

OSTEOARTHRITIC PAIN TREATMENT WITH ELECTROACUPUNCTURE

Zainal Arifin A

Subdepartment of Rheumatology
Department of Internal Medicine
Sebelas Maret University School of Medicine
Dr Moewardi Hospital, Surakarta

ABSTRACT

Osteoarthritis (OA) is a degenerative disease that quite a lot in the world and in Indonesia. OA is one cause of disability in conducting activities and joint disease is the most common manifestation in developing countries. More than 85% patients OA have disrupted activities. Painful joints are the most common complaints and most predominant manifestation of OA disease, so most OA patients came to hospital because of complaining pain. This symptom is the most predominant in osteoarthritis and there is no therapy that can treat this disease. The therapy is pain assessment in the primary treatment of osteoarthritis. Many researches have proven the effectiveness of pain therapy on the OA acupuncture. The mechanism works through nervous and humoral mechanisms. Electroacupuncture is one of the results of stimulating the development of technology in acupuncture point. Compared with other ways, such as stimulation with infrared rays, ultraviolet rays, lasers and magnetic fields, electroacupuncture is more popular for use. This paper reviews the mechanism of electroacupuncture in reducing pain in osteoarthritic patients.

Keywords: osteoarthritis, joint pain, electroacupuncture

Correspondence: Zainal Arifin A, Subdepartment of Rheumatology, Department of Internal Medicine
Sebelas Maret University School of Medicine, Dr Moewardi Hospital, Surakarta

INTRODUCTION

Osteoarthritis (OA) is a joint degenerative disease associated with damaged cartilage joints. Vertebrae, pelvis, knee and ankle are most often affected with OA. OA knee radiological prevalence in Indonesia is quite high, namely reaching 15.5% in men and 12.7% in women (Soeroso et al. 2006). Based on the survey of the US National Health and Nutrition Examination, indicates that the prevalence of osteoarthritic knee is around 0.1% at the age of 25 - 34 years and increased to 30% at the age of 75 years, and the incidence in women twice than that in men (Scott 2006). Osteoarthritis, one of the causes of the condition and inability of activities due to joint disease, is the most common in developing countries (Rosenberg 2005). In the century to the impact of future challenges of OA may be more because of the large number of elderly populations (Soeroso et al. 2006). Because the most predominant symptom of OA is painful, and there is no therapy that can treat this disease, the therapy assessment is the primary treatment of OA (Scott 2006).

To help reducing the painful complaint, which is the most predominant symptom, we usually use anti-inflammatory non-steroidal (OAINS) drugs or medicines. Because the complaint of OA pain has chronic and progressive nature, the use of OAINS

usually lasts a long time, so it is very common side effects of OAINS, so that more OA dangerous than the disease itself. In the United States, after using OAINS the 100,000 patients suffering from stomach ulcer, 10000-15000 died every year because of stomach ulcer. Some drugs have been and are tested on animals and clinical testing in humans. New medicines are often referred to as the Agents or Chondroprotective Disease Modifying Drugs Osteoarthritis (DMOADs) (Soeroso et al. 2006).

Research has proved the effectiveness of acupuncture in pain in OA therapy (Vas et al. 2004; Wit et al. 2005). Analgesic effect of this acupuncture method has been recognized by WHO and obtained a license by the FDA in 1996. Electroacupuncture or electrical stimulation is a method that is preferred in providing acupuncture excitation (Miles 2004). Frequency that can be used is a low frequency (<10 Hz) and high (100Hz and 200 Hz). Differences in frequency of use can affect the type of neurotransmitter release (Sudirman 2008), whereas the low frequency releases endorphin and Betha methionin, enkephalin, while at high frequency it releases dinorphin (Ullet and Hann 2002)

PATHOGENESIS OF PAIN IN OSTEOARTHRITIS

Experts examine the disease that is now called OA. OA is a disease that disrupts cartilage homeostasis metabolism with structure damage proteoglycan kartilago that it has not been clearly known. Mechanical and chemical sinovial injury on joints that occur between multifactorial of other factors as age, mechanical stress, or excessive use of joints, muscle defects, obesity, genetic, humoral, and cultural factors (Zainal 2006).

