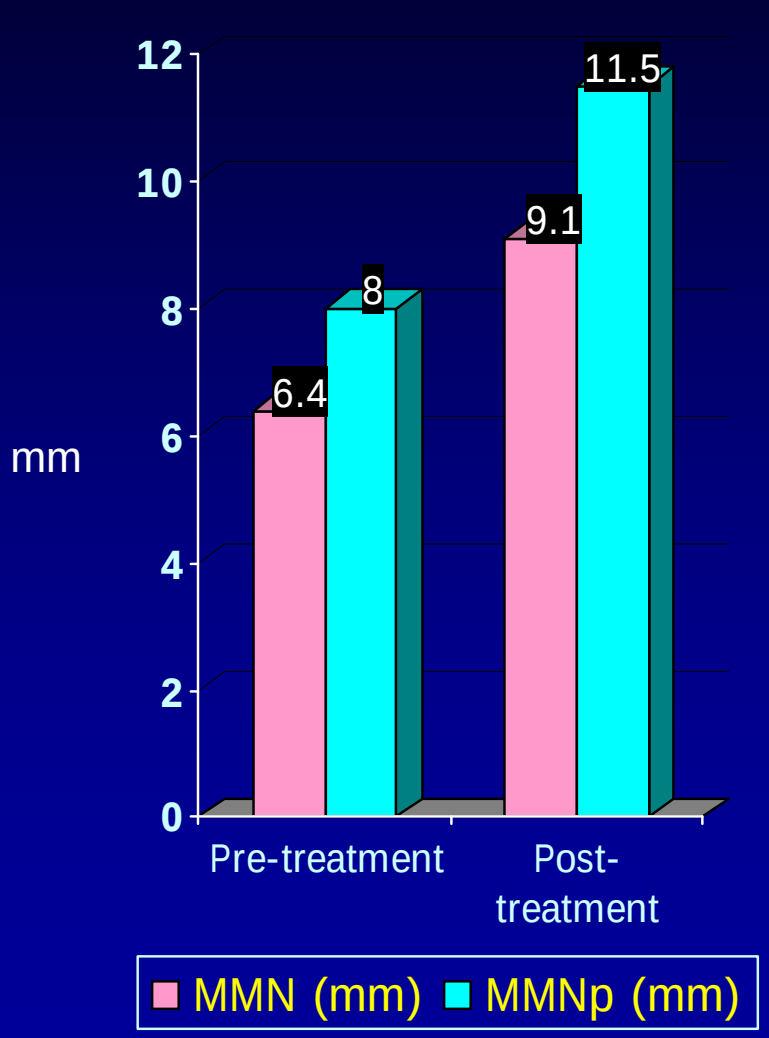
GROUP I : Age < 6 weeks

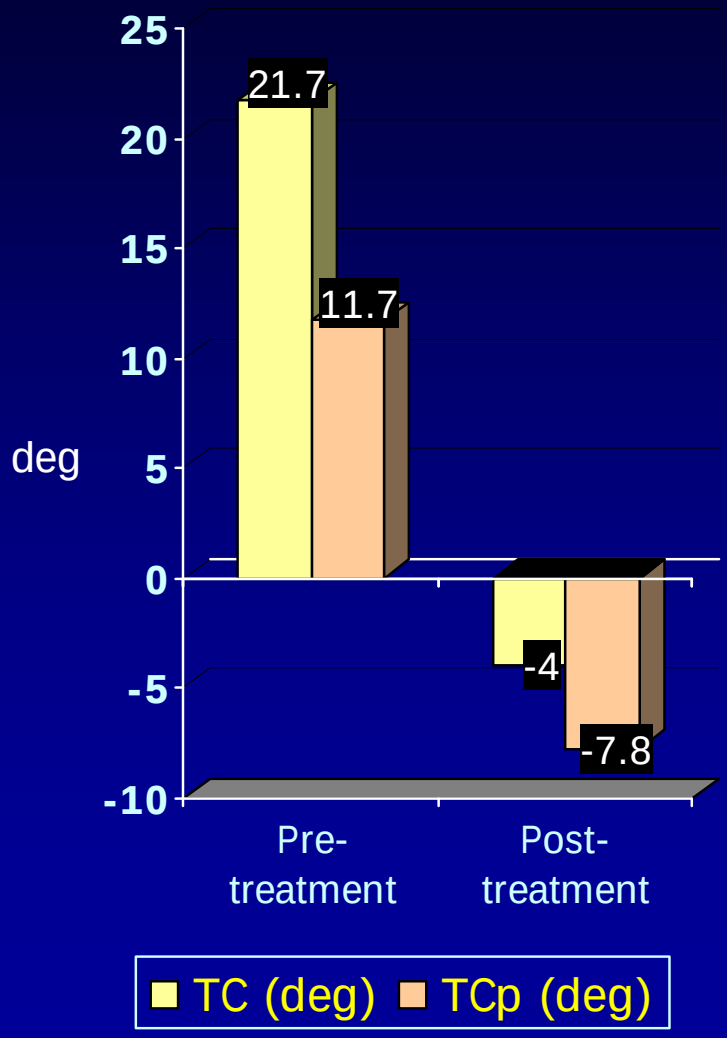


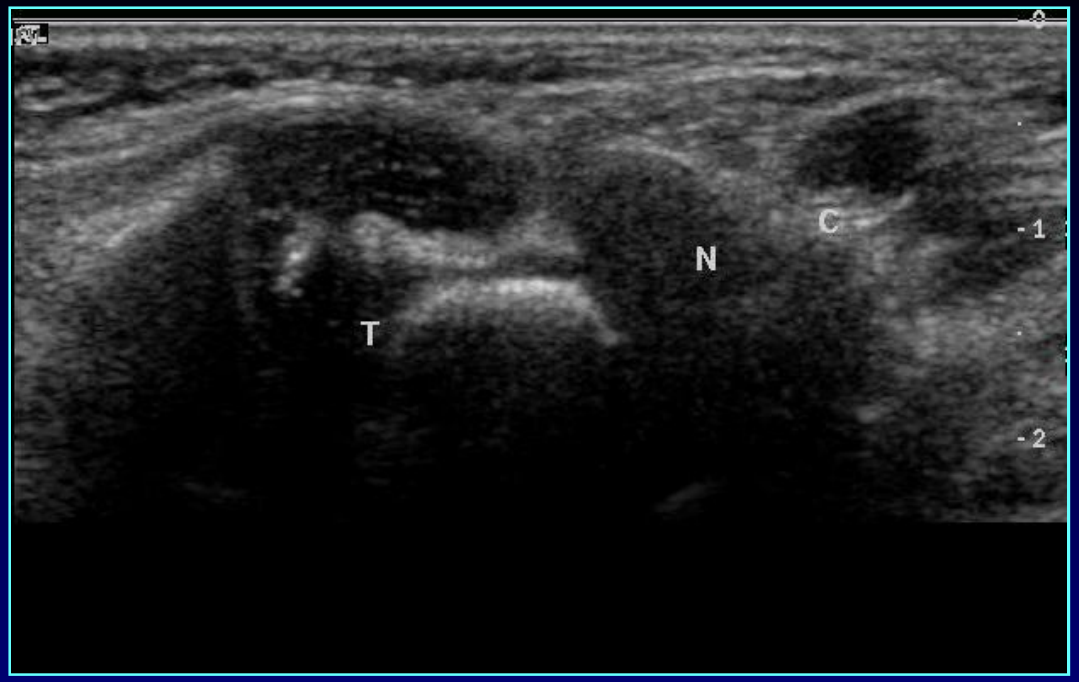


EFFECT OF TREATMENT

GROUP II : Age > 6 weeks

