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Electrical Treatment of Severe Head and Neck Cancer Pain

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• **A new modality for the treatment of severe head and neck cancer pain is introduced along with three representative cases showing its effect. The modality uses an extremely low-frequency, low-amperage AC. The mechanism of action is as yet theoretical, with evidence that endorphins and enkephalins are released. All results have been extremely positive in reducing pain.**

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Chronic pain related to advanced cancer is among the most severe of human maladies. Anyone who is associated with the ongoing care of the patient with carcinoma is aware of this haunting state. Unfortunately, treatment is difficult and often without satisfactory results. Heavy medication with codeine, meperidine hydrochloride, morphine sulfate, and with various "cocktails," including cocaine and other drugs, often fail to give substantial relief. Rhizotomy and surgical debulking of the tumor offer little alleviation of pain in head and neck cancer. Radiation of tumor-involved areas sometimes offers temporary relief, but may cause radionecrosis and can only be used in a small percentage of patients.

See also Commentary p 381.

In view of this, a new modality is being introduced for the treatment of pain in head and neck cancer. Although the principle of electrical treatment of disease is not new, the technical development of electronic equipment is at a new level.[1,2]

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BACKGROUND

The application of electricity for the treatment of pain is a modality that has received much attention in the last 15 years.[3] In 1965, Melzack and Wall[4] received the Nobel Prize for the gate theory, which gave a mechanism for the reduction of pain with electrical stimulation. Presently, transcutaneous electrical nerve stimulation (TENS) is used as adjunctive treatment to medication and biofeedback in pain clinics.

Transcutaneous electrical nerve stimulation works by means of electrical stimulation of peripheral nerves with DC. The waveform is generally of the galvanic type, and the current intensity is in the milliamperage range. Either by fatiguing the peripheral nerves or by blocking the pain fibers with competitive stimulation, pain is reduced. The drawback to this treatment is that it is generally temporary and often only lasts while the patient is receiving the stimulation. Because of danger to the carotid sinus, stimulation in the head and neck is dangerous and is not used.

Recently, modifications in the waveform and intensity of stimulation have produced more profound effects on pain than with traditional TENS. The waveform is a varying biphasic, rectangular shape of AC powered by a battery. The intensity of stimulation is in the microamperage range, and the best frequency is between 0.5 and 8 Hz. Because of the low intensity, danger of muscle stimulation and excitation of the carotid sinus is greatly reduced. This allows for stimulation in the head and neck.

The results of these changes have produced modifications in pain that seem to fall into other mechanisms than those accounted for by the gate theory or by fatigue of peripheral nerves. Recently, endorphins and enkephalins have been demonstrated to be involved in the reduction of pain through electrical stimulation.[5,6] This has been deduced by the fact that the effects of electrical stimulation are blocked by naloxone hydrochloride, which blocks the opiate receptor sites in the brain.[7,8] The implication of this suggests a new systematic mechanism involving the peripheral lesion, pituitary gland, limbic system, thalamus, and cortex. The path mediating the electrical stimulus is not always accountable to known peripheral nerves and may involve biologic electromagnetic field lines.[9] This mechanism may be related to acupuncture and the meridian system.

Electrical fields have also been shown to affect the cell membranes in cartilage cells.[10] Perturbation of cell membrane potentials by an electrical field causes fluxes of sodium and calcium across the cell membranes. This, in turn, affects cyclic adenosine 3′5′ monophosphate and enzyme systems within the cell. By this mechanism, the cell itself can be manipulated on a metabolic level.

With this introduction and background, three case histories of severe pain caused by carcinoma of the head and neck are presented. All patients treated were told that there might be momentary discomfort while the electrical stimulation was given. No known adverse effects have been reported to date. All patients consented to this new form of treatment.

REPORT OF CASES

Patients at the Veterans Administration Medical Center in Cleveland were selected on the basis of having severe pain not well controlled by conventional therapy. All patients had squamous cell carcinoma of the head and neck and had received both surgery and radiation as their treatment. All had a history of recurrence.

Electrical treatment was delivered to the involved painful areas with a computerized AC pulse generator. Two hand-held electrodes were placed across the involved areas. All treatments were given with 0.5 Hz, and the intensity of the current was usually 500 μamp, except when pain was felt, at which time it was decreased to 50 μamp. Treatment time varied with each patient, but usually lasted two minutes on each area stimulated.

