Acupuncture – What’s The Point?
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History
The ancient form of acupuncture predates recorded history. Thousands of years ago, during the Daoist tradition people would meditate and observe the universal energy flow. During a portion of the stone age stones, bones and bamboo were crafted into needles to be used for healing. The first written record of acupuncture was over 2000 (403 B.C. to 221 B.C.) years ago, in China, during the period of Huang Di, the Yellow Emperor. A dialogue between Huang Di and his ministers became the basis for the first written text on Chinese medicine entitled, Huang Di Nei Ching. The Yellow Emperor’s Classic of Internal Medicine was divided into two parts. The first and most famous part, Su Wen is on “Questions of Organic and Fundamental Nature”. The second section, Ling Shu, or “Spiritual Axis” focuses on acupuncture including meridian descriptions, location and function of early acupuncture points including needling techniques. Another text was published a bit later with part being based on the Nei Ching and is still in existence today. By the end of this period Chinese medicine fully adopted acupuncture. The first full-time practitioner of Chinese veterinary medicine was Shun Yang (or Pao Lo).

Traditional Chinese Medicine (TCM) evolved through centuries of observation of nature, the cosmos and the human body. There are four types of TCM and in turn, Traditional Chinese Veterinary Medicine (TCVM) in which the body is a balance of two opposing and inseparable forces, yin and yang. Disease is caused by an imbalance of these energies. Acupuncture works to balance the energies of the body and health is achieved when the body is in a balanced state. Acupuncture, the focus of this talk is one of three disciplines of TCVM.

Qi, pronounced chee, is the energy of the body, meridians, food and of the universe. This life force or life energy, when in balance, flows through channels or meridians, and is fundamental for health. When Qi is impeded symptoms of disease appear. Symptoms vary but can include, pain, illness, chronic disease or emotional disturbances. Acupuncture points along meridians have physiologic functions that serve to restore the normal flow of Qi.

Western cultures rejected acupuncture early on due to lack of medical knowledge and research even though it had been practiced in Asian countries since before recorded time. About 50 years ago a more current awareness of neurophysiology and neuromodulation became the first steps in understanding the multi-faceted pathophysiology of pain, perception and interventional methods modifying them to create homeostasis. More recent research has demonstrated the neural mechanisms of acupuncture and its beneficial effects.

Acupuncture Points
Acupuncture points, from Chinese translating as “communicating holes”, are distinct foci within shallow depressions.¹ There is an abundance of structures located at these depressions including blood vessels and afferent nerve endings that are sensitive to touch, pressure, chemical changes, immune modulatory cells and pain. The group of these structures has been termed neural acupuncture unit (NAU) and includes activated neural and neuroactive components within the surrounding skin, muscle and connective tissue.²

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Scientifically there are five mechanisms to explain how acupuncture initiates pain relief. There are local effects, segmental analgesia, extra-segmental analgesia, central regulatory effects, and myofascial trigger points.

Local Effects
Inserting a needle causes micro-trauma to the local tissues and the interaction with the rest of the nervous system. The response of the local nerve endings after insertion is termed local axon reflex. A series of substances are released; mast cells and nerves release histamine and neuropeptides causing blood vessel dilation and increased blood flow. In the periphery, the sensitivity of the local nerve endings (Aβ, Aδ and C fibers) increase. Capillary permeability is increased, enhancing tissue perfusion and tissue repair. Fibroblasts start spreading facilitating wound healing. Adenosine is produced from ATP and its local anti-nociceptive effects decrease the perception of pain and prompt nitric oxide generation after binding to blood vessel epithelium. Humans describe a delayed dull, aching sensation after needle insertion called “de qi”. The acupuncture stimulus is carried by afferent peripheral sensory nerves to the central nervous system, engaging sympathetic and parasympathetic systems. Information is integrated and ascends to the brainstem, thalamus and cerebral cortex, promoting analgesia trying to balance the autonomic nervous system.

Spinal and Segmental Analgesia
The most well-known mechanism supported to show how acupuncture works to relieve pain is Melzack and Wall’s neural segmental gate theory from 1960’s. The hypothesis suggests that acupuncture stimulates myelinated Aδ fibers, which are faster than the slower unmyelinated C fibers carrying nociceptive/chronic pain. The faster response blocks the transmission of nociceptive pain signals with release of neurotransmitter, enkephalin, at the level of the spinal cord. The adjacent spinal segments also receive these signals thus providing regional analgesia.

The dorsal horn receives afferent signals from skin, muscle and viscera. Somatic pain can therefore cause visceral manifestations of disease, i.e. referred pain. Visceral pain may be suppressed by stimulating somatic receptors at the same segmental level. This is useful when local acupuncture points cannot be used i.e. treatment of a regional spinal segment is likely to have effects on related structures served by the same spinal segment.

Extra-segmental Analgesia
Somatosensory signals from Aδ fast pain fibers and slower C fibers traveling to the dorsal horn of the spinal cord are transmitted cranially via spinothalamic tracts to the thalamus and brain stem.
Serotonergic neurons are activated and transmit signals back down the spinal cord causing more release of serotonin in the dorsal horn causing enkephalin release which inhibits pain signals. Noradrenaline is diffusely released in the dorsal horn directly inhibiting post-synaptic membrane of the transmitting cells, thus reinforcing the effect of acupuncture impeding nociception.

