THE ELECTRO ACUPUNCTURE: A MODE OF ANALGESIA

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INTRODUCTION

The role of electroanalgesic modalities in treatment of chronic pain syndromes has long been questioned by medical practitioners because of the lack of adequate randomized, double-blind sham-controlled studies to support their use in clinical practice [1-3]. Earlier few sham-controlled studies involving the use of electroacupuncture reflected some significant benefits in terms of lowering pain scores, improvement in sense of well-being, physical activity, and quality of sleep, and reduction in need for oral analgesic medication [4-6]. Recently, Sator-Katzenschlager and co workers described a prospective, randomized sham-controlled study by using auricular acupuncture. The study involved electrical stimulation of an auricular acupuncture point which resulted in enhancement of analgesic benefits of acupuncture in patients with chronic low back pain. This study has contributed the growing body of scientific data supporting the use of electro analgesic modalities in the management of chronic pain [7]. Some studies have also documented the long term benefits of electroanalgesia in chronic pain and significant benefits to patients receiving electrostimulation by accelerating their ability to return earlier to full-time work as well as improved quality of life [8-11]. Therefore, we have reviewed the role of electrotherapy as one of the modes of analgesia for the management of chronic pain.

PROPOSED MECHANISMS OF ELECTROANALGESIA

The physiological mechanisms of electroanalgesia have not clearly explained that how different modalities of electrical therapy induce analgesia?. The survey of literature reveals the paucity of work that could lead to assess the mechanism and efficacy of electrotherapies compared to placebo treatments. Most studies indicate both reduction in pain threshold and its perception. In 1960's, Prof. Melzack and Wall explained the mechanism of analgesia by bringing forward the "Gate control theory", which suggested that stimulation of large-diameter afferent nerve fibers may inhibit second-order neurons in the dorsal horn of spinal cord to suppress the conduction of pain impulses through the small-diameter fibers to the higher brain centers [12]. It is the most commonly used hypothesis to explain the relief of pain on using high-frequency Transcutaneous Electrical Nerve Stimulation (TENS) therapy [13,14]. During 1970's the raphe spinal structures were identified as part of brain analgesia system along with the discovery of endogenous opioids [15] which opened the avenues of research on electroacupuncture mechanisms. During 1980's, Prof. Jisheng Han at Beijing Medical University China demonstrated that electroacupuncture stimulation at the rate of 4 pulses per second (pps) in rabbits releases enkephalins and endorphins in the brain and spinal cord. He injected antibodies to endogenous opiates intrathecally into the spinal cord of rabbits before the administration of electroacupuncture, which resulted in blockade of electroacupuncture analgesia [16]. Richard Cheng of Toronto Canada in addition to the same observation, also showed that stimulation at the rate of 200 pps would lead to the release of monoamines, serotonin and nor epinephrine [17]. Prof. Pomeranz and Stux proposed that analgesia by needles through the peripheral nerve stimulation might send signals to brain and release endorphins. He and his co- workers were the first ones to experiment on the spinal cord of anaesthetized animals and found that acupuncture analgesia was mediated by endorphins. They identified that the electroacupuncture blocked the transmission of the noxious stimuli to brain which could have also been blocked by giving pre-electroacupuncture naloxone; an opiate receptor antagonist [18]. Different studies have shown that blockade of opioid receptors with naloxone in the habenula, nucleus accumbens, amygdala, or periaqueductal gray matter had prevented the analgesia produced by the electroacupuncture [19-22].

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It has also been suggested that acupuncture needle directly stimulates A delta nerve fibers, which have an inhibitory feedback effect on pain transmission mechanisms. Therefore, central and peripheral nervous systems work together in acupuncture to establish local anaesthesia and deep general anaesthesia, whereas naloxone can inhibit the effect of acupuncture [23-25].

The functional magnetic resonance imaging (fMRI) shows that how acupuncture stimulation can have the specific effect on the nervous system [26]. A study using fMRI in human subjects, has suggested that electroacupuncture stimulation desensitizes or reduces the activation of central areas of the cortex that are believed to be involved in pain signal processing and perception [27].

The currently proposed scientific bases for the mechanisms of analgesia produced by various electrical therapies include:

a. Presynaptic inhibition in the spinal cord.
b. Endogenous pain control by the release of endorphins, enkephalins and dynorphins.
c. Direct Inhibition of an abnormally excited nerve.

INDICATIONS FOR THE USE OF ELECTRICAL THERAPIES

a. Musculoskeletal pain including Tennis elbow, fibromyalgia, chronic backache osteoarthritis, rheumatoid arthritis, myofascial pain, tension headaches [28-33].
b. Neurogenic pain including phantom pain, sympathetically mediated pain, post herpetic neuralgia, trigeminal neuralgia, atypical facial pain, brachial plexus avulsion, pain after spinal cord injury [30,34,35].
c. Visceral pain and dysmenorrhea [36].
d. Miscellaneous conditions including migraine headache, dental pain, recurrent jaw pain, post operative nausea and vomiting, angina pectoris [30,37].