PAIN

Definition of pain according to The International Association Study of Pain (IASP) is an sensory emotional experience and that is not enjoyable due to damage to the network, whether actual or potential, or are likely to be damaged or that are described with the characteristics of damage, as already mentioned (Wright et al. 2002). Pain relief due to pain stimulation on receptor (nociceptor) substances by both mechanical stimulation, chemical, or thermal. Each network has receptor especially painful on the skin, blood vessel, perios and viscera (Sherwood 2000; Tanra 2000; Wirjoatmojo 2000). Pain is a warning in the form of damage to the network. Sore may assist individuals to live and do functional activities, (Kertia et al. 2003; Meliala 2004). There is some pain whose classification should be to define the selection algorithm management and how to overcome the pain (Wirjoatmojo 2000).

According ONSET stimulus and cause, pain can be classified as acute pain and chronic pain is. When it is called acute pain localization and obvious, is generally associated with damage to the network and the pain disappears when the damage to the network significantly. Prototype acute pain is a painful surgery. On the painful chronicles the painful and are likely to be settled with acute pain due to the inability of the body to restore function to return to its physiological homeostatic level. An example is a chronicle of pain due to cancer pain. According to the mechanism for the occurrence, pain can be classified into nociceptive pain and Non Nociceptive pain. Nociceptive pain is pain caused by nociceptor stimulus, the stimulus caused by damage to the network and inflammation. According to the location, the pain in nociceptive can be grouped into somatic pain and visceral pain. According its pathophysiology, pain can be grouped into nociceptive aches or pain inflammation, the pain that arises due to the mechanical stimulus to the nociceptor. Neuropatic pain, the pain that arises due to the dysfunction of primary nervous system.

Pain Transmitter

a. A delta nerve fiber

A delta nerve fiber is a fiber with a nerve with small diameter wrap which has myelin conduction velocity 12-30 m/sec and is fast conductor of pain. The pain as feeling is conducted and interpreted as punctured or cut. The nature of pain is short and localized (Strong et al. 2002)

b. C nerve fiber

C nerve fiber have any speed conduction of 0.5-2 m/sec, and the conduction is slow. C nerve fiber is not myelinated. The type conducts painful feelings such as pulse, pain in, and the feeling of heat that causes uncomfortable. Chemical pain caused chemical substances such as acetylcholine, bradykinine, prostaglandin, ion potassium ion, and ATP (Stoelting 1999).

c. Neurotransmitter

In the transmission flow is stimulated (excitatory), while the flow is impeded the modulation (inhibitory). In the fast transmission, the NT is a role glutamic acid, aspartic acid, and ATP. While in the slow transmission, NT is a role that substance P, Somatostatin, and Peptide Internal Vasoactive (Stoelting 1999). Substance P is a polypeptide compound end of the nerve-free and in the medulla spinalis posterior cornu work through receptor Neurokinin I, as a neurotransmitter excitation and the incidence of painful stimulation (Widhiartawan, 2004)

THE COURSE OF THE PAIN

The process of a strong stimulation in peripheral until it is perceived as pain in the nerve center of the order (cerebral cortex) is a series of electrophysiological as nociception, consisting of 4 processes (Nazaruddin 2002; Strong et al. 2002, Purwandari, 2004), namely :

a. The transduction process

Transduction process is a process in which strong stimulation changed into electrical impulse that will be received tip-end of the nerve peripheral or body organs. A delta fiber is a fiber nerve with 1-3 mm thick and covered by thin film myelin. Speed of impulse transmission in the fiber A delta is about 20 m/s. Like the other sensory fiber, fiber continuity A delta is where the neuron's pseudounipolar its cell body is located on the dorsal root ganglion C, while the fiber is a nerve fiber with 1 mm thick and does not have myelin.

b. Transmission Process

The process of transmission is through the nerve impulse distribution sensory as advanced process transduction, spread through a nerve fiber and fiber Delta C of peripheral to medulla spinalis. In general there are 2 ways how to reach sensation nociceptive nerve center stack, namely through neospinothalamic tract for fast-spontaneous pain and painful tract paleospinothalamic to slow.

