Acupuncture Notes

History of acupuncture:
* Chinese medicine must be analyzed within context of sociopolitical shaping; acceptance or rejection of concepts of disease by groups in society has rarely been independent of socioeconomic and sociopolitical determinants—consciously or unconsciously (recent example: HIV/AIDS).
* Acupuncture believed to have started during Neolithic period 2000-12000BC—same time animals domesticated; during Zhou (Chou) dynasty 1027-221 BC when vet med became separate entity and 650BC first vet book: Canon of Vet Med w/ legends of treating animals w/ acupuncture; there is speculation acupuncture started in India or Tibet but unclear.
* 220AD two schools of medicine: pharmacology/prescriptions similar to Western Med and the other involved traditional Chinese medicine
* 1800s Chinese government essentially banned acupuncture and there was an influx of Western physicians at treaty ports (Dutch East India Company and during the Opium War).
* 1928 acupuncture discussed in what is now the Veterinary Record in Europe
* 1941 the Marxist T’an Chuang termed Chinese medicine “the collected garbage of several thousand years” but Chinese medicine continued to be practiced.
* 1950s 3 independently working vets in Europe started working on mechanisms of neural therapy and acupuncture including lower skin resistance and sensitivity to acupuncture points.
* Surgical analgesia with acupuncture first applied to horses and donkeys in 1969
* 1972 During President Richard Nixon’s diplomacy with the People’s Republic of China, journalist, James Reston successfully treated w/ acupuncture for postoperative pain after an emergency appendectomy and so NIH sponsored team of physicians to study Chinese medicine.
* 1974 IVAS founded as non profit educational organization for vets internationally interested in acupuncture; the basic course is 120 hr course w/ certification completion after passing a written and practical exam, spending 40 hrs with a certified IVAS acupuncturist and having a case report accepted by the organization.
* TCM (traditional Chinese medicine) as we know it is very new—reinvention of the second half of the 1900s. It has not evolved as an unbroken system from the ancient past. So much of the research has been done in other countries and some of that must be very carefully scrutinized due to their government’s influence on research.

More recently:
1993 FDA reported that Americans spending $500 million/yr for acupuncture
1994: NIH organized 13 acupuncturists to present to 22 FDA officials, evidence from 5 areas: pain, drug dependency, stroke, asthma and nausea
FDA was impressed with results but concerned with: 1. No multi-centered studies 2. sham acupuncture produced effects, causing it to not be a good placebo control; their goal however was to determine efficacy, not mechanism of action; based on this feedback from FDA officials, acupuncture lobby petitioned 3000 pages to change acupuncture
treatment from Class III to II (III investigational only—not enforced well; II safe & effective but require restrictions).

1996: FDA reclassified acupuncture (for those 5 indications) as a Class II.

1997: Consensus Conference by NIH (where medical controversies are debated); 12 member panel in fields of acupuncture, pain, psychology, psychiatry, physical medicine/rehab, drug abuse, family practice, internal medicine, epidemiology, physiology and biophysics plus 25 experts from these fields presented data to the conference audience of 1200. Conclusion: current studies provide equivocal results due to design, sample size and difficulty of using controls; however promising results emerged in post-operative and chemotherapy nausea/vomiting and dental pain as well as other areas such as drug dependence and may be useful as an adjunct treatment or an acceptable alternative or be part of comprehensive management. Findings of basic research elucidate mechanisms of action of acupuncture, including release of opioids in the CNS and changes in neuroendocrine function.

Future:

NIH has set up the National Center of Complementary and Alternative Medicine with over $100 million/yr to organize research; additionally 12 university-based centers; alternative med courses included in undergrad medicine curriculum of 65 US medical schools (Harvard, Yale, Stanford, Johns Hopkins, Columbia…)

Scientific Basis:

Placebo effect long has been around (works by suggestion, distraction and hypnosis): 1945 study w/ morphine v. sugar injection resulted in 70% v. 35% relief of pain. When acupuncture introduced into this country 1970s that was how it was believed to work, however that does not explain why it has been successful in China for >1000yrs, Europe for >100 years and why animals and small children respond.

2 studies showed hypnosis V. acupuncture for analgesia: results are that naloxone blocks acupuncture from working (opioid antagonist).

Until 1973, acupuncture evidence was all anecdotal from ¼ of the world’s population.

2 BIG Questions: 1. Does acupuncture work (physiologically rather than psychologically/placebo) and 2. If it works, what is the mechanism?