CONTRAINDICATIONS FOR THE USE OF ELECTRICAL THERAPIES

a. In patients with pace maker.
b. In pregnancy, electrical therapies may induce premature labor.
c. It may result in laryngospam if the electrodes or needles are placed on the anterior neck.
d. It should be used cautiously in patients with spinal cord stimulator or intrathecal pump [30,38,39].

MODES OF ELECTRO THERAPIES

There are different ways to administer electrical therapy to achieve desired therapeutic effects. It is possible that by changing frequency, waveform, pulse duration, electrode configuration, and duration of stimulation, one can produce a range of therapeutic effects including relief of chronic pain and induction of sensory effects or to facilitate motor functions [40,41].

The most popular electrical therapies are

a. Electroacupuncture
b. Conventional TENS
c. Acupuncture like TENS(ALTENS)
d. Pulse (burst) TENS
e. Interferential Current Therapy
f. Percutaneous electrical nerve stimulation (PENS)

Electro Acupuncture

Specific acupuncture points are pricked on the surface of the body by means of needles. These needles are electrically stimulated through flexible wires, via small crocodile clips, attached to a pulse generator. Usually 4-8 needles can be stimulated at one time via parallel channels on the stimulator [42,43]. In order to achieve maximum benefit from electroacupuncture treatment, the strongest tolerable current intensity is recommended by Pomeranz [18].

Conventional TENS

One of the most commonly used forms of electroanalgesia is Transcutaneous Electrical Nerve Stimulation (TENS). A TENS unit consists of one or more electric generators, a battery, and a set of electrodes. These units are small which are

programmed to deliver stimuli of variable current strengths, pulse rates and pulse widths. The usual settings for the stimulus parameters are as follows:

Amplitude: Low intensity, just above patient threshold. **Pulse Width:** 10- 1000 microseconds. **Frequency:** 80-100 pulses/sec. The optimal settings of the stimulus parameters are subjective and determined by the trial and error [44].

Acupuncture Like TENS (ALTENS)

In ALTENS, the treatment is given without using needles; instead, small flexible pads are applied on the acupuncture points. The current is of high intensity and low frequency. This method is often considered for those patients who do not respond to conventional TENS [22, 45].

Pulse (Burst) TENS

This is also one of the options used in therapeutic settings of TENS. In this method low intensity stimuli are used which fire in high frequency bursts. The recurrent bursts discharge at 1-2 Hz while the frequency of impulses in between each burst is at 100 Hz [46,47].

Interferential Current Therapy

Interferential therapy involves different form of electrical stimulation than TENS. The 2, 4 or 6 applicators are arranged in same or different planes according to the requirement. This modality is based on the principle that two medium-frequency (KHz) currents are applied to the skin, so as to induce a low frequency current in deep tissues which is equivalent to the difference in frequency between the two medium-frequency currents. Interferential therapy allows effective stimulation of deep tissues, whereas TENS is predominantly a cutaneous or superficial stimulus [46-48].

Percutaneous Electrical Nerve Stimulation (PENS)

The acupuncture like needle probes are used as electrodes in PENS. These are placed at dermatomal levels which correspond to the site of pathology. In this technique the current bypasses the local skin resistance and causes precise and desired level of stimulation in close proximity to the nerve endings [4, 6, 32, 49].

EFFICACY

Most of the studies represent electro therapy as a useful and effective therapeutic modality in the management of pain [50]. In general, the response rates for various pain syndromes have been documented between 50-80% [28]. According to the National institute of health consensus panel of researchers, electrotherapy is not only useful alone but can be successfully combined with conventional therapies to treat various pain disorders [29]. The combination of electro therapy and conventional medicine can bring the state of complete relief from pain or, reduction in dosage of drugs along with minimizing their risk of side effects [29,50-52]. In a study, acupuncture was used for the treatment of rheumatoid arthritis that proved more effective than intra-articular steroids [53]. The electro acupuncture treatment for chronic low back pain was found better long term pain relieving modality, compared to placebo treatment [9]. In another study preoperative electrotherapy reduce post operative pain and requirement of analgesics alongwith reduction of sympathoadrenal response that normally occurred during surgery [37]. A study compared the effects of electro acupuncture and diclofenac in the treatment of osteoarthritis knee. Its results revealed that electroacupuncture was significantly effective than placebo and diclofenac in some cases but combined treatment was equally effective as electroacupuncture therapy alone [54]. The evaluation of electrical therapy in the treatment of peripheral neuropathy revealed the reduction in mean continuous pain intensity by 32.9% and intensity of attacks by 59% which manifested its role in treatment of such patients [55]. One of the advantages of the electrotherapy is that the incidence of reported adverse effects is lower ascompared to many drugs and available medical procedures. Much of the clinical experience suggests that electrotherapy may be a reasonable option for a number of clinical conditions [29].

CONCLUSION

Clinical trials emphasize that commonly used electrical modalities of today, offer effective alternatives to the conventional treatment for various disorders especially pain. These modalities can safely be used as an adjunct to medical treatment to get better long term effects alongwith

patient's satisfaction by reduction in the dose of medicine. Therefore, most of the patients with pain can perhaps live better with electrotherapy. However, despite increasing indications and use of electrical therapy, it is still debatable as to how it works? It appears that electro analgesia is induced by the inhibition of sensory transmission along the pain pathways and or by the release of endogenous opioids.

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