The treatment of upper extremity reflex sympathetic dystrophy with prolonged continuous stellate ganglion blockade

Twenty-nine consecutively treated patients over a 5-year period with upper extremity reflex sympathetic dystrophy were admitted to Massachusetts General Hospital for prolonged continuous stellate ganglion blockade. Diagnosis was based on the presence of pain, decreased joint motion, trophic changes, and vasomotor disturbances. Selection for blockade was made on the failure to improve with outpatient physical therapy, tranquilizers, and mild analgesics. Treatment consisted of indwelling-catheter injections of bupivacaine hydrochloride every eight hours to the stellate ganglion for an average of 7 days, supplemented with vigorous physical therapy. Improvement during treatment was documented in all but two patients with regard to pain and decreased joint motion and in two-thirds with regard to trophic and vasomotor changes. Long-term follow-up demonstrated a relapse rate of 25%, but marked improvement persisted in the rest and normal status was attained in four of 26 patients at an average of 3 years later. (J HAND SURG 8:153-9, 1983.)

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Fig. 1. Cross section of neck at C7 level. Needle is inserted between carotid and trachea posteromedialward to encounter anterior surface of body of C7, then withdrawn 1 to 2 mm so as to be on anterior surface of longus colli muscle and in fascial compartment containing sympathetic trunk.

Fig. 2. Anteroposterior radiograph of needle in place on lateral portion of anterior surface of body of C7 vertebra.

Fig. 3. Anteroposterior radiograph of distribution of 10cc Renografin dye injected 5 minutes previously.
Fig. 4. Catheter for intermittent injections sewn in place at level of C7 vertebra.

ment. They are also instructed in recognition of common side effects, such as hoarseness and difficulty in swallowing, and they sat with the patients for 10 minutes after the injection. We have noted increased resistance to injection when catheters migrate, so when they did, they were pulled back slightly and inserted again. If migration persisted or catheters leaked, they were removed. Once the block was in effect, intensive physical and occupational therapy commenced. Other modalities used were elevation (when swelling was a feature of the syndrome) oral nonsteroidal anti-inflammatory agents, mild analgesics, tranquilizers, and muscle relaxants. No transcutaneous electrical stimulators were used. Treatment continued until a plateau of improvement had been reached with stellate ganglion blockade, then patients were discharged to continue outpatient physical therapy. All patients were carefully monitored and evaluated while in the hospital and reviewed in detail for long-term results.

Results

Of the 29 patients, 23 were women and 6 were men. Their age distribution is shown in Fig. 5 and indicates a predominance in the 50- to 70-year age group. Fourteen had involvement of their dominant arm, 15 of the non-dominant.

In 15 patients fractures had occurred before the onset of RSD. Eleven of these were in the distal radius, and seven of these had had closed reductions before casting for periods of 5 to 8 weeks. The four who were not manipulated were cast for 3 to 4 weeks. Two patients had metacarpal fractures that had been immobilized for 4 weeks and two had humeral neck fractures that had been treated in a sling for 3 weeks. All fractures were healed at the time of treatment for RSD. Another five patients had had carpal tunnel releases prior to the onset of the syndrome and one patient had undergone a cervical laminectomy and suffered inadvertent nerve root
damage. Three patients developed the syndrome after major crush injury to the arm and two after minor injury with superficial bruising. One man had the syndrome develop in association with angina pectoris and a recent coronary artery bypass operation. In two patients no precipitating event could be identified.

All patients complained of either burning or aching pain and had decreased joint motion of the hand on examination. Twenty-seven had vasomotor changes characterized by erythema or blanching of the skin or temperature changes. All but five patients had trophic changes of atrophy, shiny or thin skin, or edema. The duration of symptoms prior to hospitalization is summarized in Fig. 6. It ranged from 3 weeks to 3½ years, the average being greater than one year, of persistent, disabling symptoms. All patients were graded according to the classification system of Betcher et al. Grade I is characterized by severe pain with marked vasomotor changes, loss of joint motion, and atrophy. One patient in this study fell into this category. Grade II is milder, with dull pain, mild vasomotor changes, edema, or atrophy. Twenty-six patients met these criteria. Grade III is the mildest and most subtle form, with responses to injury being only slightly more exaggerated than normal. There were two patients in this category in our study. This distribution of grades is representative of many other studies.