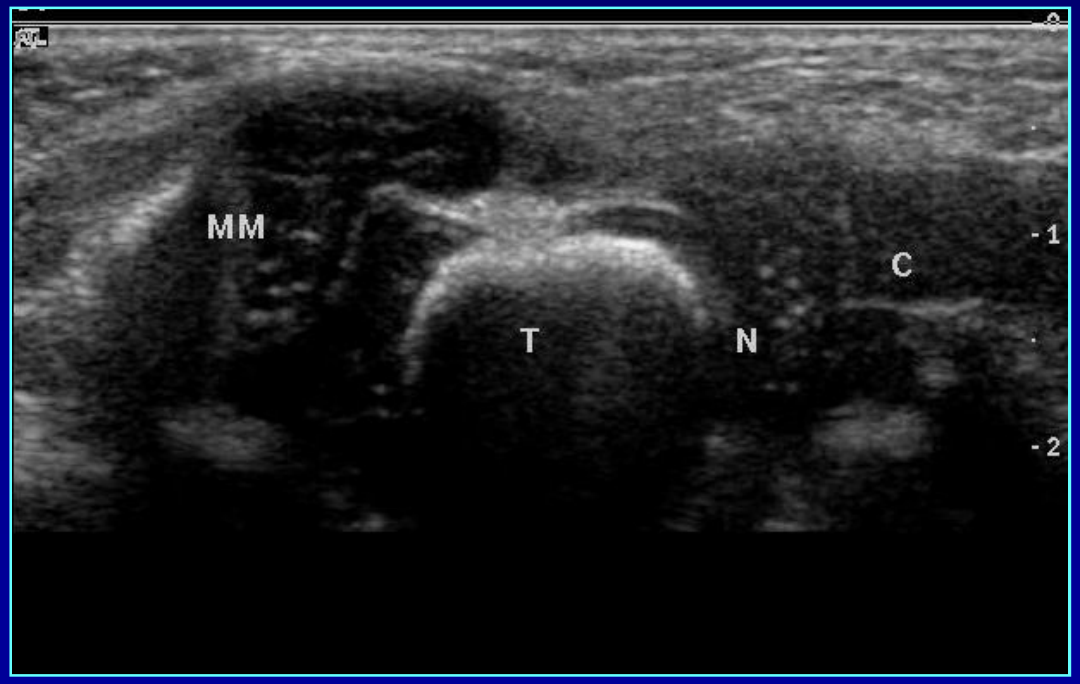


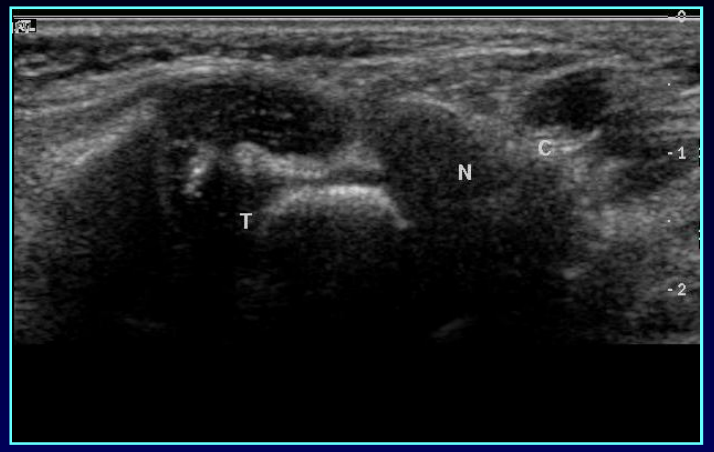




USG at start of treatment

USG at end of treatment



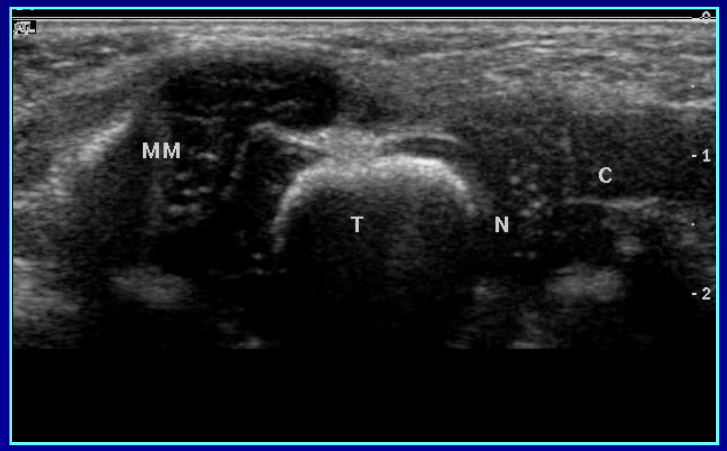


10 day old neonate, Pirani score 5/6

