

Acupuncture for Pain Treatment

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Abstract: Traditional Chinese Medicine is a therapeutic system comparable to allopathic medicine. Its most known application concerns with pain control and that is why it is mostly performed by anesthesiologists, pain therapists or pure acupuncturists.

Acupuncture has great and wide potential: treatment of acute low back pain, intra-operative electro-analgesia and other therapeutic indications well recognized by WHO.

Acupuncture points can be rubbed down, warmed up, electrically stimulated or simply hit. Their existence is scientifically proven.

Acupuncture can be used in daily clinical practice: its efficacy as anti-emetic or preventive treatment for nausea and vomiting associated with pregnancy, chemotherapy and individual sensitivity is well proven.

Acupuncture can support medical therapy in the first approach to chronic pain and in the second step it can completely replace pharmacological therapy.

Although the number of treated patients is smaller, acupuncture seems to be similar to pharmacological therapy with regard to postoperative pain control.

Keywords: Pain, acupuncture, electro-analgesia.

INTRODUCTION

What is acupuncture? It is a form of therapy that stimulates particular skin points by inserting fine metal needles, to restore a condition of balance within the body that can be modified by any cause [1].

The earliest European records about acupuncture were written by infantry captain and later French consul in China, Dabry de Thiersant Claude Philibert (1826-1898): "Medicine among the Chinese" (1863) and "Medical equipment among the Chinese", coauthor Dr. J.L.Souberain. However, the first modern treatise on acupuncture was written by Soulié de Morant, French consul in Shanghai. In 1934 he published his "Synopsis of True Chinese Acupuncture".

In 1975 Dr. Niboyet and Dr. Rabischong wrote an article that demonstrated the histological existence of acupuncture points; the paper was published by "La nouvelle presse médicale".

An acupuncture point consists of a thinning of the epithelium, together with minuscule tiny capillary and lymphatic vessels, and a nerve fiber held together by supporting tissue. This thick bundle of non-mielineated, cholinergic nervous

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fibers is intertwined with myelinated fibers. "The skin is only a support and reflects a deeper energetic circulation that never varies".

The vital energy represents human health, particularly when its three main components are balanced: *yong qi* (feeding energy), *wei qi* (defensive energy), *yan qi* (ancestral energy).

Intra-operative acupuncture analgesia was first used in China at the end of the '50s following a fortuitous observation: needle manipulation of specific points of the body completely relieved pain following tonsillectomy performed under local anesthesia.

Chinese people started to adopt this technique not only to treat, but to prevent pain [2, 3]. After an experimental phase - from 1958 until 1968 - in China acupuncture became current practice since 1970.

During the same period in Europe, acupuncture for surgical analgesia gained wide popularity [4], and results of selected studies were published in 1972, by Bresset, regarding odontostomatological surgery, and in 1974 by Niboyet, regarding general surgery.

During the Meeting of Grancière, in September 1975, prof. Damaso Caprioglio and Dr. Fedelina Caputi (Odon-

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toiatric Research Centre - Dental Children Clinic – Milan, Italy) gave a demonstration of acupuncture analgesia.

How acupuncture analgesia works is still matter of discussion [5, 6]. In the sixties an experiment was made: Li-4 (*Hegu*) was continuously acupuncture-stimulated for 50 seconds to raise considerably the pain threshold: this reached a maximum level in 20'-30', and then did not change anymore. After needle extraction pain threshold decreased 50% exponentially within 15-17 sec. General increment of pain threshold and slow decline of analgesic effect seem to imply the production and circulation of endogenous substances capable of canceling pain caused by needle insertion during acupuncture treatment [7].

In China several animal studies (in rat and rabbit especially) demonstrated that electrical stimulations of increasing intensity cause a parallel rise of pain threshold, therefore explaining acupuncture analgesic effect [8].

These results have been obtained not only in human but in animal experiments also, defying therefore the “placebo effect” theory.

To demonstrate a scientific basis all acupuncture studies usually treat 3 groups of patients: pharmacological therapy, “sham” acupuncture and acupuncture therapy [9-11].

Since 1976 common belief was that 'true' acupuncture versus 'sham' acupuncture (applied anywhere on the body surface) obtained the same results [12], as needle insertion itself causes a “stress reaction” and release of histamine, bradykinin, cAMP, PGs, serotonin and other compounds involved with inflammatory cascade.

MECHANISMS OF ACTION

Most acupoints correspond to zones with lower resistance than that of the surrounding skin [13]. At these points skin impedance is lower, so the skin is crossed easier by electrical current. Normally the skin has a DC resistance in the order of 200.000-2 million ohms. At acupoints this is down to 50.000 ohms; this resistance becomes even lower during diseases of particular organs.

