Role of Anaesthetist in Pain Management

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Pain

- An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.
Acute Pain

- Acute pain serves an essential role for the individual as it informs of actual or impending tissue damage.
- Self-limiting and proportionate to the degree of injury sustained.
- Physical, thermal or chemical stimuli initiate a cascade of events that lead to predictable physiological, psychological and behavioural responses.
Acute Pain

- Nociceptive signals exert profound changes within the peripheral nervous system in response to injury but also extend to affect the spinal cord, higher centres within the brain and remote organ systems through the neuro-humeral and endocrine response.
Chronic pain is pain that persists beyond the expected time of healing. The time course for the development of chronic pain is variable, and arbitrary time classifications (e.g. longer than 6 months) are often inaccurate. The ongoing pain becomes a significant disease process, rather than being a symptom. The transition to chronic pain is marked by changes in both physiological and psychological responses.
Early Approaches to Pain Management

- **Surgical/Procedural**
  - Trepanning (headache)
  - Blood letting (acute side pain)

- **Stimulation**
  - Acupuncture

- **Topicals**
  - Oil, sulfur rubs

- **Life Style Change**
  - Sexual abstinence
  - Exercise
  - Hot spas
  - rest
Early Approaches to Pain Medications

- **Ancient Egypt**
  - Berry-of-the-poppy plant - Headache
  - A frog-warmed-in-oil - Burn
  - Fermenting goat dung - Burn
  - Beer - General vehicle

- **India (1st C.)**
  - Hemp (cannabis) - Anesthetic

- **Early Greek Medicine**
  - Willow Bark - Childbirth
Involvement of Anaesthetist

- Management of acute pain
- Intra-operative
- Post operative
- Management of chronic pain
Treatment of acute pain

- Multimodal
  - Opioids/ paracetamol/ NSAID’s
  - Nerve blocks/ Field block/ infiltration
  - Spinal Analgesia
  - Epidural Analgesia
Epidural injection

Injection site

Anesthetic shot
Treatment of acute pain

- PCA
  using morphine / pethidine / fentanyl

- PCEA
  using LA with opioids
PCA Pumps
PCA Pumps
Treatment of chronic pain

- Use of a multimodal approach, incorporating antidepressants
- Anticonvulsants
- Local anaesthetics
- Corticosteroids
- Opioids.

Additionally, diagnostic and therapeutic nerve blocks can be helpful. Psychological counselling and support is equally important.
Chronic pain management requires an interdisciplinary approach. The elements of this approach include treating the underlying cause of pain, pharmacological and non-pharmacological therapies, and some invasive procedures.
Treatment of chronic pain

- Early recognition and aggressive management of neuropathic pain is critical to successful outcome. Multiple treatment modalities are provided by an interdisciplinary management team.
Numerous treatment modalities are available and include systemic medication, physical modalities (e.g. physical rehabilitation), psychological modalities (e.g. behaviour modification, relaxation training).
Treatment of chronic pain

- invasive procedures (e.g. trigger-point injections, epidural steroids, sympathetic blocks), spinal cord stimulators, intrathecal morphine pump systems and various surgical techniques (e.g. dorsal root entry zone lesions, cordotomy and sympathectomy).
Treatment of chronic pain

- The tricyclic antidepressants (TCAs).

- The mechanism of action for the alleviation of neuropathic pain is thought to be due to the inhibition of reuptake of serotonin and norepinephrine within the dorsal horn; however, other possible mechanisms of action include alpha-adrenergic blockade, sodium channel effects and NMDA receptor antagonism.
Drug dose

Amitryptyline 10-25 mg, increasing to 75 mg nocte
Venlafaxine 37.5 mg-75 mg nocte
Fluoxetine 20 mg nocte
The anticonvulsant medications can be particularly effective treatment for neuropathic pain that is described as burning and lancinating in nature. Commonly used medications in this category include phenytoin, carbamazepine, valproic acid, clonazepam and gabapentin.
Treatment of chronic pain

- The mechanism of action of the anticonvulsant medications is thought to involve membrane stabilisation.