CASE 1.—A 58-year-old man had squamous cell carcinoma of the laryngopharynx diagnosed in 1980. It was staged at T4N2M0. The patient received full-course radiation therapy to the primary tumor in the piriform sinus and to the ipsilateral neck node. He had recurrence in the larynx after one year and underwent a laryngectomy and radical neck dissection. Four months later, a metastatic mass was discovered in the area of the neck that had been operated on. Further radiation treatment was given and provided temporary palliation of growth and pain. Pain became the most notable problem, requiring at least 7 mg of morphine sulfate every four hours along with various sedatives. This failed to give complete relief. At this point, electrical stimulation to the neck was given. Treatment was given directly across the area of the tumor with a current of 500 μamp at 0.5 Hz for ten minutes. The pain disappeared. The treatment was repeated the following two consecutive days, and the patient remained pain free for one week without further treatment. At the end of one week, pain returned and he was again treated. The patient again remained pain free, but began having symptoms of withdrawal from the morphine. He was then placed on a regimen of methadone hydrochloride. He is presently pain free with electrical treatments every three days for one minute.

CASE 2.—A 54-year-old man had a total laryngectomy performed for a T3N0M0 lesion of the larynx in 1980. In 1981, he had a metastatic neck node, for which he received a neck dissection and follow-up radiation therapy. The patient also had a pneumonectomy for a separate primary squamous cell tumor of the left lung. He continued to have severe pain of the right sides of the neck and jaw. No residual tumor was found. He required combinations of codeine, zomepirac sodium (Zomax), and amitriptyline hydrochloride (Elavil) for control of pain. He also had severe pain around the pneumonectomy site. He received little relief of pain from these medications. Electrical stimulation was then used on the patient. The neck, mandible, and pneumonectomy scar were treated with 0.5 Hz at 500 μamp for two minutes at each site. He received complete relief of pain in the head and neck that required no further pain medication, and he has had no recurrence of pain in this area. Relief of the pneumonectomy pain lasted 50 hours and disappeared again after treatment.

CASE 3.—A 59-year-old man had T4N1M0 squamous cell carcinoma of the base of the tongue and supraglottis. He received full-course radiation therapy to the primary tumor and involved part of the neck. Radiation treatment failed to eradicate the tumor entirely from the base of the tongue, and the patient complained of severe pain radiating to both ears. Codeine and meperidine failed to control the pain completely. The patient was treated with electrical stimulation and immediately felt a relaxation of the tongue and neck musculature. The pain was completely relieved with a treatment of 0.5 Hz at 500 μamp for 12 minutes. The effect lasted for eight hours, after which the pain again returned. The same treatment was again given and lasted for 24 hours. The patient left the hospital against medical advice and now has recurrence of pain.

COMMENT

We have presented three representative cases of pain control with a new form of electrical stimulation. To our knowledge, this is the first report of this modality used in the head and neck. Naturally, a prospective double-blind study is necessary before absolute conclusions involving pain may be made. Such a study has been done with this modality on back pain that dismisses the placebo effect; and indications from our experience are that these results will be substantiated in prospective studies of head and neck pain.[11,12]

The three cases anecdotally presented are representative of similar cases recently treated by us with this new form of electrical stimulation. Without exception, in every case there has been a positive effect in decreasing pain. Each patient had been asked to evaluate his pain on a scale of one to ten before and after each treatment, and they consistently reported a decrease in subjective pain. Objectively, these patients could be followed up by observing the amount of pain medication they required. In case 1, the patient went from 7 mg of morphine sulfate every three to four hours to no pain medication at all for one week. At this point, the patient had to be placed on a regimen of methadone to guard against withdrawal symptoms. However, he has noted no return of his former severe pain.

The longevity of the results was especially encouraging. In no case was the result less than eight hours, and in case 2, the effect lasted more than three weeks. There was no indication of side effects, such as respiratory depression or depression of alertness. The treatments were relatively painless and usually there was no sensation of the electrical stimulus.

This form of electrical stimulation should not be confused with TENS. As has been explained earlier, the mechanism of action is different, involving endogenous release of hormones and neurotransmitters. These effects may be similar to those produced through acupuncture.

Much research is still needed in this new area of electrical treatment for pain. The positive results are unquestionable, but more work is needed in defining the basic mechanism of action.

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