High skin conductance is probably related to a local 'gap junction' high density: 'gap junction' are hexagonal protein complex that create channels between adjacent cells, thus making cellular communication easier and enhancing electric conductance.

At acupoints the following characteristics have been well documented: thinner skin, higher temperature, higher metabolism, and CO₂ production.

Acupuncture analgesic effect takes place at different levels [14-16].

Peripheral Level

Experimental studies (Chang 1978) [17] on animals demonstrated that during acupoint stimulation at the toe the resulting analgesia did not vary with a superficial nerve transection, while it was abolished by deep nerve injury. These results show that acupuncture needle stimulates and activate deep receptors, which inhibit pain transmission at the spinal

dorsal horn. The acupuncture-activated nervous fibers are large, myelinated high-speed fibers.

Spinal Segmentary Level

The “Gate Control Theory of Pain” by Melzack & Wall in 1965 [18] demonstrated that large diameter A β nervous fibers stimulation is capable of blocking pain transmission via A δ and C fibers at spinal cord, through GABAergic interneuron excitation. Later on, in 1990, Bowsher *et al.* demonstrated that A δ fibers stimulation itself is capable to block pain transmission (C fibers) at spinal dorsal horn through enkephalinergic or dynorphinergic interneuron stimulation [19]. This theory satisfactorily explains the analgesic effect of acupuncture at spinal level, as most of the nervous fibers involved are A δ fibers.

Diencephalon and Brain Stem Reticular Formation

In animal experiments [20] acupuncture stimulation anywhere in the body, trigeminal area included, inhibits the response of thalamic cells that receive paleospinothalamic fibers. Interestingly enough morphine achieves the same effect. It is also possible that acupuncture inhibits nucleus thalamus via spinothalamic pathways, in accordance with the thalamic inhibitory effect of reticular formation on pain transmission. Experimental data concerning β -endorphin excretion from hypophysis during acupuncture are available, and they could explain acupuncture analgesia via β -endorphin release in liquor cerebrospinalis and blood [21]. At the same time hypothalamus activates mesencephalic inhibitory pathways via endorphin excretion.

Descending Centrifugal Control

Acupuncture and descending control of nociception are related, as already demonstrated [22]. Some parts of brainstem reticular formation can be activated via reflex control: i.e. raphe magnus nucleus and periaqueductal grey matter, which again inhibit pain transmission via descending pathways [23]. Interestingly enough serotonin, chemical mediator released by descending fibers of brainstem raphe nuclei, produces an analgesic effect during acupuncture stimulation. On the contrary, noradrenaline decreases diencephalic effect of acupuncture while facilitating at descending level.

Cortex

Cerebral cortex has a primary role in integration and modulation of pain via descending pathways, subsequently modifying pain perception. The secondary somatosensory area is stimulated by electro-acupuncture so that raphe magnus nucleus and inhibitory descending pathways are activated. At the same time the primary somatosensory area inhibits nociceptive response at the raphe magnus nucleus [24].

Peripheral nervous system is crucial in pain modulation when considering acupuncture analgesia. The analgesic effect can be nullified if post herpetic neuralgia exists or local anesthetic infiltration is applied to the acupoint.

In the '70s, studies of cortical evoked potentials [25] permitted to understand interrelations between cortical activity and visceral function modifications caused by acupuncture, and the following theory was formulated: the system of

meridians is an independent system connected to cerebral cortex, and it acts through neurohumoral mechanisms.

A more recent and generalized model proposes that acupuncture stimulates cerebral cortex first via peripheral nervous system, thus controlling peripheral organs thanks to hormones and chemical compounds.

Close relationship between acupuncture and nervous system is revealed also by acupoints and “trigger” points overlapping. Trigger points are oversensitive skin points which can be particularly tender on palpation, with local or distant pain.

This neurohumoral theory shows evident shortcomings:

- *Acupoints distribution*: for instance, the auricle does not have relevant innervations or vascularization, or highly important functions, apart from sound hearing. Nonetheless it has the highest acupoint density (10% of total amount of body surface), with strong therapeutic implications.
- *Aspecific acupoint activation*: each nerve is activated by specific stimuli, while therapeutic effect of acupuncture can be achieved through needle insertion, temperature variation, ultrasounds, pressure and vacuum.
- *Bidirectional regulatory acupuncture effect*: by agreement, nerve stimulation evokes an unidirectional effect, i.e. vagal nerve stimulation decreases heart rate, opioids decrease intestinal motility, etc. On the contrary, PC6 (the sixth point on the Heart’s Master meridian) stimulation increases heart rate when bradycardia occurs, while it decreases heart rate when tachycardia is present; ST36 (the 36th point on the Stomach meridian) can either increase or decrease intestinal motility.

