Visual Diagnosis

Water Immersion-Induced Skin Wrinkling Test in Complex Regional Pain Syndrome

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Patient description

An 11-year-old boy was referred for right leg pain that had lasted for 3 months. No history of trauma was documented, and infectious, vascular, and neoplastic evaluation was unremarkable. Physical examination revealed atrophy of the right lower limb, and the right foot was cold and pale. He demonstrated allodynia with light tactile stimulation. He also complained of decreased heat and cold sensation and decreased sweating of the affected limb. A water immersion-induced skin wrinkling test was performed. Compared with the left toes, decreased skin wrinkling of the right toes was observed after immersion in warm water (104.0°F) for 20 minutes (Fig 1). Thermal tomography of the right lower limb showed a lower surface temperature (Fig 2). In the absence of vascular disorder, the result suggested peripheral sympathetic dysfunction of the affected limb. A diagnosis of complex regional pain syndrome was made. Trigger point injection provided some relief for the pain, and physical therapy was commenced.

Discussion

Complex regional pain syndrome is a painful disorder that is disproportionate to the precipitating event and accompanied by sensory disturbances, motor dysfunction, and autonomic dysfunction.1 There are no specific laboratory diagnostic procedures for complex regional pain syndrome. However, the evaluation of sympathetic function is important because sympathetic dysfunction constitutes a major pathophysicsology of complex regional pain syndrome. Sympathetic function is normally evaluated using thermography, laser Doppler flowmetry for assessing blood flow, and various tests for examining sudomotor function.2 However, the need for specialized equipment limits the usefulness of these tests.

Wrinkling of the skin of the fingers or toes is a normal response to water immersion that requires intact sympathetic innervation. Water immersion-induced skin wrinkling is initiated by passive diffusion of water across the epidermis into the sweat ducts, which in turn alters electrolyte homeostasis, decreases membrane stabilization, and increases sympathetic vasomotor firing with subsequent vasoconstriction. Vasoconstriction leads to a reduction in the volume of fingertip pulp, which would normally pull down the overlying epidermal skin to form wrinkles.3 Water immersion-induced skin wrinkling has been reported to be decreased in patients with diabetic neuropathy and in

FIGURE 1.
The first to fourth toes of both feet are shown after immersion in warm water. Skin wrinkling was seen running vertically from the interphalangeal crease on the second and third toes of the left foot. Compared with the left toes, decreased skin wrinkling of the right affected limb was observed. (The color version of this figure is available in the online edition.)
patients after cervical sympathectomy. The water immersion-induced skin wrinkling test is a simple test of peripheral sympathetic function and is useful even in pediatric or uncooperative patients.

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References