Acupuncture points: cutaneous areas with higher concentrations of free nerve endings, nerve bundles and nerve plexi, mast cells, lymphatics, capillaries and venules; lower electrical resistance than in surrounding skin. Transmission of stimulus travels to spinal cord by afferent peripheral nerves. Evidence: injection of local anesthetic into point prevents electrical transmission; acupuncture performed on paralyzed limb does not result in analgesia; from spinal cord, stimulus follows pain pathway.

Meridians: deduced by propagation of sensation along the channels; in horses, rarely, needling associated w/ a line of raised hair along the back; PSAC travels 1-10cm/second (slower than Cfibers) but may be integrated in parietal cortex sensory areas.
Pain Pathway:
2 pathways of pain, for the 2 types of pain: fast/sharp $\rightarrow$ neospinothalamic tract and for slow/chronic pain $\rightarrow$ paleospinothalamic tract.

Pain receptors are free nerve endings which transmit pain impulses (mechanical, thermal or chemical) and are components of sensory nervous system and are made up of A-delta and C fibers.

A-alpha and A-beta sensory neurons are not involved in pain transmission but still may play role in some mechanisms of acupuncture.

Impulse travels peripheral nerve to dorsal horn of the spinal cord; somatic and visceral sensory neurons enter dorsolateral funiculus and Lissauer’s tract several spinal segments cranial and caudal to point of entry.

This is where people and primates differ from most domestic animals...primates projection neuron travels contralateral spinothalamic tract where domestic animals have diffuse, bilateral and multisynaptic pathway for conduction of pain impulses to the brain.

Neospinothalamic tract:
A-delta: thin and poorly myelinated; transmit pain 6-30m/sec—sharp pain
In dorsal horn, 10 lamina;
   A-deltas synapse mainly in lamina I before crossing the cord
A-deltas mainly end in thalamus where signals are transmitted to somatosensory cortex;
Glutamate released from A-deltas in spinal cord which usually lasts for milliseconds.

Paleospinothalamic tract:
C-fibers: 1/10 the diameter and unmyelinated and transmit impulses .5-2m/sec –slow aching pain
C-fibers travel up the paleospinothalamic pathway (older system)
C fibers mainly terminate in laminae II and III which is the substantia gelatinosa; signals pass through one or more short fibers before synapsing in laminae V before crossing the cord
Excitatory neurons release glutamate but mainly substance P in the cord—substance P increases slowly over seconds to minutes. May explain the double pain response (quick and the lagging sensation after pinprick)
1/10 to ¼ of fibers pass to thalamus; mainly terminate in lower regions including the periaqueductal grey region; this is why localization of this type of pain is poor—b/c of the multisynaptic and diffuse connectivity of this pathway.

Pain perception: Complete removal of somatic sensory areas of cerebral cortex does not destroy animal’s ability to perceive pain. Brain stem, reticular formation, thalamus cause conscious perception of pain. Cerebral cortex is important in perceiving quality of pain.

Pain Suppression
3 major components: 1. periaqueductal gray matter which sends signals to 2. raphe magnus nucleus/nucleus reticularis paragigantocellularis which send signals down dorsolateral columns in spinal cord to 3. pain inhibitory complex in dorsal horns of spinal cord which can block pain before relayed to brain.
Neurotransmitters involved inhibiting pain; >18 endogenous peptides w/ opiate-like activity=endorphins
3 precursor molecules make endorphins:
1. proopiomelanocortin \( \rightarrow \) for B-endorphin and ACTH
2. proenkephalin \( \rightarrow \) metenkephalin and leu-enkephalin
3. prodynorphin \( \rightarrow \) dynorphin

B-endorphin 10-100X more potent than morphine and circulates for hours; enkephalins have <1% potency of morphine and circulates for seconds/minute; dynorphine 200X potency as morphine

B-endorphin in pituitary and brain (especially pars intermedia and hypothalamus)
Enkephalins along pain pathways—periaqueductal gray matter, RMN and substantia gelatinosa in spine (signaled by serotonin at nerve endings in spine)
Dynorphin in spinal cord and PAG and RMN but in much lower quantities

Activation of the analgesia system by signals entering PAG or inactivation of pain pathways by morphine-like drugs can almost totally suppress pain signals entering peripheral nerves.

Role of Endogenous Opioids:
Microinjection naloxone into periaqueductal gray matter or intratheically over spinal cord inhibits acupuncture in rat and rabbits where naloxone into sites w/out endorphins had no effect.

Neurotransmitter Receptors:
Takes 10X more naloxone to reverse enkephalins than morphine; 1.5X as much naloxone to reverse dynorphin. Could explain why a few studies showed naloxone did not reverse acupuncture analgesia.

