

## Thermography

### REFLEX SYMPATHETIC DYSFUNCTION (RSD) AND SYMPATHETIC MAINTAINED PAIN (SMP)

Reflex Sympathetic Dysfunction (RSD) is a syndrome characterized by chronic pain, tenderness, and vasomotor instability usually in a distal extremity. Lack of recognition, familiarity and a simple diagnostic test has often delayed diagnosis and proper management. There are three basic stages to RSD.<sup>1-6</sup>

The first stage usually occurs after a trauma, whether chemical, physical or mechanical. Sometimes the trauma is a minor one. Symptoms can include pain, hyperesthesia, local edema, muscle spasm, stiffness, limited mobility, vasospasms, burning pain, and hyperhidrosis. This stage is often called "sympathetic maintained pain" (SMP). The sympathetics react to the minor trauma causing what is usually a temporary vasoconstriction of the area's small vessels. This is a normal protective mechanism. For reasons poorly understood, the sympathetic reflex arc sometimes does not stop. This is an abnormal response.

In stages two and three the symptoms worsen, and dystrophic changes occur to the hair, skin, and nails. By stage three the pain is intractable, there is marked muscle atrophy, flexor tendon contractures, edema, and bone deossification (Sudeck's atrophy). By this stage the syndrome can truly be classified reflex sympathetic dystrophy syndrome (RSDS).

In the first stage, which is usually overlooked or misdiagnosed, the patient presents with chronic pain that just will not subside, with temperature changes in the hands (cold). The coldness of the extremity can easily be detected by thermography scanning. Thermography has been labeled by the Anesthesiology Department at Texas Tech University as the prime diagnostic criteria in the diagnosis of sympathetic hyperactivity in RSD and SMP.<sup>3</sup>

The pathophysiology, though poorly understood, seems to be that as trauma occurs, sympathetic afferent fibers are stimulated by local nociceptors and mechanoreceptors. A patient injured her foot, which was painful, cyanotic, cold, swollen, and hyperesthetic. Radiographs were normal, but a bone scan was positive for traumatic synovitis. A thermogram disclosed a 2° drop in temperature consistent with RSD stage one. (Fig. 1) This information is relayed to the internuncial pool at the cord level and spreads. It then stimulates efferent sympathetic stimulation causing vasospasm, myospasm, decreased thermal emission at the skin, and sometimes dystrophic changes.<sup>1-6</sup>

The thermographic findings should show a Delta T or temperature difference from right to left of at least 2°C. The criterion for nerve fiber irritation is 1°C. The normal variation from right to left in numerous studies has been shown not to exceed a few tenths of a degree. The findings are usually hypothermic and are regional. It does not follow a peripheral nerve or dermatomal pattern, but affects many surfaces of the limb. It will usually give the appearance of global nerve levels, but is actually

sympathetic hyperactivity or SMP pain.

Figure 2A and 2B shows lower extremity hypothermia compatible with sympathetic hyperreflexia in a runner secondary to ankle sprain. In both cases the Delta T is greater than 3°. The possible reason for regional hypothermia and the appearance of multiple nerve level involvement is that at the spinal level one preganglionic fiber will synapse with about 100 postganglionic carrying sympathetic efferents. This will give the widespread involvement of thermal change.

If stage one, which is usually the stage in which the patient is in your office, is not recognized and then properly treated, it can and often will progress to the later severe debilitating and usually irreversible stage three RSD. By this stage, conservative care will no longer be appropriate and medical treatment such as sympathectomy and blocks are usually performed. The goal is to recognize this syndrome early on, while chiropractic treatment can have a positive effect, and while these patients are still being treated in your office. It is of utmost importance to break the sympathetic reflex via physiotherapy, exercise, manipulation, and mobilization in stage one RSD.<sup>8,9</sup> Thermography is the diagnostic test of choice for RSD.<sup>1-9</sup> Thermography has been demonstrated to be a highly specific and sensitive test for the diagnosis and management of RSD.<sup>2,5</sup> Furthermore, utilizing thermography in combination with cold stress tests (autonomic challenge) has further enhanced the utility of thermography as a diagnostic aid in RSD.<sup>2,7,11,12</sup> When a patient has chronic pain that is resistant to treatment, refer for a thermography scan to rule out RSD or SMP. If, in fact, it is afflicting the patient, you can alter your treatment approach. RSD/SMP can begin very soon after trauma. Be suspicious when the patient complains of burning, throbbing pain; coldness of extremity; hyperhidrosis; allodynia; and hyperpathia (pain and discomfort in response to just gentle touch and even moving hair follicles).

Treatment of RSD is dependent upon early recognition, and treatment is best delivered in a multidisciplinary approach utilizing physiotherapy, manipulation, exercise, and mobilization of the joint involved, as well as sympathetic blocks/injections.<sup>8,9,13</sup> Usually a pain-management specialist such as a neurologist, physiatrist or anesthesiologist could be consulted. Since RSD can progress to stage two or three despite aggressive efforts to inhibit progression, it is best to have other medical professionals cotreating/observing the patient.

In a study by Dietz et al., on the treatment of RSD in children, published in *Clinical Orthopedics and Related Research*, noninvasive, nonpharmacologic management consisting of mobilization and massage was found to be effective. In another study by Duncan et al., manipulation with sympathetic blocks was also shown to be effective.<sup>8,9</sup> In a case study published in *Chiropractic Technique*, a child with foot RSD secondary to ankle sprain was treated successfully by manual adjustive procedures.

It is important that the doctor of chiropractic be aware of RSD. The most common symptoms are chronic pain, especially of a burning nature, allodynia hyperpathia, cold extremity, and hyperhidrosis. Thermography is considered by many in the chiropractic and medical communities to be the test of choice in early diagnosis since thermography is a window to the sympathetic nervous system.

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