USG at start of treatment

3 months old, Pirani score 0/6

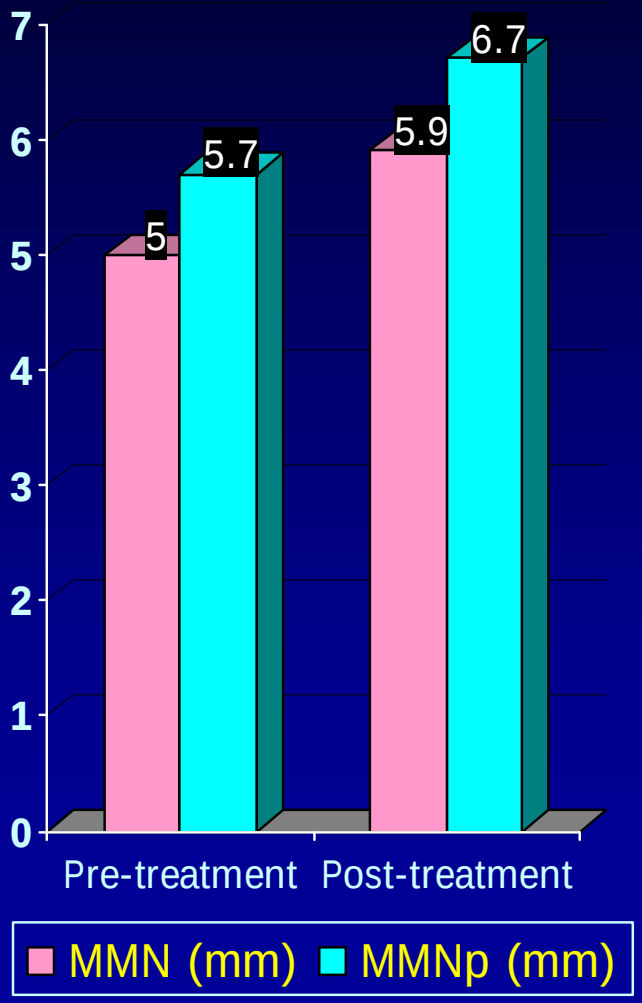
USG at end of treatment

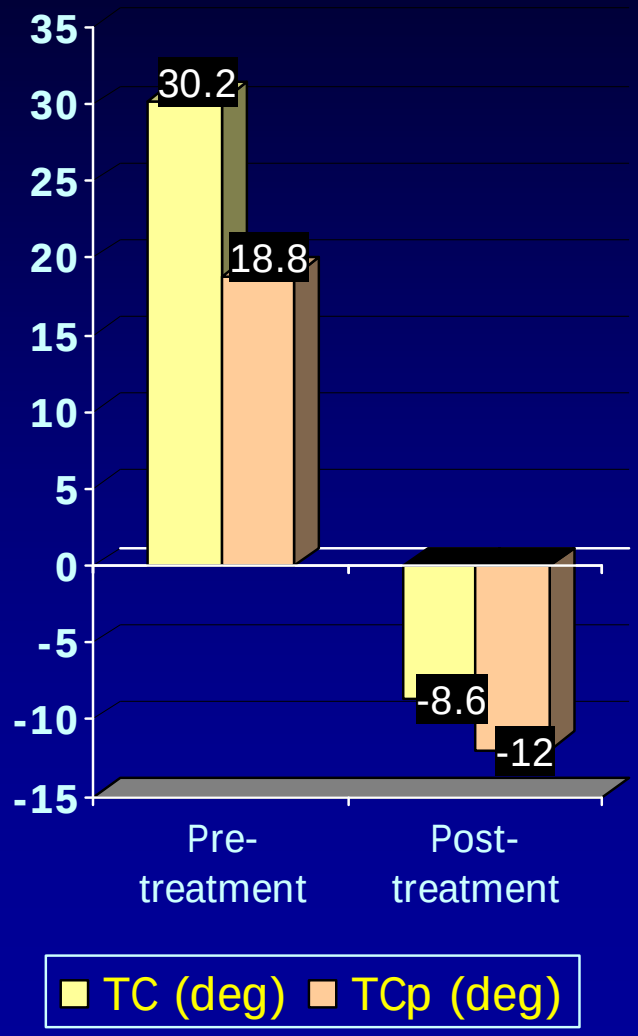


SPURIOUS CORRECTION