On neospinothalamic tractneri quickly through the transmission of A delta fiber and then culminate in dorsal cornu in the medulla spinalis and synapsed with dendrit on neospinothalamic assistance through neurotransmitter. Axon from this neuron to the brain and cross over to the other side through the anterior commisura alba, rose to the top anterolateral column, the contra lateral. Fiber is then ended in the ventrobasal complex in the thalamus and synapsed with dendrite on somatosensory cortex.

On paleospinothalamic tract, painful slow is mediated by C fiber to lamina II and III of the cornu dorsal, known as substansia gelatinosa. Impulse and carried by a nerve fiber ending in lamina V, also on cornu dorsal, synapsed with the neuron that join the fiber from the fast lane, cross the opposite side via the anterior and commisura alba rose above through anterolateral. Neuron is then ended in the brain stem, with stops at the tenth fiber thalamus and the other in the medulla, pons, and central substantia grisea sentralis of tectum mesencephalon.

c. Modulation

Modulation is the process of internal control in the nerve system, can increase or reduce the perception of pain. In this process of interaction occurs between the systems with painkillers endogen Feed pain into cornu posterior medulla spinalis. Endogeneous analgesics (encephalin, endorphin, serotonin, noradrenalin, GABA) can press on the painful impulse cornu posterior medulla spinalis. Endogeneous analgesics this system has the ability to press on the painful input cornu posterior process descendance and the brain is controlled by someone, cornu posterior can be viewed as a gate that can be closed and open sore in the input channel. Modulation process is influenced by personality, motivation, education, culture and emotional status of a person.

d. Perception

Is the result of the end of the process transduction, transmission, and modulation produces a subjective

feeling of pain is known as perception. Introduction and interpretation signal pain occurs primarily in cortex somatosensory and other areas in the brain.

PAIN IN OSTEOARTHRITIS

Pain arises as a result of the osteoarthritis excitation nociceptor in the joint such as knee and the other. For example, in the knee joints nociceptor located in the joint capsule, ligamen, bone periosteum, fat ball joints, and around the blood vessel, but there are not prone to the joints (Strong et al. 2002; Bonnet and Walsh, 2004).

Betha factor TGF stimulates collagen synthesis and proteoglycan and pressing stromelycin, the enzyme that degrades proteoglycan, increase the production of PGE2 and the inhibition effect of PGE2 synthesis by IL-1. In addition, TGF Betha also provides potentiation against osteophyte emergence as one of the disease (Felson et al. 2004).

Nitrit Oxide can also play a role in damage-prone joints (Hancoeck et al. 2008). Stimulate NO synthesis through MMP chondrocyte. Normal cartilage does not produce NO unless excitative on IL-1. IL-1 itself also has effects on multiple cell joint fluid, the increase of enzyme synthesis degrades vulnerable joints, prevent the normal synthesis and repair chondrocyte and suppresses synthesis of PG so that caused a Osteoarthritis (Brandt, 2005; Soeroso et al. 2007)

Table 1. The cause of painful joints in patients OA

| Pain sources | Mechanisms |
|-------------------|---|
| Synovium | Inflammation |
| Subchondrial bone | Intraosseus hypertension, microfracture |
| Osteophyte | Periosteal nerve end stretching |
| Ligament | Stretching |
| Joint capsules | Inflammation, distention |
| Muscle | Spasm |

Pain in the Osteoarthritis has been described as a deep ache pain in the joints that is localized (Brandt 2005). OA pain is the result of a complex between the changes in structure, process and central pain mechanisms peripheral, and subjective differences. In addition, pain is also influenced by cultural, gender, and psychosocial factors. (Scott, 2006)

In the process inflammation OA, the painful stimulus occurs as a result of the exemption nociceptor various mediators biochemical during inflammation occurred. Inflammation caused immunologic a series of reactions initiated by the antigen which is then processed by antigen presenting cell (APC), which will then be

expressed to the cell surface with the appropriate determinant HLA. Which expressed antigen will be bound by these T cells through receptor T cells on the surface of the T cells formed complex trimolecular. This will trigger a complex series of reactions with the release immunologic various cytokine (IL-1, IL-2), so that activation occurs, mitosis, and proliferation in T cells. T cells that teraktifasi will also produce various mediators lymphokine and inflammation that stimulate macrophage working to improve phagocytotic activity and stimulates proliferation and activation B cells to produce antibody (Setyohadi et al. 2006).