Valproic acid increase gamma–amino butyric acid (GABA) levels in the substantia nigra and corpus striatum.
Treatment of chronic pain

- Gabapentin, reportedly, increases extracellular GABA levels throughout the brain, including the thalamus, and causes the release of GABA from glial cells.

- Lamotrigine also has action at sodium channels and hence may suppress the neuronal release of glutamate (amino acid involved in neuronal hyperexcitability and persisting pain).
Treatment of chronic pain

- Gabapentin.
- Indicated in the treatment of various neuropathic pain states, such as complex regional pain syndrome, deafferentation neuropathy of the face, post-herpetic neuralgia, sciatic-type pain and HIV-related neuropathy.
Pregabalin is a more recently developed drug licensed for neuropathic pain. Its efficacy and side-effect profile is similar to gabapentin but it is easier to titrate.

[i] British National Formulary (BNF54); September 2007
The systemic local anaesthetics that are commonly used include lidocaine, tocainide and mexiletine (oral analogue of lidocaine). The assumed mechanism of action to effect analgesia is the acute blocking of sodium channels.
Autonomic drugs which have proven beneficial in the treatment of neuropathic pain include the alpha–2 agonists (e.g. clonidine) and alpha–1 antagonists (e.g. prazosin, terazosin).

Clonidine has also been shown to potentiate the neuropathic pain-relieving action of the NMDA antagonist while preventing its neurotoxic and hyperactivity side-effects. Clonidine is available in several different dosage forms and can be administered orally, transdermally or spinally.
Corticosteroids are believed to provide long-term pain relief because of their ability to inhibit the production of phospholipase A2 (PLA2) and through membrane-stabilising effects - hence their utility for epidural steroid injections (ESIs).

References

i] Epidural steroid injections for low back pain and lumbosacral radiculopathy. Benzon HT. Pain 1986; 24(3): 277-95


If a chronic neuropathic pain condition is already well established, treatment is more difficult. Sensitisation (e.g. "wind-up") is presumed to have already occurred, so the ideal medication would include an NMDA receptor antagonist. Ketamine non-competitively antagonises NMDA receptors.
Treatment of chronic pain

- **Calcium channel blockers**
  Activation of [NMDA receptors](https://en.wikipedia.org/wiki/N-methyl-D-aspartate) leads to calcium entry into the cell and initiates a series of central sensitisation. This sensitisation may be blocked not only with NMDA receptor antagonists, but also with calcium channel blockers that prevent Ca\(^{2+}\) entry into cells. A double-blind study revealed that epidural verapamil and bupivacaine reduced the amount of self-administered postoperative analgesic versus epidural bupivacaine alone. It is suggested that epidural verapamil may prevent central sensitisation by surgical trauma.
Treatment of chronic pain

Clinical experience with the use of opioids for chronic, severe, non–malignant pain which is neuropathic in character suggests that there may be a sub–population of chronic severe pain patients who may clearly benefit from maintenance with opioid analgesics.

Many studies have shown that neuropathic pain is responsive to opioid treatments.
Epidural injection
Epidural injection
Caudal injections
Trigeminal neuralgia

- trigeminal neuralgia is a severe, lancinating pain in the trigeminal nerve territory that can be triggered by various stimuli (e.g. touch).
Medical treatment
Carbamazepine standard of treatment for this condition.
Phenytoin has a lower rate of success, but a patient occasionally responds to it and not to carbamazepine. Baclofen has proven efficacy in this condition. Amitriptyline has been used, but the success rate is low.
Gabapentin, Lamotrigine.
Jannetta pioneered microvascular decompression (MVD). This procedure consists of opening a keyhole in the mastoid area and freeing the trigeminal nerve from the compression/pulsating artery; then, a piece of Teflon is placed between them. Large series have been published, and the initial efficacy is more than 80%.
Alcohol injection of the trigeminus can be performed at various locations along the nerve and is aimed at destroying selective pain fibres. Although it is an easy procedure, the success rate is low. Glycerol injection of the gasserian ganglion to destroy selectively the pain-transmitting fibres has been used for a long time. This injection has a higher efficacy rate and a lower recurrence rate than the alcohol injection.
Percutaneous radiofrequency rhizotomy and percutaneous microcompression with balloon inflation are relatively inexpensive accessible techniques and are less invasive than surgery, with a lower (long-term) efficacy-to-recurrence ratio.
Trigeminal neuralgia

