Adult Acquired Spastic Equinovarus Deformity

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Acquired Spastic Equinovarus in the Adult

- CVA
- Traumatic Brain Injury (TBI)
- Anoxic Brain Injury
- Spinal Cord Injury
- Other conditions affecting the upper motor neurones
- Deformity of previously normally shaped foot
Spasticity

- The motor disorder characterized by velocity-dependent increase in tonic stretch reflexes ("muscle tone") with exaggerated tendon jerks, resulting from hyperexcitability of the stretch reflex as one component of the upper motor neuron syndrome. Lance (1980)
Reflex Arc

Courtesy: whatdotheyknow.com

Peter J Briggs, Freeman Hospital, Newcastle upon Tyne, UK
Hyperactive Reflex Contraction

The knee jerk is a reflex action

Courtesy: slideshare.net
Reflex Antagonist Inhibition

Courtesy: whatdotheyknow.com

Peter J Briggs, Freeman Hospital, Newcastle upon Tyne, UK
Reflex Antagonist Inhibition
Spasticity

- Disinhibition of the reflex arc
- Excitation of antagonist muscles
  (Co-contraction)
Clinical Problems

- Pain
- Deformity
- Shoe fitting difficulty
- Skin damage
- Standing / Transferring
- Walking
Time Course of Spasticity

Muscle Tone

CVA 6 months
TBI 18 months
Early Management of Spasticity

- Maintain joint posture and flexibility
- Physical therapy
- Splinting
- Serial casting
- Medication
- Nerve blockade
Local Anaesthetic Motor Nerve Block

• Spasticity can be abolished by local anaesthetic motor nerve blockade


Local Anaesthetic Motor Nerve Block

- Facilitation of stretching and splinting
- Determination of which muscles affected
- Differentiation of deformity from spasticity or contracture

From: Buffenoir et al, 2005
Phenol Motor Nerve Blocks

- Longer term effect
- Equinovarus
  - Gastrocnemius/Soleus
  - Tibialis posterior
- Nerve regeneration
- Recurrent spasticity

Moore and Anderson, 1991
Kirazli et al, 1998
Botulinum Toxin A

- Ease of injection placement
- Easily repeatable
- Diagnosis of muscle involvement
- Slower response than phenol nerve blocks
- Duration
- Long term effectiveness
Botulinum Toxin A

- Equinovarus deformity
  - Soleus / Gastrocnemius
  - ± Tibialis posterior
- Reduced spasticity
- Reduced pain
- Improved foot posture
- Improved gait
- Stretching and splinting

Reiter et al, 1998
Kirazli et al, 1998
Pittock et al, 2003
Yelnik and Bonan, 2003
Farina et al, 2008
Foley et al, 2010
Bollens et al, 2013
Son et al, 2015
Selective Motor Neurotomy

- Preliminary diagnostic local anaesthetic motor nerve block
- Open surgery
- Tibial nerve and motor branches identified
- Microsurgical assistance
- Partial division of the selected motor nerves

From: Botte et al, 2000
Results

- Gastro-Soleus weakness at two months
- Strength recovery by two years
- Correction of deformity
- Improved ankle dorsiflexion and gait speed
- Non-recurrence of spasticity and deformity (?)
  - 8 of 49 treated patients underwent tendon transfer by two years
  - 30 patients reviewed for the study

Deltombe et al, 2015
Results

• Follow up
  – Maximum 2 years

• Long term results (?)

Sindou et al, 1988
Fève et al, 1997
Decq et al, 2000
Roujeau et al, 2003
Caillet et al, 2003
Buffenoir et al, 2004
Deltombe et al, 2008
Rousseaux et al, 2008
Buffenoir et al, 2008
Rousseaux et al, 2009
Deltombe et al, 2010
Sitthinamsuwan et al, 2013
Deltombe et al 2015
Botulinum v Selective Neurotomy

- 2 and 6 month review
- Muscles treated:
  - Soleus in all
  - Tibialis posterior and FHL in 50%
- Comparable improvement in:
  - Ankle range of motion
  - Gait analysis
- Neurotomy
  - Better improvement in ankle stiffness
  - Minor surgical complications

Bollens et al, 2013
Summary – Early Management

• Early management of spasticity is aimed at preventing joint contracture
• Selective motor neurotomy may have a place
• Patients with contracture are excluded
• Long term results are not known
• Are they reproducable?
• Botulinum toxin A is more widely used
Later Management

• Assessment
  – Deformity
  – Which muscles involved
    • Muscle balance
    • Muscle strength
  – Correctability / Contracture / Joint stiffness
  – Standing and walking ability / potential
Muscle Balance - Sagittal Plane

Ankle and Digital Extensors
Tibialis Anterior

Ankle and Digital Flexors
Gastrocnemius / Soleus
Muscle Balance – Coronal Plane

Invertors
Tibialis Posterior

Evertors
Peroneals
More detailed study:


Muscle Balance

- Primary deforming force
- Antagonist co-contraction
  - Tibialis posterior
  vs. Tibialis anterior
• Primary deforming force
• Antagonist co-contraction
  – Extensor hallucis longus
Muscle Strength

- Assessment by MRC grading
- Difficulty in spasticity and contracture
- Spastic muscles are weak muscles
Spasticity / Contracture / Joint Stiffness

- Clinical examination
- Response to Botulinum toxin injections
- Local anaesthetic nerve blockade
- Electromyography
Management Options

- Spasticity without contracture
  - Botulinum toxin injections
  - Stretching programme
  - Splinting

- Tendon transfer surgery
  - Split tibialis posterior tendon transfer
Management Options

• Spasticity with muscle contracture
  – Tendon lengthening
    • Achilles tendon
  – Tendon release / tenotomy
    • Digital flexors
  – Tendon transfer
    • Split tibialis posterior transfer
    • Transfer of digital extensors to the midfoot
Management Options

- Spasticity with joint contracture
  - Joint arthrodesis surgery
  - Rebalancing of muscle force
    - Tendon transfer
    - Tendon lengthening
    - Tendon release
Management Options

- Spasticity with joint contracture
  - Joint arthrodesis surgery
  - Rebalancing of muscle force
    - Tendon transfer
    - Tendon lengthening
    - Tendon release
Results

- Pain relief
- Improved shoe fitting
- Reduced skin damage from deformity, splints and footwear
- Improved standing and transfer balance
- Walking potential
Results

• Better outcome in focal neurological injury
• Less satisfactory in global brain injury
• Long term stretching programme
• Splints
Conclusion

Improve a person’s capacity from 5% to 10%

you double their ability

and halve their dependence