Since 1971, it has been known that the product line cyclooxygenase (Cox) arachidonic acid metabolism have a major role in the inflammatory process. There are 2 routes isoforms Cox called Cox-1 and Cox-2. Channel Cox-1 has a physiological function activation may free eichosanoid involved in physiological processes such as prostacycline, thromboxan A2 and Prostaglandin E2 (PGE2). On the path Cox 2 may produce prostaglandin pro inflammation that will deal with the enzyme protease and other mediators inflammation in the process of prostaglandin in inflammation. Its role in causing pain in the inflammatory process was more complex. (Setyohadi et al. 2006)

In the process inflammation, going 4 interaction systems is the system of blood coagulation, kinine system, the system fibrinolysis, and the complement system, which will deliver a variety of protein inflammative good amine vasoactive and chemotactic substances that will attract more cells to the inflammation inflammation. (Setyohadi et al. 2006). Inflammation going on OA sensitization can cause the structure of peripheral, Spinal and supraspinal the process involved in nociception. The release of mediators such as prostaglandin and inflammation may bradykinine result in sensitization arising from nociceptor so painful. This process is responsive to the movement of a movement so that normal joints can cause pain (Vicenzino et al. 2002).

ANALGESICC ACUPUNCTURE WORKING MECHANISM IN OSTEOARTHRITIC PAIN

History Acupuncture

Science Acupuncture is part of Traditional Chinese Medicine (TCM), a medicine derived from the Chinese and the country has known more than 4000 years ago. Literatim acupuncture comes from the word Acus which means needle, and puncture the pin means. Chinese Book of the oldest that still can be found, entitled The

Yellow Emperor of Internal Medicine, or Huang Ti Nei Cing arranged between the years 400-200 BC (Filshie, 1998). School doctor empire was established in the first period of the Sui Dynasty (589-618 M years), and since that experience for hundreds of years are collected and recorded based on the observed carefully. The result of the Shin she has a variety of empirical experience that lets them predict the development of the disease and determine which drug is suitable for each stage is. (Mills, 2006)

Knowledge of acupuncture spread from China through the Arabian countries and to the west. In the United States (U.S.), science has developed acupuncture environment in China town in the city of San Francisco and New York. Elstein in Hospital and the Hospital Massachusett has done research on the anesthesia with acupuncture. Dr. Allen Russeck from the Institute of Medicine and Rehabilitation New York, has been successful in the removal treatment at the pain of chronic diseases with acupuncture (Tse et al. 1985).

During the last two decades, acupuncture has developed in the U.S. Based on reports from Consensus Development Conference on Acupuncture held by the National Institute of Health (NIH) in 1997, acupuncture have been used widely by health experts, dentists, acupuncturist, and other practitioners to overcome the pain and other health disturbances. Recording until the year 2002 by the National Health Interview Survey, which is the largest survey of Complementary and Alternative medicine (CAM) is the 8.2 million adults in the USA has got acupuncture therapy, and 2.1 million people have got acupuncture therapy in previously (Mason 2004).

Acupuncture development in Indonesia began with the arrival of immigrants from the nation of China arrived in Indonesia. Just Science Acupuncture limited only live in their own environment and its surroundings, and only she Shin (who practice acupuncture generation to generation from their parents) are doing practice. In the year 1963 on the instructions of the Minister of Health, Prof. dr. Satrio, the Ministry of Health research and develop ways of the east, including acupuncture to form a research team Sciences traditional East, the practice began at that time was held officially acupuncture in Hospital Dr. Cipto Mangunkusumo, Jakarta, which then developed into a sub-section under the In part Diseases, and the next unit to be acupuncture hospital dr. Cipto Mangunkusumo (RSCM) in this period (Wong, 2006).