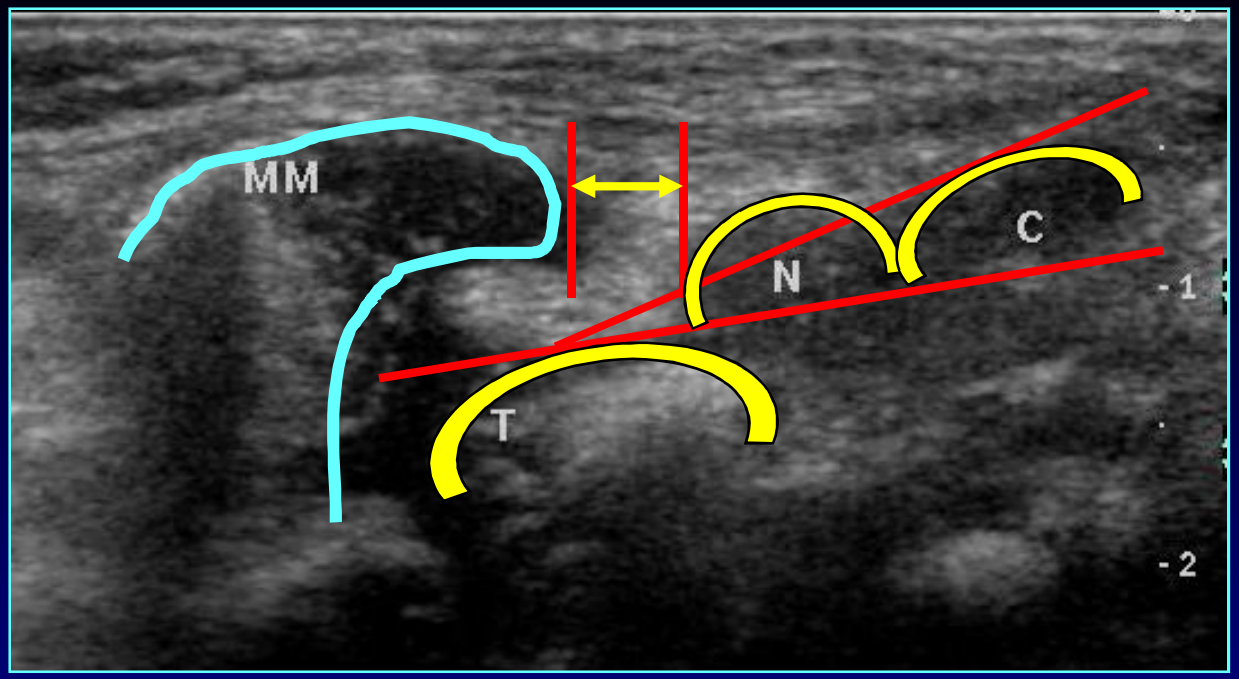
- Seen in 5 feet (15%)-Detected easily on USG
- Break in naviculo-cuneiform joint on USG – ‘Horizontal breach’
- Pre-treatment USG showed a very little increase in MMN on manipulation
- Post treatment USG showed insignificant change in MMN distance but TC angle normalized
- Clinically feet appeared well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