Several clinical studies have moreover demonstrated how scarce acupuncture clinically significant adverse events are [26-28], at the opposite of conventional neurostimulating therapies [29], even though a check-list of items that should be included in a case report of an adverse event related to acupuncture would be needed [30]. Accidents may occur if the practitioner uses acupuncture improperly [31]; most adverse events are avoidable with better understanding of the anatomy of the human body and appropriate antiseptic practice [32, 33].

Over the last decades, thanks to modern neuroimaging techniques, several interesting studies [34-36] have investigated acupuncture treatment: interpreting the diverging results has been often difficult. The use and efficacy of acupuncture treatment are not yet widely accepted in scientific and medical communities; demonstration of regionally specific, quantifiable acupuncture effects on relevant structures of the human brain would facilitate acceptance and integration of this therapeutic modality into the practice of modern medicine. Many of the beneficial effects may be mediated at the subcortical level in the brain with a general controlling action on the visceral and psycho-emotional functions. The acupoints have a different specificity correlated with the his-

tological structure or the kind and the amount of own innervation.

Electro-acupuncture is the electrical stimulation of acupoints. Over the last 30 years it has been practiced in Western countries and China, and was recently validated by the National Institute of Health (Bethesda) for postoperative analgesia. In Fig. (1) an example of a commercially available electro-stimulator is displayed.

Electro-acupuncture analgesic effect is immediate, and quickly and constantly achievable, promoting healing and functional recovery in musculoskeletal diseases especially [37, 38]. This certainly is the most known result, but acupuncture and electro-acupuncture act at different levels, modulating a variety of processes, from immune response to endocrine response.

A controlled Chinese study using PET [39] demonstrates that electro-acupuncture induces a greater activation of contralateral cerebral hemisphere (cortex and thalamus), homolateral (basal ganglia) and bilateral, in comparison with plain acupuncture, thus confirming the quickest and deeper sedative effect of the first technique, in comparison with a more gradual and etiologically equilibrating effect of the second one.

Every subtype of opioid receptor is a molecular sensor that can be selectively activated by a specific electro-acupuncture frequency. At 2 Hz analgesia is produced by α and δ receptors activation, at 100 Hz is mediated by K receptor activation, between 2 and 15 Hz all three receptors are activated [40, 41]. Electro-acupuncture can induce significant changes in endorphin gene expressions. At 2 Hz electro-acupuncture increases mainly preproenkephalin gene expression with no effect on prodinorphan, while at 100 Hz it causes a selective increment of prodinorphan gene expression.

SCIENTIFIC VALUE

Several international agencies have already expressed a favorable statement on acupuncture.

In 1977 (later modified in 1990-1993 e 1998) WHO listed a series of diseases which could benefit from acupuncture treatment [42]: acne, anxiety, asthma, headache, irritable bowel, conjunctivitis, rhinitis, cyclic idiopathic edema, diabetes mellitus, depression, herpes simplex recurrences, shingles, hepatitis, influenza, low back pain, PID, osteoarthritis, otitis, Bell’s palsy, neuralgia, sciatalgia, hemiplegia, tinnitus, dizziness, vaginitis.

In November 1997, the Consensus Development Conference on Acupuncture, in Bethesda, Maryland USA, listed other conditions for which acupuncture may be effective [29]: post-operative/post-chemotherapy vomiting, dental extraction pain, dysmenorrhea, tennis elbow, fibromyalgia, myofascial pain, addiction, stroke rehabilitation, rhinitis, carpal tunnel [43-47].

In 1994 the European Community promoted the EU COST project on “Unconventional Medicine”, with over 550 different research groups involved. The study was concluded in 1998 in Pavia with a consensus statement on acupuncture



Fig. (1). Electrostimulator for electroacupuncture.

that validated its use in low back pain, sciatalgia, headache, iatrogenic and pregnancy-induced vomiting [48].

In 2002 the Centre for Reviews and Dissemination (CRD) released a statement [49] that declared acupuncture as effective as allopathic medicine in treating the following diseases, symptoms or conditions: acute and chronic pain, asthma, nausea and/or vomiting, obesity, tinnitus, stroke rehabilitation.