SGB was performed in the manner described in 28 of the 29 patients. The patient who did not receive the injection had a grade II RSD for 2 years after a carpal tunnel release and had a planned SGB cancelled due to coincidental electrocardiographic changes. Six patients had interspersed saline placebo injections and all noted a marked diminution of effect that was reversed by bupivacaine injection.

A small number of patients had an initial Horner's syndrome and subsequently lost the constricted pupil response, but maintained the relief from arm symptoms, with continued injections.

Complications of treatment occurred in eight patients. Three episodes of chest pain followed injection. One was secondary to cardiac ischemia, which resulted from hypertension induced by anxiety over the procedure. The other two were of unknown cause and results of physical examination and electrocardiograms were normal in this patient at the time of the chest pain and subsequently. One tachyarrhythmia developed after injection, but was self-limited and was unassociated with electrocardiographic changes. Because of these reactions, epinephrine was subsequently eliminated from bupivacaine and reactions seemed less frequent. There was one slightly cellulitic catheter tract that cleared after catheter removal, two episodes of hoarseness that persisted for over 24 hours, then resolved, and one small amount of arterial bleeding from the catheter site, controlled with pressure.

Duration of blockade is presented in Fig. 7 and ranged from 1 to 14 days, the average being 7 days.

The results of treatment at the time of discharge from the hospital were marked overall improvement in 90% of the patients. The conditions of 27 of 29 were improved with regard to pain, 21 of 29 with regard to vasomotor changes, 18 of 29 with regard to trophic changes, and 26 of 29 with regard to range of motion.

Long-term results were assessed in 26 of the original 28 patients who received the SGB. Eighteen of these were by direct interview and examination by one of the authors and eight by detailed telephone interview. The time since treatment ranged from 6 months to 6 years, the average being 3 years. All patients were encouraged to participate in an intensive physical therapy program. Two patients required surgical release of finger contractures within 1 year of treatment and one patient later underwent surgical sympathectomy.

At the time of follow-up, 19 of 26 patients felt the pain had remained improved. This correlated with maintained decrease in pretreatment analgesic use. Sixteen felt range of motion had remained improved and this was evident on physical examination. Overall, 19 felt they would be willing to subject themselves to this procedure again for the same results and seven patients regarded gains in the hospital as minimal over the long-term and would not repeat the process. Four patients had regained normal function of their arms and on examination had normal extremities. Trophic
pain and swelling. With therapy she reached the following motion at discharge: Wrist 80°, thumb 60°, index finger 170°, long finger 180°, ring finger 185°, and small finger 200°. At follow-up 2 years later she was without any pain and only noticed occasional stiffness of her fingers. Examination showed no evidence of swelling or skin changes and demonstrated the range of motion recorded above.

Case No. 3. This 53-year-old salesperson had a carpal tunnel release for median neuropathy. Her original symptoms were cured, but she developed a syndrome of arm and hand burning pain and stiffness immediately postoperatively that was soon associated with blanching of the skin on her hand and cold intolerance. This persisted for 3 years and prevented her from returning to work despite treatment with exercises, ultrasound, and muscle relaxants. She had, on examination, a pale, dry, atrophic forearm and hand with normal shoulder and elbow motion. The hand was hyperesthetic and had the following motion: wrist total passive 60°, thumb 50°, index finger 110°, total flexion, long finger 135°, ring finger 120°, and small finger 135°. She was admitted to the hospital and had a 5 day course of continuous SGB with immediate relief of pain and rapid progression to full and normal hand motion by the time of discharge. This patient returned to work within 2 weeks and remains normal after 4 years.

Discussion

The first written record of reflex sympathetic dystrophy occurred in the sixteenth century when Ambrose Pare reported that after phlebotomizing Charles IX, the king developed severe pain in the arm. Fortunately, the pain eventually subsided spontaneously. Percival Pott, in the eighteenth century, described the painful sequelae that can follow nerve injuries. In 1813 Denmark described the syndrome following a gunshot wound to the median nerve. This required amputation of the arm to control the pain and has been the only successful report of this method of management to date.