SPURIOUS CORRECTION (N = 5)

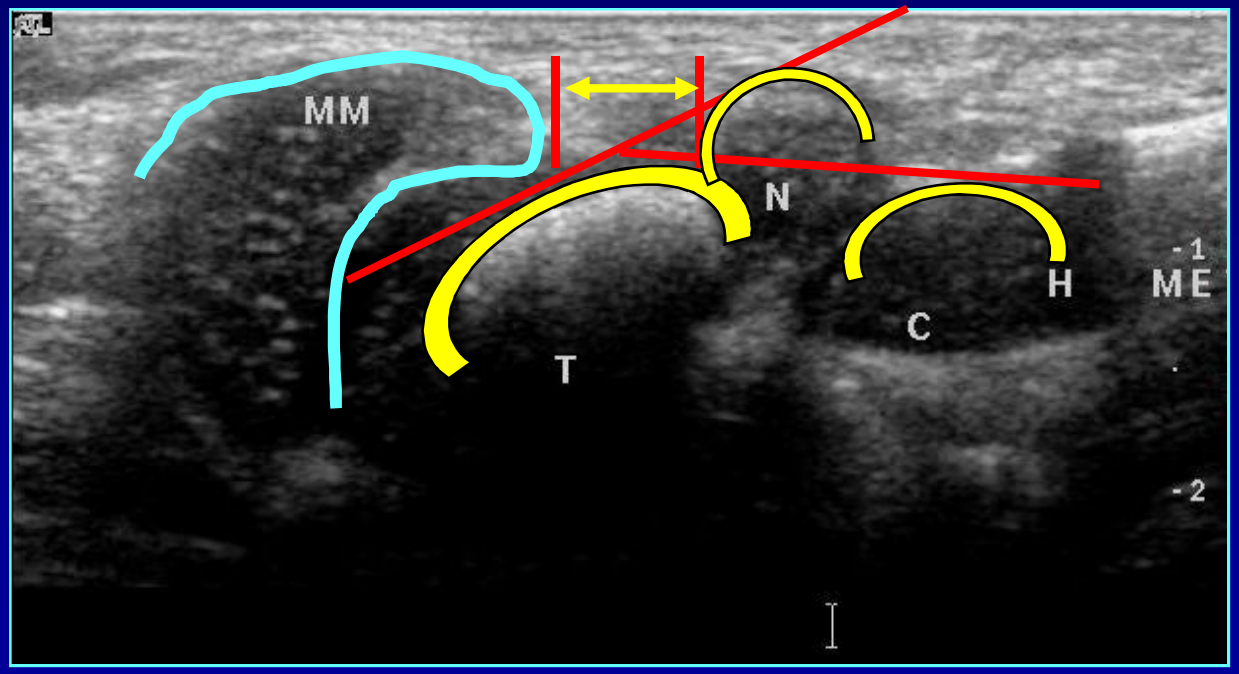


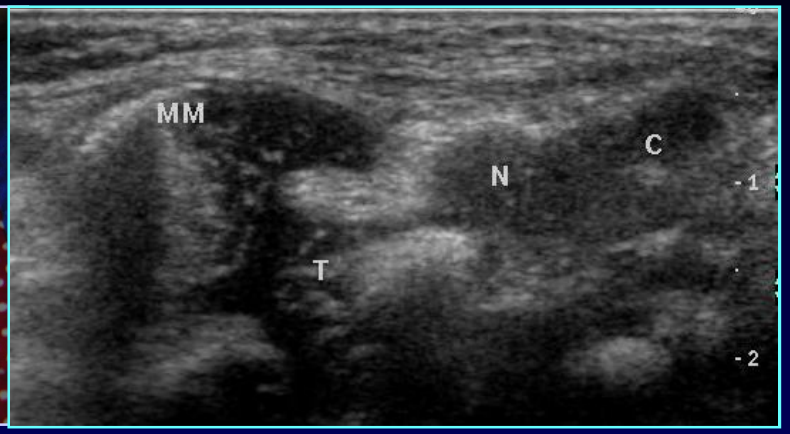


Pre treatment sonography



Post treatment Sonography showing spurious correction



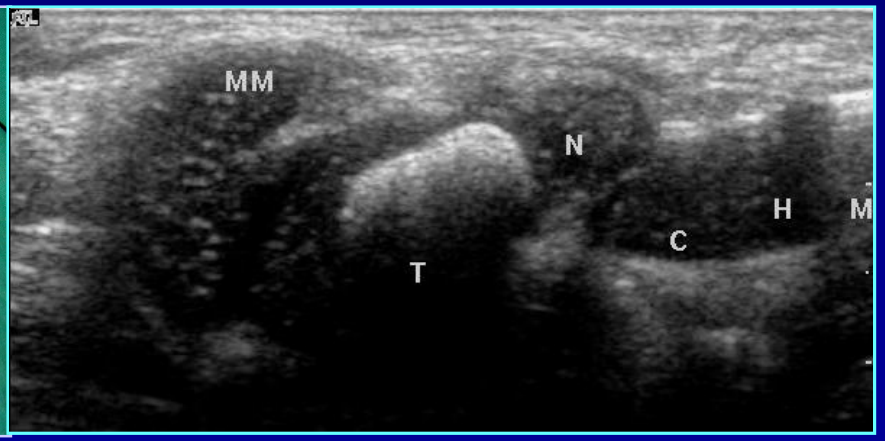


2 month old neonate, Pirani score 6/6