Brain levels of endorphins go through circadian rhythm. Acupuncture has different effects on brain levels of endorphins depending on time—goes w/ treatment at certain times /per day.
Different endorphin receptors and although endorphins known mainly for analgesic properties, opiate receptors present on gut and blood vessels (motility/vasodilatation)

Visceral Pain:
True visceral pain transmitted through sympathetic and parasympathetic fibers of the autonomic NS and sensations are referred to surface areas of the body often far from the organ in contrast w/ parietal sensations conducted directly into local spinal nerves which are localized over the painful area. Within the dorsal horn, visceral afferents terminate on laminae I and V; there is not specific population of neurons exclusively processing visceral info; instead visceral information is encoded by cells of several ascending pathways (including spinothalamic). Acupuncture stimulation can cause a cutaneovisceral reflex allowing stimulation of a somatic point to influence internal organs by a sympathetic induced segmental superficial and visceral effect. The term viscerocutaneous reflex used to describe diseased organs that are able to refer pain—example is McBurney’s point (lower right abdomen reactive in appendicitis.)
Neural Mechanisms:
5 Theories—likely a combination of the 5:
1. Gate Theory: Stimulated A-beta fibers quickly carry sensory info to substantia
gelatinosa synapsed on inhibitory interneuron’s which closed the gate to ascending pain
before slower C-fiber stimulus could get there. This would prevent pain impulses from
reaching higher brain centers; more-likely gate closed by A-delta fibers. Selective
inhibition of A-deltas first inhibits pain but then potentiate more noxious pain from C-
fibers.
This “gate” has been proven by injecting lidocaine into an acupoint. It blocks the
needle’s stimulation from traveling to the spinal cord.
Criticized because acupuncture points on the face can induce analgesia; sensory afferents
are processed in trigeminal nucleus in brainstem which communicates with the substantia
gelatinosa to the level of the fourth cervical segment in the spine. Gating does NOT
explain delayed onset or results of cross-circulation studies.
2. Increased blood supply: Acupuncture results in release of bradykinin, vasodilator; also
increases immunity of local tissue by stimulating mast cells at the acupoint. The release
of histamine also increases vasodilatation.
3. Humoral Theory: stimulation results in afferent nerves from periphery to CNS which
activates hypothalamic-pituitary gland and releases neurotransmitters (endorphins,
serotonin, ACTH, etc). More specifically the release of B-endorphin and met-enkephalin
into periaqueductal gray matter, CSF and blood resulting in: 1.B-endorphin and met-
enkephalin released to activate raphe nuclei and results in descending inhibitory system
and 2. mesolimbic analgesia releasing serotonin and met-enkephalin at a supraspinal
level. Experiment: 2 rats surgically connected by vasculature; acupuncture performed on
one rat but effects seen in both rats. Another example: Naloxone shown in many studies
to reverse the effect of acupuncture; in addition, opioid concentrations increase in the
blood and decrease in brain during acupuncture; mice genetically deficient in opioid
receptors consistently have poor response to acupuncture. Lip twitch: acupressure shown
to double B-endorphin levels w/in 5 min of application. Opiate receptors present in GI
tract and help regulate peristalsis, on blood vessels and contribute to dilation.
4. Viscerosomatic response: acupuncture can exert impressive influences on internal
organs; autonomic NS can be influenced by acupuncture (bradycardia—
sympath/parasymp) Enteric neurons release neurotransmitters (Substance P, met and leu-
enkephalin, serotonin, etc…)
5. Bioelectric theory: channels (meridians) allow nerve impulses due to low electrical
impedance which has been repeatedly measured. Normal skin has DC resistance of
200,000-2 million ohms; acupuncture points 50,000. Works on a direct current which is
boosted by stimulation of an acupuncture point.

Needles placed far away from painful area works by activating the mid-brain and
hypothalamic-pituitary axis by increasing circulating neurohormones. Needles placed
close to site of pain alleviate pain by causing vasodilatation.

Addendum: stimulation of large Alpha-B sensory fibers from tactile receptors depress
transmission of pain probably from local inhibition in the spinal cord—the reason that
rubbing skin near painful area is effective in relieving pain—excitation of central analgesia system may be the basis of pain relief by acupuncture as well.