THE PHILOSOPHY OF ACUPUNCTURE

Treatment in China, also in acupuncture, health is determined by the ability of someone to maintain the balance of the body. The disease arises when the balance is disrupted and the process to restore normal body balance and harmony can not afford them. The theory of harmony in the body of the principles stated in the Yin Yang and Five Elements Five or phases, which continues to rotate to maintain balance between the influence of the opposite variety. If one of the influences of this is in excess or less, it can disrupt the balance of the body. Harmony and balance also depends on the smooth flow of Qi (chi) or vitality (Filshie 1998)

Basics of Traditional chinese medicine (TCM) is the theory of Yin and the five elements that comprise the elements of wood, fire, earth, metal and water. In the view of modern medicine, the balance of Yin is defined as homeostasis which is the unity of humoral, immune system, nerve system and endocrine. Has been known that the activities are quick and short, the picture area of the body in the head and neck region, where in the world of medicine is the center of all activities of movement, either conscious or autonomous. Yin is slow with long duration of activity and over the front of the body is relatively soft and close to the organ Viscera. Five elements of the phenomenon of aberration one of the elements with simple elements that affect the condition of I; Ain, and the more severe deviation, the more other elements of the sick (Kosnadi, 2005)

In a Acupuncture (TCM) of human life is supported by Qi (life energy), blood and body fluids of the body of work that we can live. The concept of western medicine tends to be more understanding of the material and structure, while the eastern medicine (TCM) tends more to the phenomenon, and its correlated function. In acupuncture therapy, meridian theory, Qi encompasses travel in the meridian, meridian determination, and acupuncture point is a very important part to learn more. (Linda Wilson et al. 2005)

Meridian is a system of longitudinal lines and transverse, which functions Qi and blood channel, connecting the top and bottom, right and left, front and rear, outside and in, with the entire network of organs from the body skin, tendon, muscle and bone. Meridian meridian consists of 12 general and 8 special meridian (Quyang et al. 2004)

Acupuncture point is the point on the surface of the body that can be stimulated with different modality, among others being pricked with the needle acupuncture, heated with moksa, given the pressure, or with laser rays, giving rise to the balance of Yin in the body. Parts of the body is used as a measure to determine the location of the point between the two fingers bending the tip of the middle finger interphalangeal joints (1 inch) wide thumb or hand (1 inch) (Saputra 2005).

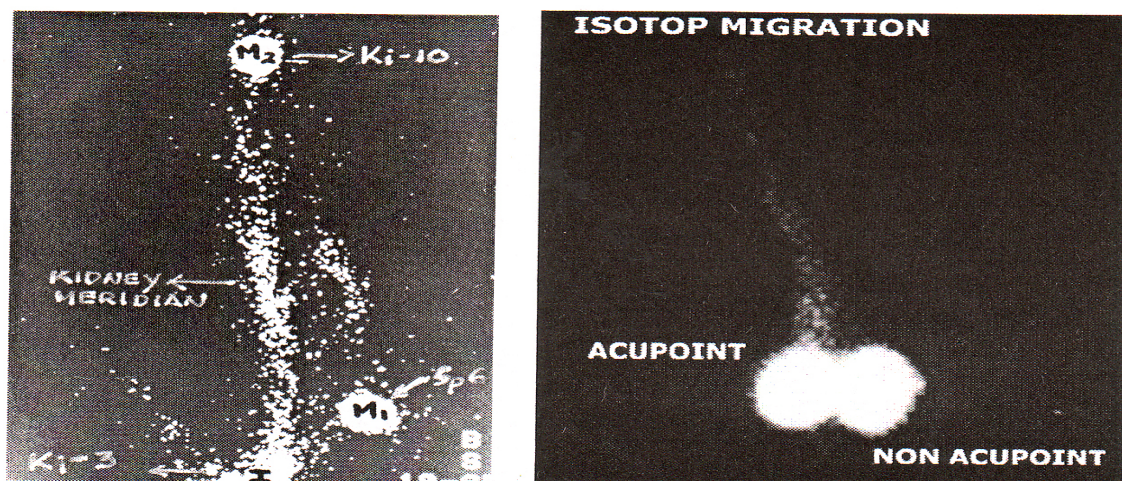


Figure 4. Differences acupuncture point and not a point after acupuncture given radioisotop Teknesium perteknetat and monitored with gamma rays (Koosnadi, 2005)