Recently introduced, gamma-knife treatment consists of multiple rays (over 200) of high-energy photons concentrated with high accuracy on the target (i.e. trigeminal nerve root). This treatment destroys specific components of the nerve. Of those treated, 60% of patients are pain free immediately, and more than 75% of patients have greater than 50% relief after 1.5 years. This treatment can be used after a patient's failure to respond to any of the above-mentioned procedures, including this one. The device contains a stable source of radiation (60-Co), which frees this technique from requiring an external source of radioactivity (e.g. cyclotron)
Complex Regional Pain Syndrome I

CRPS I formerly known as reflex sympathetic dystrophy, consists of continuous pain (allodynia or hyperalgesia) in part of an extremity after trauma including fractures. However, the pain does not correspond to the distribution of a single peripheral nerve. The pain is worse with movement and associated with sympathetic hyperactivity. The patient often complain of cool, clammy skin which later becomes pale, cold, stiff and atrophied. This process often occurs within weeks of trauma, which may be mild.
Complex Regional Pain Syndrome I

- This process often occurs within weeks of trauma, which may be mild.

**Treatment of CRPS I**

- Mobility, physiotherapy, rehabilitation and sympathetic nerve blocks.
CRPS II, formerly known as causalgia, consists of burning pain in the distribution of a partially damaged peripheral nerve (most commonly median, ulnar or sciatic).

Pain may occur within a month of injury and may radiate beyond the nerve’s distribution.
Complex Regional Pain Syndrome II

- The condition results from abnormal sweat and vasomotor sympathetic efferent pathways, possibly due to abnormal connections between efferent sympathetic fibres and somatic sensory fibres at the injury site. The skin is classically cold, moist and swollen, becoming atrophic later.

**Treatment of CRPS II**

sympathetic nerve blocks.
Sympathetic blocks

- Performed to treat CRPS I and II, phantom limb pain and to improve blood flow (e.g. Raynaud's disease and intra-arterial injection of thiopentone).

- Sympathetic ganglia may be blocked at three levels:
  - Cervicothoracic ganglia (stellate ganglion block)
  - Coeliac plexus (coeliac plexus block)
  - Lumbar ganglia (lumbar sympathetic block)
Sympathetic blocks

- Blockade may be short term (local anaesthetics) or permanent (phenol or alcohol).

**Phenol**

- This is a neurolytic agent used for nerve blocks. Hyperbaric 5% solution in glycerin is used for subarachnoid neurolysis of nerve roots; 0.5-2.0 ml has an effect for up to 14 weeks. 6-7% solution in water is used for sympathetic nerve blocks.
Spinal cord stimulator

- **Dorsal column stimulation**

This is a technique for intractable pain. Electrodes are placed above the highest level of the pain and connected to a subcutaneous inductance coil, usually on the abdominal wall, by insulated wires. The patient then applies an external power source over the coil for pain relief.
This procedure is indicated for post-herpetic neuralgia, central pain and severe cancer pain. A small electrode is inserted into the spinal cord at each level of the pain, and radiofrequency lesions are induced to destroy the abnormally active dorsal horn neurones. The procedure is believed to interrupt the pain pathways via the lateral spinothalamic and spinoreticulothalamic tracts.
Stellate ganglion block (cervicothoracic sympathetic block)

Indications

Pain syndromes

Complex regional pain syndrome type I and II
Refractory angina
Phantom limb pain
Herpes zoster
Shoulder/hand syndrome
Angina
Stellate ganglion block (cervicothoracic sympathetic block)

- Vascular insufficiency
  - Raynaud's syndrome
  - Scleroderma
  - Frostbite
  - Obliterative vascular disease
  - Vasospasm
  - Trauma
  - Emboli
Coeliac plexus block

**Indications**

- For relief of pain from non-pelvic intra-abdominal organs.
  - Acute pain - may be performed during surgery for postoperative pain relief.
  - Chronic pain - chronic severe upper abdominal visceral pain - e.g. chronic pancreatitis (local anaesthetic blocks only).
  - Cancer pain - useful for upper abdominal organ cancer pain, and is frequently used for carcinoma of the pancreas.
Coeliac plexus block