In spite of these considerations, several scientists expressed concern that the evidence supporting acupuncture was weak. In 1999 Tang and coll. published on BMJ a review of 2.500 articles using the RCT (Randomized Controlled Trial) criterion, and stated that ‘only a small percentage of papers (11%) looks reliable enough’ [50]. Paradoxically the better the study the worse the clinical result!

Acupuncturists perfectly know that the success of a therapy depends upon timing of the therapy itself, and technique of stimulation: the same acupoint can be tonified, solving urinary incontinence or ineffective uterine contractility during delivery, or dissipated, improving both urinary incontinence and uterine hypertonus problems.

In Table 1 the most frequently used acupoints are listed.

RISKS

Acupuncture is not dangerous in skilled hands, but none-

theless proper training and expertise is mandatory. For example, during pregnancy different acupoints of same meridians have different functions: LI4 (*Hegu*), ST23 (*Taiyi*), SP6 (*Sanyinjiao*), BL60 (*Kunlun*), BL67 (*Zhiyin*) can be tonified or dissipated, but the correct timing and indication avoid potential disasters.

Beware of depth of needle insertion: i.e. SP-11 (*Jimen*) possible injury to the femoral artery; DU-16 (*Fengfu*) possibility of spinal lesion; similarly all thoracic and abdominal acupoints are potentially dangerous.

The most common adverse effects are: hematoma, muscular spasm, vagal reflex (different from ‘acupuncture sickness’ – see below), anatomical lesions in different sites, local infections evolving in generalized sepsis, needle rupture.

In 2001 Mac Pherson and coll. published a survey of 34.000 acupuncture treatments, administered by 1,848 acupuncturists members of the British Acupuncture Council [51]. No major adverse incidents like permanent disability, hospitalization, Emergency Department admittance or death were seen. Minor adverse effect were 43 (0.13%): 12 intense nausea or collapse, 7 worsening of symptoms, 5 large hematomas or intense pain, 4 emotive reactions, 2 forgotten needles, 1 moxa burnt. Temporary minor adverse incidents were 5136 (15%): 2.8% worsening of symptoms, 1.7% small hematomas, 1.2% pain, 0.4% bleeding. Finally transient reac-

Table 1. Acupoints For Pain

ACUPOINTS	SITE
6 P	Forearm, radial side, 5 cm under the elbow
4 IC	At the corner between 1 and 2 metacarpus
11 IC	On the radial side of the elbow
15 IC	Anterior side of the acromion process
67 V (for resistant pain)	5 toe, 2 mm on the external side

tions were: 11.9% relaxing feeling, and 6.6% a feeling of greater energy.

Acupuncture sickness is fortunately a rare phenomenon, consisting of: pallor, nausea, sweating, weak pulse, lipothymia or syncope [52]. It usually happens at the beginning of the treatment, after the insertion of the first 2-3 needles, for unknown reasons. It is probably related to manual needle manipulation and *De Qi* retrieval. The needles are extracted as quickly as possible, and “resuscitation” acupoints are massaged:

1. Du-26 RENZHONG (Water Channel), located at 1/3 distance from border of upper lip to nose;
2. H-9 SHAOCHONG (Lesser Rushing), on the radial site of the little finger, about 2 mm posterior to the corner of the nail;
3. Lu 11 SHAOSHANG (Lesser Merchant) on the radial site of the thumb, about 2 mm posterior to the corner of the nail.

CONCLUSIONS

The possibility to know well both type of Medicine - Conventional and Traditional Chinese - permits to offer the patients the best available quality of treatment. Pneumonia must be treated with antibiotics, but associating acupuncture treatment will improve and speed up healing of our patient, boosting his immune response and decreasing duration of illness and discomfort.

If early treated with acupuncture, low back pain will miraculously ease in the first few hours, and resolve after few acupuncture treatments, at the opposite of a conventional pharmacological treatment with steroids, muscle relaxants, NSAIDs, plus or minus the related side effects.

At our hospital we have created a multimodal pain therapy approach: pharmacological therapy is associated to acupuncture, electro-acupuncture, analgesic blocks, and invasive pain therapy (radiofrequency).

Different professionals alternate, debate, cooperate to reach a comprehensive approach to pain treatment.

Over the last few years more and more International Congresses started to take interest in non conventional Medicines, as they represent a therapeutic opportunity that should be exploited in daily practice.

Unfortunately cultural and economic oppositions are still very strong, and many medical colleagues consider acupuncture therapy not effective: however, its potential usefulness is out of question, and “...there is sufficient evidence of acupuncture’s value to expand its use into conventional medicine and to encourage further studies of its physiology and clinical value” (NIH panel assessment 1997-2007).

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