THE WORKING MECHANISM OF ANALGESIC ACUPUNCTURE

Basically, the mechanism of analgesic acupuncture consists of 2 aspects of the close, the nervous and humoral mechanisms. Persyarafan on the mechanism, the impulse can be explained that the excitatory nociceptive may forwarded by nerve fiber with a thin diameter, while the excitatory impulse at the point of matchmaking acupuncture may dihantarkan by berdiameter thick nerve fiber (Jin et al. 2004)

Based on the Gate Control Theory is presented by Melzack and Wall in 1965 that the dihantarkan signal from the medulla spinalis to the center of a higher proportion of dependent nerve fiber activity berdiameter thick and thin berdiameter by the diaktifasi excitative from the outside. Activation of nerve fiber thick berdiameter may prevent impulse nociception, whereas activation of the nerve fiber berdiameter slight increase may nociception. This explains the effect Analgesic from acupuncture through nervous (Ullet and Han, 2002; Jin et al. 2006; Setiohadi et al. 2007)

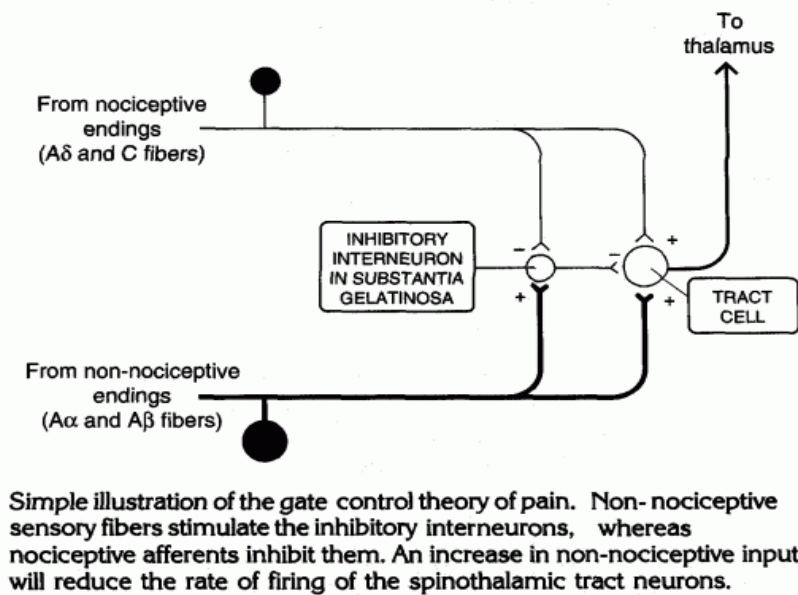


Figure 5. Gate Control Scheme Theory

In addition through the nerve, the action in the painful acupuncture also known through the biochemical or humoral mechanisms. In the way across the barriers between sinaps or nerve, nerve impulse must be bridged by a chemical substance called neurotransmitter. The findings neurotransmitter role in the control of pain started when Snyder found receptor opiate in 1973. Receptor opiate mainly found in substansia gelatinosa, medulla spinalis, descendent tract nucleus, nucleus raphe brain stem, hypothalamus, thalamus the medial, amygdalum, korpus striatum, limbic lobe, and substansia grisea. Then Hugh and Kosterlitz find endogen morphine (encephalin and endorphin) in 1975 (Kastono, 1999).

It has been found in various receptor opioid nerve center stack and the various types of receptor may explain various effects of opioid (Sulistia, 2005). Receptor is

mediating estimated effect analgetic Betha endorphin with endogen as a ligand. Met enkephaline can be a ligand endogen from receptor delta, while dinorphin as ligand endogen receptor Kappa (Jin et al. 2006). Mechanism of analgesic acupuncture via this route is the endorphinergic. This is evidenced by the fact naloxon systemic negate/prevent the occurrence of analgesia due acupuncture.

Excitative acupuncture path toward supraspinal in mediated through tract Spinothalamicus, but there are some collateral before reaching the nucleus in the thalamus. The aim of the nucleus by excitatory acupuncture is Dorsoventralis posterior nucleus Thalami, are excitatory pain in general to the nucleus Medianus Thalami. Collateral originating from the path is increased to Magnus rafe nucleus, nucleus paragigantoseularis, and to periakquaductal gray.