- **Technique**

  - The block is performed using X-ray screening, intravenous sedation, local anaesthetic infiltration of the superficial layers, with the patient in the prone position. Intravenous fluids are required pre-block to reduce the risk of hypotension after the procedure. It normally takes two needle insertions, one on each side to block both of the coeliac ganglia, but on some occasions good spread to both sides is achieved just using one needle. The needle entry point is just below the tip of the 12th rib, and using X-ray screening in two planes, the needle is advanced until it hits the side of the L1 vertebra.
Cryoanalgesia

This is use of extreme cold to damage peripheral nerves and provide pain relief that lasts for several months. This technique causes axonal degeneration without epineural or perineural damage, allowing slow regeneration of the axon without neuritis or neuroma formation.
Traditional Chinese acupuncture

- Incorporates elaborate concepts to explain disturbed body functioning: Qi (the vital life energy flowing along meridians); bodily imbalance in the cosmic regulators Yin and Yang; re-establishment of normal equilibrium by insertion of needles at special points to disperse ‘evil air’.
Trigger points are found in muscles, tendons, ligaments, joint capsules, periosteum and subcutaneous tissues, and are often caused by trauma, repetitive overstrain, emotional upset and excessive cold or heat. They are usually localised to one body region and may produce muscle weakness, shortening, palpable taut bands and fibrositic nodules. Deactivation can be achieved by dry needling (acupuncture) or wet needling (injecting dilute local anaesthetic or saline). Superficial needling into overlying subcutaneous tissues
Modern stimulators have a large variety of modes and settings but are generally used in two ways:

- low-intensity (1–2 mA) and high-frequency (50–100 Hz), thought to work via gate-control mechanisms at the spinal cord level
- high-intensity (15–20 mA) and low-frequency (1–5 Hz), thought to work like acupuncture by endogenous opioid release.
Revolutionary Approach to Pain

Pain is of Primary Importance
Curative Model

Rehabilitative or Management Model
Multi-Disciplinary Pain Program Models

- Pain Consultation Team
- Multidisciplinary Programs
  - Multidisciplinary Outpatient Programs
  - Multidisciplinary Inpatient Programs
- Pain Service
## Chronic Pain Disciplines and Roles (Core)

- **Anesthesiology** – nerve blocks
- **Kinesiotherapy** – pool therapy; activity
- **Neurology** – eval. treatment
- **Nursing** – patient care
- **Physical Medicine** – exercise; modalities
- **Physical Therapy** – exercise; modalities
- **Psychology** – eval. and treatment
- **Occupational Therapy** – eval and treatment
- **Vocational Rehab** – job eval and training
Chronic Pain Disciplines
(Adjunctive)

Dietetics – nutrition and diets
Educational therapy – skill enhancement
Internal Medicine - consultation
Neurosurgery - consultation
Orthopedics - consultation
Pharmacy – medication support
Psychiatry – psychotropic treatment; addiction mgt
Recreational Therapy – social activities
Social Work – community support
Multimodal Analgesia

- Lower doses of each drug can be used therefore minimizing side effects.
- With the **multimodal analgesic approach** there is additive or even synergistic analgesia, while the side-effects profiles are different and of small degree (Pasero & Stannard, 2012).

![Analgesia vs. Side-effects Balance](image)
OPIOIDS

Efficacy is limited by Side-Effects

- The harder we “push” with single mode analgesia, the greater the degree of side-effects
How do we do it?

**Multimodal analgesia:** Several analgesics with different mechanisms of action, each working at different sites in the nervous system

- Acetaminophen
- Non-steroidal anti-inflammatory drugs (NSAIDs)
- Opioids
- Anticonvulsants
- Antidepressants
- Local anaesthetics
- NMDA Antagonists
- Non-pharmacologic methods
Goal

- To provide patients with a level of pain control that allows them to actively participate in recovery
  - This level will be individual to each patient
- To minimize nausea and vomiting
- To minimize other side effects of analgesics
  - Sedation
  - Ileus
  - Weakness
  - Hypotension
YOU ARE LEAVING
PAIN
ENJOY THE JOURNEY!