Pain Management-An Overview

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introduction

- Pain is a universally understood sign of disease and the most common symptom.
- Physicians have been struggling.

From Rene Descartes' 1664 *Treatise of Man,*
Definition

- Pain is a feeling triggered in the nervous system.
- Pain may be sharp or dull.
Pain Scale

Pain measurements are scored on the Numeric Rating Scale (NRS).
Pain fibres

• A-beta, A-delta, and C fiber axons.
• A-beta are responsible for light touch and moving stimuli.
• A-delta and C fiber axons are responsible for pain sensation.
• A-delta fibers: small-diameter, myelinated
• C fibers: small-diameter, unmyelinated
• Because of differences in myelination, A-delta fibers produce fast pain responses and C fibers produce slow pain responses.
Pain threshold
Types of pain

- The 2 major categories of pain are **nociceptive** and **neuropathic**.

- **Nociception**: results mainly from tissue inflammation injury
  1. Superficial somatic pain is from cutaneous nociceptors on the skin or superficial tissues.
  2. Deep somatic pain is from somatic nociceptors on ligaments, bones, blood vessels, and muscles.
  3. Visceral pain is from visceral nociceptors within body organs.
Abdominal pain
Neuropathic pain

- Neuropathic pain is induced by damage to the nerves themselves.
- Hyperpathic symptoms of burning, tingling, or electrical sensations are classic for neuropathic pain.
Neuropathic pain

• The axons of primary afferent nociceptors enter the spinal cord through the dorsal root ganglion.
• Multiple sensory nerves converge onto ascending spinal nerves of the spinothalamic tract on their way to the thalamus.
• This convergence gives rise to the concept of referred pain, whereby pain signals originating in one part of the body may be felt in the dermatomal distribution of another nerve (shown).
• For example, patients with ischemic chest pain feel pain in their left shoulder because the sympathetic afferent nerve fibers of the heart are concentrated in the dorsal root ganglion of the T2-T6 spinal segments.
pathways

Image courtesy of National Institutes of Health
Pain sensitization
sensitization

- Sensitization is an adaptive process in which innocuous stimuli produce an excessive response.
Pain modulation

• Placebo can have a significant analgesic response, and anxiety can magnify the perceived stimuli.

• Descending signals from the frontal cortex and hypothalamus help modulate the ascending transmission of the pain signal by opiate receptors.
Pain modulation

- Pain modulation enhances or dampens pain signal

- A6 = locus coeruleus, ACC = anterior cingulate cortex;
- NTS = nucleus tractus solitarius;
- PAG = periaqueductal gray matter;
- PFC = prefrontal cortex; RVM = rostra ventral medulla

+ pain facilitation
- pain inhibition
Investigation to identify the root cause of a patient's pain

- Imaging: MRI & CT
- Nerve & muscle conduction studies may help
- MRI of a patient with cervical radiculopathy.
Treatment

Start here

Non-opioid
+/- Adjuvant

If pain persists

Weak opioid
+/- Non-opioid
+/- Adjuvant

If pain persists

Strong opioid
+/- Non-opioid
+/- Adjuvant
Pharmacological treatments are based on specific biochemical pathways

- Many **non-narcotic analgesics** inhibit the cyclooxygenase enzyme, which is responsible for the formation of prostaglandin, prostacyclin, and thromboxane.

- **Opiate medications** mimic endogenous opioid peptides.

- **Tricyclic antidepressants** are thought to potentiate the effect of opiates.
Drug level estimation
Chronic pain

• Patient-controlled analgesia (PCA) allows patients to self-titrate their intravenous pain medication
patch
Patches

- Transdermal patches provide controlled drug delivery with a lower potential for abuse than oral analgesics. Patches can be applied once every 12 to 24 hours.
- Conditions like postherpetic neuralgia and chronic cancer pain are routinely treated with transdermal patches.
- Opiate-infused lollipops and buccal lozenges are other alternative forms of drug delivery used to treat patients with malignant pain.
Regional block
Regional block
Surgery
device implantation or tissue removal

• Limited for patients with discrete deficits who fail conservative management.

• Surgically implanted devices such as morphine pain pumps and spinal cord stimulators are available for use on a case-by-case basis.

x-ray of a spinal cord stimulator implanted in the thoracic spine.
TENS
Transcutaneous electrical nerve stimulation, or TENS: adjuvant pain control devices that provide pulsatile electric impulses.

The mechanisms: presynaptic signal inhibition, endogenous pain control, direct inhibition of abnormally excited nerves, and restoration of afferent inputs.

TENS: used for low back, arthritic, sympathetically mediated, neurogenic, visceral, and postsurgical pain.

There is a paucity of randomized controlled trials confirming the effectiveness of TENS units.
Acupuncture
Chronic-refractory Pain: summary

• Chronic, refractory pain is best managed with a multidisciplinary team approach that includes psychology, occupational therapy, physical therapy, vocational rehabilitation, and relaxation training.

• Acupuncture (shown), dietary supplements, and hypnosis are commonly used methods of pain control in the non-mainstream medical community.

• Large-scale trials is lacking.

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