Non-Pharmacological Pain Management Using Acupuncture
Learning Objectives

- Discuss the latest evidence for non-pharmacological management of chronic pain for cancer survivors using a multi-disciplinary approach.
Pain

- Unpleasant sensory and/or emotional experience associated with actual or potential tissue damage.
- Most common reason for patients to seek health care.
- Major symptom in many medical conditions and can significantly impact a person’s quality of life and general functioning.
- In 2017 draft standards, the Joint Commission recommends nonpharmacological pain treatment.
- Pain is one of the most common symptoms in cancer patients. It is present in more than 85% of cancer patients terminally ill.
Types of Pain

- Nociceptive
  - Somatic- result of direct mechanical or chemical stimulation of nociceptors and normal neural signaling to the brain. It tends to be localized, aching, throbbing, and cramping. Classically found in bone metastases.
  - Visceral- caused by nociceptors in gastrointestinal, respiratory, and other organ systems. Deep or colicky type of pain classically associated with pancreatitis, myocardial infarction, or tumor invasion of viscera.

- Neuropathic- arises from disordered nerve signals. It is burning, electrical, or shock-like pain. Classic examples include post-stroke pain, tumor invasion of the brachial plexus and herpetic neuralgia.

- When acute, pain is characteristically associated with behavioral arousal and a stress response consisting of increased blood pressure, heart rate, pupil diameter and plasma cortisol levels. In addition, local muscle contraction (e.g. limb flexion abdominal wall rigidity) is often present.
Primary Afferent Nerves

• A *peripheral nerve* consists of the axons of three different types of neurons: *primary sensory afferents, motor neurons, and sympathetic postganglionic neurons.*

• Primary afferents are classified by their diameter, degree of myelination, and conduction velocity. The largest diameter afferent fibers, A-beta, respond maximally to light touch and/or moving stimuli; they are present primarily in the nerves that innervate the skin. The activity of these fibers does not produce pain in normal individuals. There are two other classes of primary afferent nerve fibers; the small diameter myelinated A-delta and the unmyelinated (C) axons. These fibers are present in the nerves of the skin and in the deep somatic and visceral structures. Most A-delta and C fiber afferents respond maximally to intense (painful) stimuli and produce the subjective experience of pain when they are activated; this defines them as primary afferent nociceptors (pain receptors). Primary afferent nociceptors of individual can respond to different types of noxious stimuli.
The Primary Afferent Nociceptor
Peripheral Nerves are overlaid with acupoints

- It has been suspected that the acupuncture points and meridians (channels or lines) are part of the peripheral nervous system, coinciding with nerve endings or points of bifurcation.

- Some studies have suggested that the majority of acupoints (approximately 305) are located directly over the peripheral nerves while another major group (approximately 285) are located in close proximity to the peripheral nerves.
Nerve Ending and Neural Signal Transduction

• How are the acupuncture signals projected to the brain? This question is the most interesting and it is central for understanding the mechanism of acupuncture. What are the routes by which acupuncture stimulation can reach the brain?
Sensory Signal Pathways of Spinal Cord
Spinothalamic Tracts

To association cortex
(Diffuse projection)

To somatosensory cortex

Intralaminar nucleus or
Central median nucleus

Ventral posterior lateral nucleus

Superior colliculus
Pretectal formation
Substantia nigra

Cerebral aqueduct & Posteroventral gray
Medial geniculate body
Medial longitudinal fasciculus
Medial lemniscus
Red nucleus

Midbrain

4th ventricle

Medial lemniscus
Median raphe

Pons

Medial longitudinal fasciculus
Pretectal formation
Corticospinal fibers

Medial longitudinal fasciculus
Spinothalamic

Medial lemniscus

Medulla

Cuneate nucleus
Spinal tract
Spinothalamic

Ventral nuclei
Dorsal nucleus of vagus
Glossopharyngeal nucleus
Hypoglossal nucleus
Nucleus ambiguus
Pyramid

NOCEPTION
Dorsal (posterior) horn
Intermediate zone
Ventral (anterior) horn
Central canal

Anterolateral Spinothalamic tract

Neospinothalamic Tr.
Paleospinothalamic Tr.

Spinal Cord

Ventral Column
Pain Inhibitory System I

Midbrain

- Anterolateral Spinothalamic tract (ALS)
- Reticular formation
- Substantia nigra
- Reticulothalamic tract
- Medial longitudinal fasciculus
- Medial lemniscus
- Red nucleus
- Cerebral aqueduct and periaqueductal grey

Pons

- Reticular formation
- Corticospinal fibers
- Pedunculopontine nucleus
- Spinoreticular tract
- Spinothalamic tract
- Spinothalamic tract (CST)

Medulla

- Nucleus Raphae Magnus (NRM)
- Nucleus Reticularis Posterior (PRP)
- Nucleus Raphae Magus (NRM)
- Spinoreticular and Spinoreticulothalamic tracts

Spinal Cord

- Dorsal horn
- Lamina I-IV
- Sensory projection to the thalamus and cerebral cortex

Pain Inhibitory System II

Limbic System

- Sensory Cortex
- Prefrontal Cortex
- Thalamus

Spinothalamic Tracts (STT)

- Hypothalamus
- NE: Norepinephrine
- SE: Serotonin

Spinal Cord

- Laminae I-VIII
- Relay Projection Neurons
- Nociceptive inputs
- BE: β-Endorphin

Al or C
Sens. C: Sensory Cortex  
Limb. C: Limbic Cortex  
Ins. C: Insular Cortex  
PFC: Prefrontal Cortex  
HC: Hypothalamic Cells  
ARC: Arcuate Nucleus  
PT: Pharyngeal Gland  
BL, CIR: Blood Circulation  
BE, B-Endorphin  
ENK: Enkephalin  
SE: Serotonin  
NE: Norepinephrine  
I & II: Laminae I & II  
III: Laminae III, & IV  
IL: Intralaminar Nucleus (Thalam.)  
VPL: Ventroposterolateral Nucleus (Thalam.)  
DM: Dorsomedial Nucleus (Thalam.)  
RF: Reticular Formation  
PAG: periaqueductal Gray  
RPG (NRPG): Reticular-paragigantocellular  
LC (NLC): Locus Coeruleus  
STT: Spinothalamic Tract  
SRT: Spinoventricular Tract  
SMT: Spinomesencephalic Tract
References

THANK YOU