

Electrical Inhibition of Pain by Stimulation of the Dorsal Columns: *Preliminary Clinical Report*

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LONG-TERM stimulation of the dorsal columns has been proposed recently as a potential method for relief of pain.¹ Acute electrophysiologic and chronic behavioral studies in animals suggested the possibility of this method. Further experimental studies confirmed its potential safety and have thus led to application in patients.

Since submission of the original paper on experimental observations, Wall and Sweet² have reported that peripheral nerve stimulation can produce specific focal analgesia and anesthesia. We have confirmed their results in 10 cases in which peripheral nerve stimulation was used. Frequencies of 20 to 100 cps, currents of 0.5 to 1 ma., and pulse widths of 0.5 msec. have resulted uniformly in analgesia of the nerve's peripheral area of innervation. With stimulation of the peroneal nerve, however, no decrease in sensation could be elicited in the lateral part of the foot. This emphasizes the impracticality of peripheral nerve stimulation for relief of diffuse pain.

REPORT OF A CASE

A 70-year-old man was admitted to Lutheran Hospital in early March because of severe diffuse pain in the right lower part of the chest and the upper part of the abdomen. He had previously been demonstrated to have inoperable bronchiogenic carcinoma and was suspected of having metastasis to the pleura and liver. He ran a low-grade fever and had considerable nausea and vomiting but was thought to have a life expectancy of 1 or 2 months. We explained in detail to him and his family the experimental nature of dorsal column stimulation. A nurse anesthetist daughter was of great aid in gaining their acceptance of this treatment. On March 24, 1967, a thoracic laminectomy (D2-3) was performed and a Vitallium electrode measuring 3 by 4 mm. was approximated to the dorsal columns at D3 by suturing to dura. The spinal electrode was Vitallium covered with Dow Corning Medical Grade Adhesive and Silastic. Special subcutaneous jacks were placed inferior

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to the wound for later external plug-in and stimulation. These were used so that infinite control could be maintained over stimulus parameters. Postoperatively the patient, alert and neurologically intact, complained of both incisional pain and his original chest pain.

At 6 p.m. on March 24, stimulation was begun with 10 to 50 pulses per second (400-msec. pulses, 0.8 to 1.2 volts, and 0.36 to 0.52 ma.). The patient detected a "buzzing" sensation in his back which extended around and throughout his chest but not into his legs. Both incisional and original pain were immediately abolished. After 5 to 15 minutes pain would recur, but a simple change in frequency of stimulation promptly alleviated it. For 1 hour, pain was controlled. During this time the patient maintained good movement of his legs, and vibration, position, touch, and pinprick sensations were grossly intact. Deep pain (Achilles tendon pinch) was felt only as touch.

The next day, at 9:45 a.m., stimulation was begun again and continued, except for a 2-hour period, until 9:30 p.m. The patient intermittently experienced pain which could be controlled by variations of frequency; and no narcotics were administered during this time. The patient often during the day

requested that the frequency be changed when he began to have slight discomfort.

The next day the patient was too confused for testing, but no cause could be found for the confusion. At midnight he became aphasic and developed total right hemiplegia. He deteriorated rapidly and died on



FIGURE. Postmortem view of attached stimulating electrode in cross section.

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March 30. Autopsy revealed an unexpected subacute bacterial endocarditis with embolism of the left side of brain. Massive pleural and hepatic metastatic lesions were also present. The spinal cord and electrode implant were intact (figure).

DISCUSSION

It is unfortunate that this patient died so soon from an undiagnosed endocarditis. Nevertheless, the striking abolition of his pain during 1½ days of test stimulation was most encouraging in our efforts to suppress pain. Perhaps the most striking aspect of pain relief was that deep and spontaneous pain were relieved, even though pinprick testing was normal. This emphasizes the difference

between sharp brief pain and chronic deep aching pain. Technical details must be improved, and a radiofrequency-induced stimulator will be used in the next patient. The initial results were so encouraging that it seems reasonable that technical problems can be overcome to make this a potentially practical method for relief of pain.

REFERENCES

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