Drop Foot

AOFAS Resident Review Course
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Disclosure

- Nothing to disclose
Overview

- Anatomy
- Etiology
- Evaluation
- Non-operative treatment
- Operative treatment
## Anatomy

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Insertion</th>
<th>Innervation</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>TA</td>
<td>Med cun &amp; base of 1&lt;sup&gt;st&lt;/sup&gt; MT</td>
<td>L4-S1; L4; DPN</td>
<td>Dorsiflex &amp; Invert</td>
</tr>
<tr>
<td>EDL</td>
<td>Extensor aponeurosis of lesser toes</td>
<td>L4-S1; L5; DPN</td>
<td>Ext toes &amp; Dorsiflex</td>
</tr>
<tr>
<td>EHL</td>
<td>Base of distal phalanx hallux</td>
<td>L4-S1; L5; DP</td>
<td>Ext toe &amp; Dorsiflex</td>
</tr>
<tr>
<td>PL</td>
<td>Base of 1&lt;sup&gt;st&lt;/sup&gt; MT &amp; med cun</td>
<td>L4-S1; S1; SPN</td>
<td>PF 1&lt;sup&gt;st&lt;/sup&gt; ray &amp; Evert</td>
</tr>
<tr>
<td>PB</td>
<td>Base of 5&lt;sup&gt;th&lt;/sup&gt; MT</td>
<td>L4-S1; S1; SPN</td>
<td>Evert</td>
</tr>
<tr>
<td>GCS</td>
<td>Calc</td>
<td>L5-S2; S1; Tib</td>
<td>PF &amp; Invert</td>
</tr>
<tr>
<td>FDL/FHL</td>
<td>Distal phalanx toes</td>
<td>L5-S2; S1; Tib</td>
<td>Flex toe, PF &amp; invert</td>
</tr>
<tr>
<td>TP</td>
<td>Navicular, midfoot, forefoot</td>
<td>L5-S1; Tib</td>
<td>Invert &amp; PF</td>
</tr>
</tbody>
</table>
Etiology of Paralytic Foot

- CNS – ex. CVA, head trauma
  - Spasticity, hyperreflexia
- Spine
  - Radiculopathy
  - Spondylolysis
  - Spinal Stenosis
- Peripheral nerve injury
  - Traumatic – Penetrating or blunt, knee dislocation, compartment syndrome
  - Iatrogenic – THA or TKA
    - Injury to Sciatic nerve during THA more likely to affect CPN
    - Valgus and flexion contracture increase risk of injury during TKA.
  - Neoplastic / Mass effect
Assessment of Foot Drop

- **Steppage gait, “Slap foot gait”**
  - Excessive hip and knee flexion during swing phase of gait to allow the foot and toes to clear the ground
- **Swing phase**
  - Supination deformity -> CPN injury affecting Extensors & Peroneals
- **Stance phase**
  - Walk on the lateral border of the foot
- **Assess range of motion.** **Flexible vs. Fixed**
- **Muscle strength testing**
  - Beware of secondary recruitment
  - Walk on their heels
- **Sensory exam**
  - L4 radiculopathy versus Common Peroneal Neuropathy
- **Reflexes**
  - Upper MN versus Lower MN
Assessment of Foot Drop

- Weight bearing radiographs
- MRI
  - Lumbar radiculopathy
  - Knee dislocation
  - TA rupture (dx evident by exam)
  - Neoplasm / mass effect
- EMG/NCV
  - EMG – **Sharp waves & fibrillations** at 3-5 wks, rest activity
  - NCV – Motor and sensory latency
    - **Prolonged in compression neuropathy, absent in nerve laceration distal to injury.**
  - Baseline and f/u to assess recovery
Treatment

- PT for heel cord stretching
- AFO
  - Plantar flexion stop hinge
  - Dorsiflexion-assist
  - Flaccid paralysis -> fixed AFO
- Nerve Decompression
  - Lumbar decompression
- Nerve repair / grafting
  - Knee dislocation
    - < 6cm 70%
    - 6 – 12cm 43%
    - 13 – 24cm 25%
Treatment

- **Timing**
  - Acute nerve laceration -> *Acute repair*
  - CVA -> **12 to 18 months** of rehab to determine motor recovery
    - 25% regain normal ambulation, 75% some level of ambulation
  - Closed head injury -> **12 to 18 months** of rehab to determine motor recovery
  - Knee dislocation/CPN crush/stretch injury
    - Evidence to suggest that early tendon transfer time of nerve graft may improve outcomes
      - Ferraresi et al. Neurosurg Rev 2003
Treatment

- Tendon Transfer
  - Should not be performed if nerve function may recover
  - Flexible deformities
  - Muscle will lose one grade of strength after transfer
  - In-phase / Out-of-phase (swing or stance phase)
  - In-phase transfer functions in a dynamic manner
  - Out-of-phase transfer is a static restraint to deformity
  - ?phase conversion
  - Goal – Walk without a brace
Treatment

- Posterior tibial tendon transfer to the dorsum of the foot (out-of-phase)
  - Interosseous membrane
    - PTT in direct line from its muscle through IOM to lateral cuneiform
    - Anchor point is lateral cuneiform - slightly lateral of midline to promote DF and Eversion
    - PTT may be constricted and stenosed within window in IOM
  - Anteromedial tibia
    - PTT is not in direct line from its origin to anchor point
    - Anchor point is middle cuneiform, smaller bone, greater risk of fracture
    - Does not stenose at the IOM and glides smoothly around tibia
Treatment

- PTT transfer
  - Tension with ankle at 10 degrees of DF
  - May require Achilles lengthening
  - FDL transfer to the navicular to oppose P. brevis
  - Botulinum toxin injections into the gastrocnemius-soleus complex to protect the tendon transfer post-op
  - Early active immobilization has **no added risk for tendon pullout** and has **similar functional outcomes** compared with immobilization
    - Rath et al. CORR 2010 – RCT Level I study
Treatment

- Briddle
  - Potential of making a flaccid paralysis brace-free
  - Tendon transfer is static, functions as a tenodesis
  - PTT through IOM and a slit in the TA tendon -> medial cuneiform
  - PL transected proximally, pulled distally at the cuboid tunnel, and passed subcutaneously to the anterior ankle wound
  - Suture with foot in 10 degrees of DF, heel in neutral to slight valgus
- Arthrodesis for fixed deformities

Take home points

- Identify the cause
- Assess deformity
- Thorough assessment of what is missing and what is left
- Timing of intervention
- Tendon transfer only when there is no recovery
- Tendon transfer in a flexible deformity, arthrodesis in a fixed deformity
- Low threshold for Achilles lengthening
- Tension transfer in 10 degrees of DF
Image Source

Thank You