USG at start of treatment

5 months old, Pirani score 0/6

USG at end of treatment



SPURIOUS CORRECTION

Ponseti

- 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

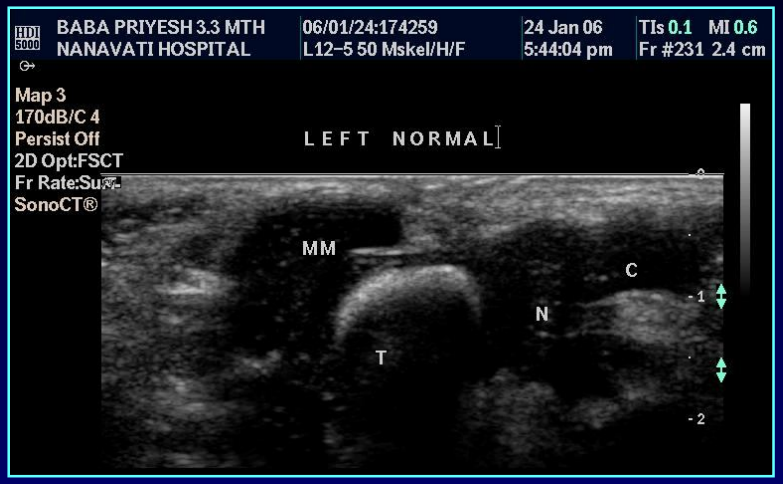
Advanced uses of USG in clubfoot