**Acupuncture/TCM**

Traditional Chinese Medicine (TCM) explains pathophysiology and homeostasis by using symbolic systems. Western illness is explained by physical and biological factors it tends to treat signs of disease, not the entire body. TCM involves examining the environment (temperature, humidity), social factors, seasonal influences, etc. Familiar terms are applied in a very different manner, for example, organs take on different roles and are connected to meridians or channels. TCM is based on the theory of opposites which are codependent on one another. The energy created is called Qi. Qi is what flows through the meridians. The most fundamental opposite is the principle of yin and yang. Nothing is entirely yin or yang but a combination of the two. Yang is light, bright, positive, outside, south, male, sympathetic nervous system, acute while yin is shade, darkness, negative, inside, north, female, parasympathetic nervous system, chronic. As strange as this may seem, in Western medicine an example of codependent opposites would be the relationship between glucose and insulin.

Zang Fu Organs: Named for their function, not their gross anatomy (therefore, a horse has a gallbladder in TCM). Lung, Large Intestine, Stomach, Spleen, Heart, Small Intestine, Bladder, Kidney, Pericardium, Triple Heater, Gall Bladder, and Liver.

Paired Meridians: Governing Vessel and Conception Vessel, LU & LI, ST & SP, HT & SI, BL & KI, PC & TH and GB & LV.

Qi: Force/energy that controls the body

**Diagnosis and Treatment**

Five Elements: Fire, Earth, Metal, Water and Wood. Describes a state of imbalance; everything is related to 5 basic elements and their relationship with each other. The balance is in constant flux and one produces the next, for example, Fire produces Earth produces Metal produces Water produces Wood produces Fire…Each organ system is represented by an element, Wood is a symbol for liver, Fire for heart, Earth for spleen, Metal for lung and Water for kidney.

Eight Principles:

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<tr>
<th>Yin</th>
<th>Yang</th>
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<tbody>
<tr>
<td>Interior</td>
<td>Exterior</td>
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<tr>
<td>Deficiency</td>
<td>Excess</td>
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<td>Cold</td>
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Describes disease by symptoms; patient evaluated by looking, listening, asking and touching; a clinical example to help explain:

**EXAMPLE:** Two horses with mild, recurring colic and anorexia.

Western Diagnosis: Both horses have gastric ulcers diagnosed after an endoscopic exam and are treated with ulcer medication. A TCM veterinarian examines the horses and finds two separate conditions. The first horse is thin with a poor hair coat and tends to
drink a lot of water and has dry/hard manure. She is nervous and her tongue is dry and red. Her pulse is thin and fast; her diagnosis: Deficient Yin affecting the stomach. The second horse has cramping when he colics and moves very heavy and slowly; he is quiet and has loose manure. His tongue has a thick, white moist coating and his pulse is tight and slippery. His diagnosis is Excess Cold Dampness Affecting the Spleen and Stomach.

Studies Involving Acupuncture:
Antiemetic: According to NIH this and post-op dental pain only conditions for which efficacy of acupuncture proven. FDA accepted only antiemesis as fully proven—2 studies; 69 inpatients 97% good to very good results and of 101 outpatients 90% good to very good results. Another study of 104 breast cancer patients receiving chemotherapy, 3 groups: acupuncture group had lowest median number of emesis episodes (5), placebo group—minimal needling and mock electro (10) pharmacotherapy group (15). Out of 17 studies it was concluded by Lee and Done—meta-analysis that nonpharmacological techniques are equivalent to antiemetic drugs
Cardiovascular: In anesthetized dogs, specific point increased blood pressure, not antagonized by naloxone; similar study w/ hemorrhagic shock in dogs, stimulation of this point helps restore blood pressure by increasing cardiac output (sympathetic stimulation by release of catecholamine’s). A different point, in anesthetized dogs showed that lowering cardiac output could be obtained—this could be blocked by atropine suggesting a parasympathetic effect.
Urogenital: Incontinence in the elderly: 90% acupuncture reduced voidings while 11% of placebo (mock TENS); female infertility: acupuncture as effective as hormone therapy; Respiratory: FDA concluded that 11/13 blinded randomized controlled trials for asthma showed positive effects however due to poor methodology of placebos reviewers found that evidence that short-term acupuncture treatment has a significant effect on asthma is inconclusive.
Gastric acid secretion: Am J of physiology showed that electro acupuncture in dogs after eating inhibits gastric acid secretion—mediated by endorphins which elevate 3 plasma peptides, somatostatin and beta endorphin. Another study showed in anesthetized rats, gastric acidity was increased and is mediated by the vagal nerve. The 2 studies differed conscious v. unconscious and in species but in conscious human volunteers, electroacupuncture showed to lower gastric acidity while sham acupuncture had no effect.