Collateral for the nucleus Rafe Magnus serotonin in sinaps issue with fiber interneuron in substansia gelatinosa. Collateral for the nucleus Paragigantoseptalis may noradrenalin release in sinaps with fiber interneuron in substansia gelatinosa. Collateral for the Periaqueductus affect gray may make hypophysis to release Betha endorphin the entrance to the liquor cerebrospinalis and enter the blood stream. There is endorphin Betha in circulation will cause a feeling of comfort, calm and patient in the general analgesia. (Sudirman, 2008)

Of fiber-fiber interneuron that received both sinaps Magnus Rafe's nucleus and the nucleus Paragigantoseptalis in substansia gelatinosa may release enkephalin met so that the inhibitor is able to compensate/excitatory especially the neurotransmitter substance P and glutamic acids derived from excitatory noxious from peripheral, so it is able to prevent excitatory aches that come from peripheral (visceral skin and organs) and Analgesics occurred. (Sudirman, 2008)

ELECTROACUPUNCTURE STIMULATION

Electroacupuncture is an application in acupuncture stimulate the point with the electric current in the stream that was pricked by a needle. This was developed in China around the year 1934 as an expansion of the use of manipulation with the hand on the needle acupuncture (Dharmananda, 2002). Electroacupuncture is one of the results of stimulating the development of Technology in acupuncture point. Compared with other ways such as stimulation with infra red rays, ultra violet rays, lasers and magnetic fields, electroacupuncture more popular for use. (Jin et al. 2002)

According Dharmananda, there are several advantages of using Electroacupuncture, namely:

- a. Electroacupuncture can ever replace the hands with excitement. This can ensure that patients get the required excitatory. During the excitatory Electroacupuncture, practitioners can provide treatment on another patient.
- b. Electroacupuncture excitatory can also generate a stronger network without causing damage due to lift and rotate the needle
- c. Easier in controlling the frequency of excitatory on hand than to use excitatory manually. Waiver of morphine on the endogen path modulation of Electroacupuncture depends on the frequency used. In the low frequency (<10 Hz) morphine endogen substance that is released endorphin Betha and enkephalin, while the excitatory high (100 Hz) that is released dinorphin, and at very high frequency (200 Hz) that is released serotonin and noradrenalin

(Sudirman, 2008). In the research with an excitatory intermediary frequency (15 Hz), is also going release endorphin Betha, enkephalin met, and also dinorphin (Ullet and han, 2002)

CONCLUSION

OA is one cause of disability in conducting activities and joint disease is the most common in developing countries. Painful joints are the most common complaint, so that people came OA to hospital because of complaints nyerinya. Symptom as the most dominant in Osteoarthritis and there is no therapy that can treat this disease, the therapy is pain assessment in the primary treatment Osteoarthritis. Pharmacological therapy because of side effects associated with very many, so many experts who seek therapy are non-pharmacological, one of which is the acupuncture. Acupuncture mechanisms work to reduce pain is through the mechanism nervous and humoral mechanisms. On nervous mechanism can be explained that the impulse nociceptive excitatory may forwarded by nerve fiber with a thin diameter, while the excitatory impulse from the matchmaking acupuncture is mediated by nerve fiber in thick diameter. Based on the gate control theory is presented by Melzack and Wall in 1965 that the transmitted signal from the medulla spinalis to the center of a higher proportion of dependent nerve fiber activity in thick and thin diameters excitatory by activation from the outside. Activation of nerve fiber in thick diameter may nociceptive prevent impulse, while the activation of thin fiber diameter may increase nociception. This work describes the mechanism for pain acupuncture on the nervous OA. Mechanism through humoral, Acupuncture be that the path can stimulate neurotransmitter release through modulation mainly inhibitory Betha endorphin, dinorphin, serotonin, enkephalin, and noradrenalin. Neurotransmitter can prevent this neurotransmitter excitatory such as substance P and glutamic acid derived from excitatory noxious in peripheral, so that excitatory able to prevent pain from peripheral. Research that should be more objective to compare the effectiveness of pain therapy on Osteoarthritis between acupuncture and medicines analgetics. Research that should be more objective to compare the effectiveness of pain therapy on Osteoarthritis with Acupuncture compared with the other therapy modality. Research on biomolecular mechanism of acupuncture should be performed further.

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