CLINICAL VIGNETTE

Idiopathic Toe Walking

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A four-year-old girl with Food Protein-induced Enterocolitis Syndrome (FPIES) presented to her primary care physician for a concern of toe walking. Symptoms initially began intermittently at age 2 but progressed to consistent toe walking by age 3. At that time, she was referred to physical therapy which improved but failed to resolve the symptoms after 6 months. The patient was able to heel toe walk for short periods but spent the majority of her time walking on her toes. She was then referred to Pediatric Orthopedic Surgery for further evaluation and treatment. Their evaluation noted she was able to keep up with her 7-year-old sister while playing but with more frequent falls and easy fatigability on walks. She was born at 39 weeks + 5 days by spontaneous vaginal delivery with no complications. Mild intention tremor and increased tone were noted at her first well child visit but were easily distinguishable and resolved after several weeks. The patient starting walking by 12 months and was able to heel toe gait until around the age of two. On examination she was able to actively dorsiflex at the ankle to -20 degrees with the knee at 90 degrees flexion and to -15 degrees with the knee in full extension on the left and to -10 and -10 degrees on the right respectively. The remainder of the musculoskeletal exam was within normal limits for her age.

The decision was made to initiate serial casting to correct the grossly tight Achilles tendons. She was initially placed in bilateral short leg casts in -10 degrees dorsiflexion with post mold splints to maintain leg extension while sleeping at night. After 1 week her dorsiflexion progressed to 0 degrees in all areas except on the right in knee extension which only improved to -5 degrees. The casting was then reapplied to +5 degrees dorsiflexion. After an additional week she was finally placed in +10 degrees dorsiflexion and one week later she was able to achieve +20 degrees of dorsiflexion and so further casting was discontinued. At one week follow up, she maintained, slightly decreased, dorsiflexion to +10 degrees. She was fitted with custom ankle-foot orthotics (AFO) which were to be worn for at least four hours per day to assist with neuromodulation. At four-month follow up the patient continued to maintain dorsiflexion and only required AFO use sporadically.

Discussion

Toe walking is common during gait development in childhood but can persist in 5% of pediatric patients. Even with persistence one large study has shown a 79% regression rate with multiple other studies have showing mixed results.[1,2] The typical heel strike pattern for gait generally does not solidify until two years of age and even afterwards may not be present during every foot strike. Persistence past two years should prompt further investigation as it may be an early sign of an underlying neuromuscular disorder. Common causes can include cerebral palsy, autism spectrum disorder and Duchenne's muscular dystrophy.[1,2]

Idiopathic Toe Walking (ITW), is a diagnosis of exclusion. It is best described as "bilateral persistent toe walking with or without fixed equinus contracture without other discernible etiologic abnormalities in patients aged >2 years".[1]

The initial evaluation should include a thorough birth and developmental history to assess for any complications which could have led to anoxic brain injury or other missed milestones pointing to a neurological issue. Multiple etiologies have been proposed including tight Achilles tendons, difference in muscle fibers of the gastrocnemius and avoidance of the heel strike due to sensory issues. There is also a clear genetic component with noted prevalence to at least some degree in multiple family members.[3]

Physical examination should focus on the range of motion at the ankles but also take into account muscle tone, strength and behavior. The Silfverskiöld test can best determine the presence, location and extent of impairment. The test is conducted by measuring the degree of dorsiflexion at the ankle using a goniometer with the leg in extension and flexed at the knee. Flexion at the knee relaxes the gastrocnemius so if there is impairment both in flexion and extension the problem is in both the Achilles tendon and the gastrocnemius.[1]

Normal dorsiflexion is typically near 20 degrees although can be roughly 2 degrees less while the leg is in extension.[4] In 2012 Williams et al[5] created a Toe Walking tool comprising 28 standardized and validated questions which can also help with identifying underlying disorders. Electromyogram (EMG) has been inconsistent in discerning between idiopathic and secondary causes of toe walking.

Given a significant degree of spontaneous resolution, treatment consists of a step-wise approach of increasing invasiveness and is only initiated if there is an impairment in range of motion found on examination. Most studies are small and results are inconsistent and are comprised of multiple interventions making definitive treatment regimens difficult to assess. Physical therapy can be attempted initially, as it was in this

patient, which consists of stretching and strengthening of the Achilles with an attempt at gait retraining and potentially desensitization of plantar feet. Although data on efficacy is not promising, the minimal risk makes it a practical first step. If physical therapy fails or the degree of impairment is significant serial casting may be initiated. Botox injection of the Achilles followed by night splinting has also shown promise but trials suffer from the same issues with size and heterogeneity. Surgical intervention consists of lengthening the gastrocnemius, soleus or Achilles tendons, appears to offer the most effective treatment. As with the other interventions, studies are small and may suffer from selection bias as the patients tend to be older with a higher degree of impairment.[6,7]

Ultimately this patient responded appropriately and continued to maintain greater or equal to 10 degrees dorsiflexion bilaterally and thus did not require any further intervention if she regressed to ankle equinus and more consistent toe walking a trial of repeat casting may have been attempted, but surgery would also have been an appropriate intervention.

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