Common Foot Neurological Conditions

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* No relevant financial or nonfinancial relationships exist.
Nerve related foot conditions

- Morton’s neuroma
- Pes Cavus (high arch foot)
- Tarsal Tunnel Syndrome
- Foot Drop
- Diabetic Peripheral Neuropathy
- Charcot foot
An entrapment of the plantar intermetatarsal nerve, most commonly between the 3, 4 metatarsals, but may involve any intermetatarsal space.

Typically more painful with shoes as there is increased pressure on the nerve.

Patients complain of burning pain that often radiates to the toes, may describe a “rolled up sock” sensation in the forefoot.
Morton’s Neuroma: exam

* **Mulder’s sign**: Pain on palpation of the involved interspace with or without side-to-side pressure applied to the metatarsal heads.

* MRI: may show if enlarged moderate/significantly.

* Diagnostic injection.
Morton’s Neuroma: treatment

* Adequate fitting shoes
* Metatarsal/neuroma pads
* NSAID’s
* Corticosteroid injections
* Nerve alcohol sclerosing injections
* Surgery to decompress or resect the nerve
* Physical Therapy
Morton’s Neuroma
Pes Cavus (High Arch) Foot

- Cavus foot can be linked to central and peripheral neurological diseases.
- Ex: polio, Charcot-Marie-Tooth disease, Friedreich’s ataxia, cerebral palsy.
- Up to 2/3 of patients with symptomatic cavus have an underlying neurological disorder. The most common is CMT.
- Electromyography, NCV, sural nerve biopsy testing can help diagnose underlying causes.
Pes Cavus (High Arch) Foot

- Subtle cavus can be non-neurological and is likely genetic.
- Often biomechanically induced with plantarflexed first ray and hyperactive peroneus longus muscle.
Pes Cavus (High Arch) Foot

* Difficult to manage due to rigid nature of the foot.
* Patient’s typically overload the lateral column of the foot.
* Common symptoms: ankle instability, peroneal tendonitis, lateral tibial stress syndrome, iliotibial band syndrome.
Cavus foot: treatment

* Orthotics: to help distribute pressures more evenly across the foot.
* Foot and ankle bracing for neurological conditions.
* Physical therapy to help reduce muscle imbalances.
* Surgical intervention for instability, weakness, pain.
Entrapment of the posterior tibial nerve or a branch in the tarsal canal by the flexor retinaculum, fibro-osseous tunnels, or the deep fascia.
Tarsal Tunnel Syndrome: etiologies

- Tumor, cyst in the tarsal canal
- Fracture fragment of calcaneus pressing on the nerve
- Severe flatfoot causing stretching of the nerve.
- Enlarged blood vessels/varicose veins
- Generalized leg edema
- Metabolic causes: Diabetes
Tarsal Tunnel: diagnosis

- Burning, stabbing, tingling at the bottom of the foot and inside of the ankle.
- Pain to the tarsal tunnel increase with activity and relieved by rest.
- Sensory loss in the plantar foot, medial ankle.
- Positive Tinel’s sign at tarsal tunnel.
- X-ray for bony pathology, MRI for soft tissue pathology.
- Nerve conduction studies.
Tarsal Tunnel: conservative treatment

- NSAID’s
- Localized steroid injection.
- Immobilization.
- Orthotics to control foot function.
- Physical therapy: iontophoresis.
- Gabepentin, Lyrica, Voltaren gel.
Tarsal Tunnel: surgical treatment

- Removal of cyst, tumor, varicose vein in canal.
- Decompression of the tarsal tunnel.
  (Similar idea as carpal tunnel release)
Foot Drop

- Weakness of ankle dorsiflexion from deep peroneal nerve compromise.
- Physical findings may include: difficulty clearing the foot during swing phase of gait (toes dragging or catching on the floor), foot slap, paresthesia's with distribution of common peroneal nerve.
Foot Drop: etiologies

1. Radiculopathy L4/L5 – disc herniation or foraminal stenosis.
2. Common peroneal neuropathy:
   - external compression; bed rails, below knee cast, trauma
   - rapid weight loss
   - traction during knee surgery,
   - inversion/plantarflexion ankle injury
3. UMN causes: CVA, ALS, MS, brain tumor, spinal cord injury.
4. Micronutrient deficiency: (Vitamin B 12 post bariatric surgery)
Foot Drop: diagnosis