In 1864 Silas Weir Mitchell, George Morehouse, and William Keen published "Gunshot Wounds and Other Injuries of the Nerves." Mitchell later used the term "causalgia" to describe the burning, lancinating pain that developed after incomplete nerve injuries observed during the American Civil War. Relief rarely followed the neurotomies he performed.

The classic roentgenographic findings of osteoporosis were described by Sudek in 1900 and again by Kienbock in 1902.

In 1916 Leriche observed that relief of the burning pain in a patient with causalgia followed perierterial sympathectomy. He proposed that sympathetic neuritis was the etiology, as did Tinel, but later postulated that sympathetic instability was the cause based on clinical response to sympathetic interruption. In 1930 Spurling reported on a brachial plexus gunshot wound...
causalgia in a bootlegger cured by cervicothoracic sympathectomy after arterectomy had failed.

During World War II many cases of reflex dystrophy were reported as successfully treated by sympathectomy. Lewis proposed that this was possibly due to the vasodilatory effect of the procedure. However, Doupe et al. thought an interruption of "crossover" nerve impulses from irritated sympathetic fibers to pain afferents in the peripheral nervous system was responsible. Livingston expanded this view in his book, Pain Mechanisms. He stated that causalgia and reflex sympathetic dystrophy follow when an irritative nerve lesion of any cause is present because the lesion serves as a focus of impulses toward the internuncial pool that integrates afferents and efferents in the spinal cord.

Livingston further stated that the heightened activity in the internuncial pool causes increased activity in the other adjacent neuron pools, leading to sympathetic excess. A vicious cycle then exists with peripheral afferents exciting the internuncial pool and spreading to involve other spinal cord areas. If the peripheral stimulus abates early the process may cease, but if it continues the syndrome may become self-perpetuating.

The use of somatic nerve blocks, intravascular injections of anesthetics, and vasodilators and sympatholytic agents have all been reported in the past with variable results.

Sympathetic blocks were first used by Leriche and later by Livingston and Homans. Experimental work to support their theoretical premise was done by Granit and Katz and Schmitt in the 1940s and more recently by Procacci et al.

After the Second World War, sympathetic blockade came into widespread use, with favorable results being reported by many workers. The use of continuous paravertebral blockade was first described in the 1950s by Thomason and Moretz for the lower extremity and by Betcher et al. for all types of reflex sympathetic dystrophy, having greatest success with grade II and III reflex sympathetic dystrophy.

Betcher et al. delineated selection criteria that have become critical in establishing a diagnosis. These include pain, vasmotor changes, delayed restoration of function, and trophic changes. They are also responsible for establishing a grading system that can encompass the broad spectrum of pain syndromes seen in reflex sympathetic dystrophy and that was described earlier in this report.

An important diagnostic and therapeutic feature of RSD is its favorable response to sympathetic blockade and this is enhanced by a prolonged, continuous technique.

Conclusions

Reflex sympathetic dystrophy is a pain syndrome characterized by pain, decreased joint motion, vasmotor and trophic changes, and a favorable response to sympathetic blockade. Many patients have one or more identifiable causes of pain other than RSD that must be accurately diagnosed and treated.

In their report on prolonged continuous SGB in 17 patients with RSD, Betcher et al. presented excellent good results in over 90%, a percentage greatly in excess of placebo effect alone, which is usually estimated at 35%. Our work confirms this initial success rate but demonstrates a 25% relapse rate at 3 years. In patients who did not respond to treatment or maintain improvement there was a high incidence of adverse factors such as pending litigation or disability claims, but no other common features were identified.

No correlation was made between level of original injury and success of treatment in our study, although Omer has suggested this and used perineural injections for selected distal lesions.

Many authors have suggested that RSD often resolves without treatment, but it is also known that some cases can persist for decades. For the patient requiring treatment, the diagnostic criteria can help predict success and, for the patient who does not respond to conventional therapy, continuous prolonged SGB with intensive physical therapy offers a significant advantage in management.

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Hands on Stamps

Mauritania—Issue of 1977. This stamp issued in commemoration of World Rheumatism Year demonstrates arthritic involvement of the hand primarily at the proximal interphalangeal joints.

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