Equinovarus Foot

Equinovarus Foot is an acquired foot deformity,

Etiology

Commonly seen in pediatric patients with cerebral palsy, spina bifida, and Duchenne Muscular Dystrophy that present with a equinovarus foot deformity.

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post-stroke spasticity.

Diagnosis

Made clinically with presence of an inverted heel with a supinated forefoot, often associated with pain and callous formation along the lateral border of the foot.

Chronic stroke survivors with spastic hemiplegia have various clinical presentations of ankle and foot muscle spasticity patterns. They are mechanical consequences of interactions between spasticity and weakness of surrounding muscles during walking.

Clinical presentation depends on the severity of spasticity and weakness of these muscles and their interactions. Careful and thorough clinical assessment of the ankle and foot deformities is needed to determine the primary cause of each deformity. An understanding of common ankle and foot spasticity patterns can help guide clinical assessment and selection of target spastic muscles for botulinum toxin injection or nerve block [1)].

Treatment

A review in 2022 highlighted the poor level of pre-operative assessment and the absence of formal criteria to indicate the different surgical approaches in the management of equinovarus foot. It reinforces the interest of a systematic standardized preoperative assessment such as selective nerve root block injection and dynamic electromyography to choose the most suitable surgical procedure [2)].

Ranges from bracing to tendon transfers to osteotomies depending on the underlying etiology, severity of deformity, and rigidity of contracture.

Patients with central nervous system injury and severe spasticity, conservative treatment and botulinum toxin type A often have a limited effect. In these cases, nerve blocks can be very useful in deciding therapeutic action [3].

Results support the evidence that diagnostic nerve block results in a greater reduction in muscle overactivity than does botulinum toxin type A in patients with spastic equinovarus due to stroke [4].

Tibialis posterior (TP) is a common target for Botulinum toxin A injection, as a first-line treatment in non-fixed spastic equinovarus deformity. For this deep muscle, ultrasonographic guidance is crucial to achieving maximum accuracy for the BoNT-A injection. In current clinical practice, there are three approaches to target the TP: an anterior, a posteromedial, and a posterior. To date, previous studies have failed to identify the best approach for needle insertion into TP. To explore the ultrasonographic characteristics of these approaches, Spina et al. investigated affected and unaffected legs of 25 stroke patients with SEV treated with BoNT-A. They evaluated the qualitative (echo intensity) and quantitative (muscle depth, muscle thickness, overlying muscle, subcutaneous tissue, cross-sectional area) ultrasound characteristics of the three approaches for TP injection. They observed significant differences among almost all the parameters of the three approaches, except for the safety window. Moreover, these analysis showed significant differences in cross-sectional area between treated and untreated. Advantages and disadvantages of each approach were investigated. These findings can thus provide a suitable reference for clinical settings, especially for novice operators [5].

Botulinum toxin type A has the highest level of evidence and the largest range of indications. However, the botulinum toxin effect is reversible and seems less effective, which supports a permanent surgical treatment such as selective neurotomy, especially for the spastic foot [6].

Selective tibial nerve neurotomy is known as an effective method to reduce focal spasticity when medical treatment including botulinum toxin is not sufficient. The tibial nerve can be targeted to treat spastic equinovarus foot with (or without) claw toes.

Tibial nerve trunk is dissected in the popliteal fossa. Sensitive and motor branches are identified using Electrostimulation to monitor motor responses. The muscular nerves corresponding to the targeted muscles are partially sectioned according to a preoperative chart. A postoperative rehabilitation program is mandatory [7].

Case series

Chan et al. analysed 61 studies (n=2,293 participants); 523 participants underwent neurotomy, 437 Gastrocnemius Lengthening, and 888 tibialis anterior transfer or alternative anterior transfers with the Flexor digitorum longus muscle/Flexor hallucis longus (n=249), the extensor hallucis longus (n=102), the tibialis posterior (n=41) and the Fibularis longus (n=41). Two studies were dedicated to osteoarticular surgeries (n=12 participants). Ankle dorsiflexors motricity was assessed before 70% of neurotomies as compared with 29% before isolated calf lengthening studies, their strength being at least 3/5 in 33% and 50% of the studies concerned, respectively. Passive ankle dorsiflexion was assessed before surgery in 87% of neurotomy studies, with 62% of studies investigating non-retracted spastic equinovarus foot. Before anterior tendon transfer with the tibialis anterior or another muscle, passive ankle dorsiflexion was reported in only 20% and 46% of studies, respectively, and dynamic tibialis anterior activation during gait in 46% and 56%. Although voluntary recruitment of the tibialis anterior produced a better functional result, the presence/correction of varus justified its transfer in 60% of studies as compared with 30% in other transfers, which were justified by hyperactivity or voluntary recruitment of transferred muscle.

This review highlights the poor level of pre-operative assessment and the absence of formal criteria to indicate the different surgical approaches in the management of equinovarus foot. It reinforces the interest of a systematic standardized preoperative assessment such as selective nerve root block injection and dynamic electromyography to choose the most suitable surgical procedure [8].

Eighteen hemiplegic patients with spastic equinovarus foot.

Methods: A selective tibial neurotomy and/or an Achille tendon lengthening, and/or a tibialis anterior tendon transfer were performed to correct a disabling SEF. The primary outcome measure was the goal attainment scale. The secondary outcome measures included body function and structure (spasticity, strength, range of motion, pain, gait speed, ankle kinematics), activities (walking aids, functional ambulation category, functional walking category, ABILOCO) and social participation and quality of life (Satispart-Stroke, SF-36) assessment before and 2 months and 1 year after surgery.

Results: An increase in the goal attainment scale score, in the body function and activity/participation domains of the ICF, a decrease in triceps spasticity and pain, an increase in ankle range of motion and gait speed, an improvement in equinus and a reduction in walking aids were observed.

Conclusions: This study confirms the efficacy of the neuro-orthopedic surgical treatment of spastic equinovarus foot after stroke to improve walking capacities and to achieve personal goals in the body function and activity/participation domains of the ICF.

Clinical rehabilitation impact: In case of post-stroke spastic foot, a personalized neuro-orthopedic surgical program including neurotomy, tendon lengthening and/or transfer improves patient-centered goals in the different domains of the ICF [9]

Case reports

A 78-year-old woman presented for evaluation of back pain, urinary dysfunction, leg weakness and progressive equinovarus foot deformity. She reported that shortly after her birth in 1924, she underwent resection of a subcutaneous 'cyst' in the lower lumbar area. Seven years prior to evaluation at our institution, she had undergone bilateral total knee arthroplasty for osteoarthritis. After the procedure, she began to experience severe low back pain that radiated into her legs. Weakness of the foot inverters, urinary dysfunction and worsening bilateral equinovarus foot deformity developed in the years following the surgery. MRI revealed a split cord malformation with a tethered spinal cord. Because of the patient's age and poor medical condition, her symptoms were managed conservatively. This case demonstrates symptomatic deterioration in an elderly patient with a tethered spinal cord after many years of clinical stability [10].

1)

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