Central Regulatory Effects
Central regulatory effects also include autonomic nervous system feedback. Following an acupuncture treatment there are higher concentrations of opioid peptides in the CSF and the plasma producing a calming effect. This was first affirmed after a study in which CSF from acupuncture treated rabbits was transfused to recipient rabbits that did not receive acupuncture. The recipient rabbits had higher pain threshold during subsequent painful procedures. An opioid antagonist will reverse the effects of

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analgesia from acupuncture corroborating an opioid mechanism. Naloxone can reverse the pain-relieving phenomenon of acupuncture.6

Acupuncture effects the hypothalamus and limbic system. Aβ afferent pain fibers terminate in the arcuate nucleus of the hypothalamus and C fibers terminate in the limbic system. Periaqueductal grey (PAG) is activated by beta endorphins released by the hypothalamus. The PAG in the mid brain is also activated by the limbic system suggesting why pain can be emotional and not just a sensation. The primary CNS structure thought to inhibit descending pain inhibition is PAG.7 Neurons in the central nervous system and periphery produce calcitonin gene-related peptide (CGRP), which acts as a potent vasodilator and has an important role in pain signaling. Acupuncture causes local levels of CGRP to increase mediating inflammation and promoting healing.8 While there are many factors involved in pain pathways and inhibition explained and yet explained, central regulatory effects augments local and segmental analgesia.

Myofascial Trigger points
MFTP are defined as hyperirritable spots within a taut band of muscle that are painful upon palpation. These areas of contracted muscle tissue can cause tenderness, referred pain, dysfunction and autonomic phenomena.9 MFTP are identified to be an important source of pain in human and veterinary medicine. They constrict blood flow and can be caused by chronic overuse, overload, injury, stress and other factors. They cause pain and dysfunction locally but can radiate to distant locations. Acupuncture needling is successful in reducing pain and pathology associated with these although it is initially uncomfortable.

Methods of NAU Stimulation
Dry Needling is the most common form of acupuncture and involves inserting metal needles into NAU. Common needles are one half inch to 2 inch needles in length and 25 – 36 gauge in diameter. Anatomical location and patient condition directs depth, angle of needle insertion, treatment duration and frequency. The needles can be rotated in a clockwise or counter clockwise direction for more “pull” or stimulated by electricity.

Electroacupuncture applies an electrical stimulus between two inserted acupuncture needles. Different frequencies will stimulate various neuromodulators. When stimulated, sensory afferent fibers cause transient analgesia via gate theory. Longer lasting analgesia is caused by invigorating Aβ and C fibers. This is thought to be mediated through NMDA receptors. Chronic pain states activate the NMDA receptor causing sensitization and hyperalgesia with the altered threshold causing a more painful response. Electroacupuncture reduces this hyperalgesia. Low intensity stimulation (1-20 Hz) primarily stimulates Aβ fibers and releases endorphins and stimulates the NMDA receptors to combat neuropathic pain. Higher frequencies (80-100 Hz) predominantly stimulate C fibers which release dynorphins and serotonergic fibers which release serotonin and norepinephrine.10 Generally lower frequencies are used in veterinary patients to tolerate the treatments. Contraindications include fractures, arrhythmias, epilepsy, shock, infection, pregnancy and malignancies.

Aquapuncture is the practice of injecting acupuncture points with sterile, soluble fluid to stimulate the points longer than dry needling. Vitamin B12, saline, polysulfated glycosaminoglycan, local anesthetics and homeopathics are all examples of substances that can be used, especially when a patient will not tolerate needles for a long period of time.

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Laser acupuncture involves using laser (3b or 4) to stimulate acupuncture points. This can be useful in needle phobic patients however it does not work as well as dry needling.\textsuperscript{11} Unlike conventional laser therapy in which the laser causes photobiomodulation, laser acupuncture targets a neural response similar to dry needling.\textsuperscript{12}

Metal implantation has been used historically for continuous acupuncture point stimulation. Most commonly used were gold beads. Implantation reduces the need for frequent appointments for lifelong needling, i.e. hip dysplasia or OA. Disadvantages are implant migration, cost and the potential for scar tissue to impede the NAU effectiveness.

Research
A PubMed search for “acupuncture” listed over 25,000 published papers and just over 400 veterinary acupuncture papers. Due to its sympathomimetic effects, GV26, is often called the “resuscitation point”. Stimulation of GV26 was demonstrated to be an effective stimulus in reversing respiratory arrest.\textsuperscript{13} It is even listed in veterinary textbooks.\textsuperscript{14} PC6 is well known and superior in treating nausea and equivalent to treating vomiting compared to many antiemetic medications.\textsuperscript{15} In a study published on treatment of non-surgical management of thoracolumbar intervertebral disk herniation in 80 paraplegic dogs, dogs receiving steroids and electroacupuncture recovered faster, with better return to ambulation, reduced back pain and reduced incidence of relapse compared to dogs receiving steroids alone.\textsuperscript{16}

Conclusion
Rigorous evidence based medicine is still lacking in large numbers. However there continues to be more substantial evidence that acupuncture can modulate the entire nervous system to relieve pain and inflammation. Because of this neuromodulation, it can and should complement any other western disease management.

References

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