- 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

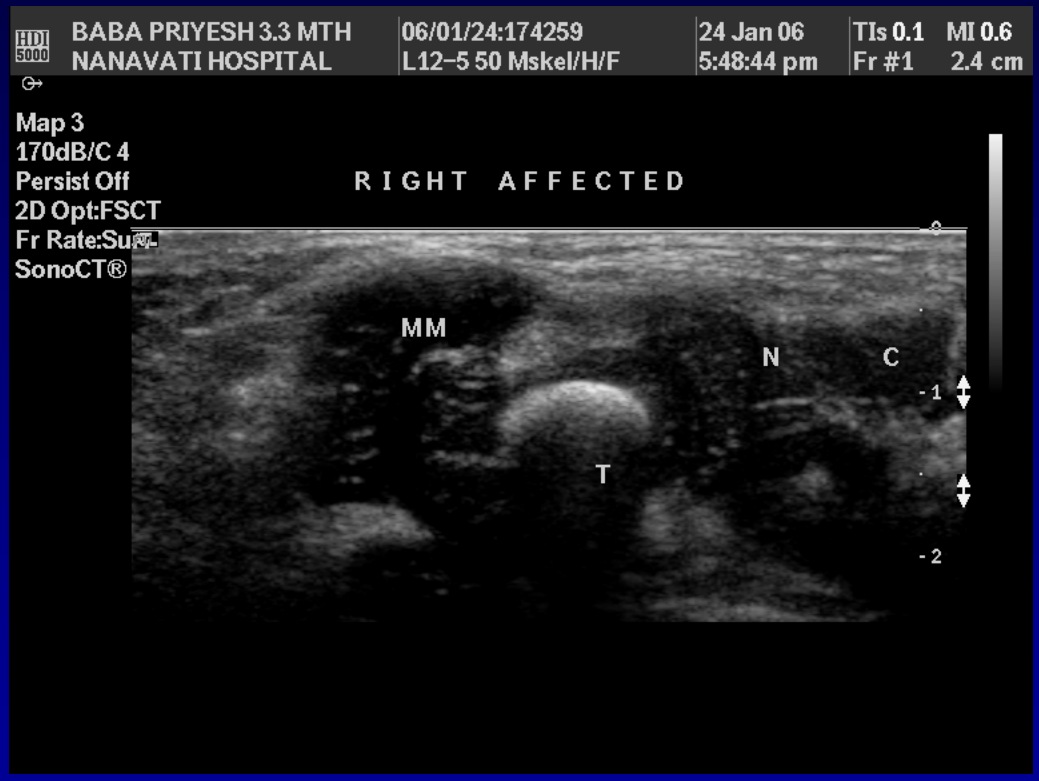
CONCLUSIONS

- 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

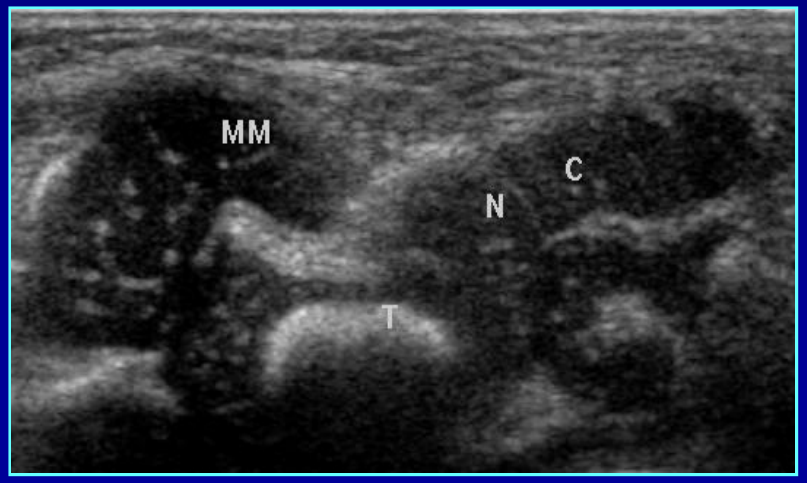
Normal foot



Dynamic Evaluation



Clubfoot



THANK YOU