- Neurological exam: motor strength testing, reflexes.
- Nerve conduction, EMG testing.
- Lab studies for metabolic or toxic causes if no trauma or obvious cause. BS, Hemoglobin A1c, ESR, CRP, BUN, Vit. B12, creatinine.
- Imaging: x-rays to evaluate for fracture tibia/fibula, MRI to evaluate for bone injury, brain/spine injury, nerve root impingement.
Foot Drop: treatment

- Bracing with AFO (Ankle Foot Orthotic), help dorsiflexion during swing phase of gait and provide stability.
- Medications: antidepressants (amitriptyline, gabapentin, lyrica), oral and topical NSAID’s
- Nerve blocks.
- Functional Electrical Stimulation: may help if bracing does not fit or work.
Foot Drop: treatment

* Team approach is useful: physical medicine rehabilitation, podiatry, interventional spine, orthotist/prosthetist, physical therapist.
* Surgery: (if conservative treatment fails)
  * Decompression of fibular nerve, sciatic nerve, nerve root, spinal cord, brain tumor.
  * Foot and ankle arthrodesis near ankle joint, tendon transfers.
  * Repair of nerve or tendon injury if traumatic cause.
Diabetic Peripheral Neuropathy

* Most common form of neuropathy in the developed world.
* Found in about 25% of diabetics.
* Distal symmetric polyneuropathy – stocking-glove pattern in hands and feet.
* Factors involved: poor glycemic control, duration of diabetes, hyperlipidemia, elevated albumin, obesity.
Diabetic Peripheral Neuropathy: treatment

* Medications: Lyrica, cymbalta, gabapentin, amitriptyline.
* Topicals: lidocaine patches, capsaicin cream.
* TENs unit.
* Treatment can help reduce symptoms and progression.
• **Patient role:**
  * Control diabetes and blood sugars.
  * Adequate nutrition.
  * Control Vitamin deficiency: Vit. B1,B6,B12
  * Maintain a healthy weight.
Patient’s at risk of foot and ankle ulceration because they cannot feel pain or sore areas.

Runners and walkers need to have cushioned well fitting shoes.

Encourage daily foot checks for problems.

Be seen urgently if any problems are noted to help reduce chance of infection or amputation.
Charcot neuroarthropathy: unilateral redness and swelling of a lower extremity.

- Foot/ankle bones begin to soften, fracture, displace. “bag of bones”
- Due to coexisting peripheral neuropathy most patient’s do not have pain.
- Can occur with other peripheral neurology etiologies: ex: alcoholic or metabolic.
Charcot Foot

- 0.1-5% of patients with peripheral neuropathy will develop Charcot arthropathy.
- Onset usually after average of 15 years of Diabetes Mellitus history.
- 50-60 years of age
Charcot foot: etiology

- 2 main theories: (likely a combination)
  - Neurovascular: vascular damage to autonomic nervous system causes reflex hyperemia and increase in blood flow to the limbs. (Washes out the bones)
  - Neurotraumatic: microtrauma initiates an inflammatory cascade leading to breakdown.
Charcot foot: diagnosis

* Physical exam: warm, red, swollen foot. Increased temperature from contralateral foot.
* Imaging: Bone scan, MRI, X-ray.
  * In presence of open wounds, infection can be very difficult to differentiate.
  * May need bone biopsy, cultures.
* Be cautious in diabetic neuropathic patient having unilateral foot and ankle swelling and/or fractures without history of trauma.
Charcot foot: treatment

- Medications: biguanides and bisphosphonates, intranasal calcitonin.
- Immobilization foot and ankle: CAM boot,
- Total contact or below knee cast with non weight bearing.
- Bones can take 3-6 months to begin to stabilize and a full year to heal.
- Once temperature reduces and bones begin to stabilize then CROW boot and long term a diabetic shoe.
Charcot foot: treatment

- If foot and ankle become a rocker bottom type foot or are unstable then surgical intervention may be needed.
  - Surgical arthrodesis of foot and ankle.
  - Removal of bone spur.
- Significant risk of ulcerations, infections leading to amputation.
Charcot Foot reconstruction
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