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Procedures for chronic pain

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Introduction

Pain is defined as an unpleasant sensory and emotional experience associated with or resembling that associated with actual or potential tissue damage.[1] In a nutshell, pain is a subjective conscious construct of the brain in response to a perception of threat. It is influenced by various biopsychosocial factors such as adverse childhood events, genetics, gender, age, etc.[2,3] Importantly, pain must not be confused with nociception.[1] Pain is consciously expressed via emotional, behavioural, and cognitive changes. Nociception is necessary but not always present nor enough to be able to produce pain, because nociception is an unconscious neural processing of harmful stimuli that is expressed through the autonomic nervous system.

Acute vs chronic pain

Pain can be acute or chronic. Acute pain is a symptom that serves an adaptive role to protect us from perceived threat. Every attempt to cure acute pain by utilising the new World Health Organization (WHO) adaptation of the analgesic ladder should be made whenever possible to prevent, among other complications, a transition to a chronic pain state.[4] Chronic pain, which this discussion is based upon, is a disease that results from evolution of plasticity of the somatosensory system with multisystemic debilitating adverse effects, all of which must be targeted to decrease the pain intensity, pain effects, and improve the quality of life.[5]

Chronic pain

The causes of chronic pain are multi-factorial and these result in neural reorganisation that occurs in either the peripheral nervous system, the spinal cord and/or the brain. It can be extremely difficult to manage chronic pain and studies have shown that in most chronic pain states, we can only achieve a 30–40% short-lived improvement in pain and its effects such as fear, catastrophising, low self-efficacy, depression and/or anxiety if only one modality of management is used.[1,6,7]

Proper management of chronic pain states therefore require an interdisciplinary team approach[8] that utilises different types of modalities such as pharmacological interventions, non-pharmacological interventions, minimally invasive procedures and/or surgical interventions to target chronic pain mechanisms and their effects (Table I).

Chronic pain mechanisms

Nociceptive pain

Pain diseases resulting from tissue damage and subsequent ongoing inflammation that involves activation and transduction of nociception at the musculoskeletal or visceral nociceptors

Table I: Multimodal management of chronic pain

Pharmacological	Non-pharmacological	Minimally invasive procedures
• Antinociceptive: paracetamol, nonsteroidal anti-inflammatory drugs (NSAIDs), opioids • Antihyperalgesics: ketamine, gabapentinoids, coxibs, etc. • Modulators of peripheral transmission/ sensitisation: local anaesthetics, carbamazepine, capsaicin, etc. • Modulators of descending pathway: amitriptyline, venlafaxine, duloxetine • Mixed analgesics and modulators: tramadol, corticosteroids	• Patients' neuroscience education (PNE) • Active physical treatment (APT) • Cognitive behavioural therapy (CBT) • Acceptance and commitment therapy (ACT) • Graded exposure • Graded motor imagery (GMI) • Group programmes • Transcutaneous electrical nerve stimulators (TENS) • Bioelectric therapy • ActiPatch pulsed shortwave therapy • Ice • Mindfulness meditation • Dry needling/trigger points injections • Acupuncture • Placebo/meaning effects	• Needle placement of drugs in targeted nerves • Neuroablation of targeted nerves for ablation of nerve fibres and plexuses using thermal, chemical, or surgical neurolytics • Neuromodulation via implantation of intrathecal infusion pumps or spinal cord stimulators • Minimally invasive vertebroplasty/ discectomy

with resultant transmission of the electrical signals via A-delta and C fibres.[9] It can occur even after a single insult, but arbitrarily occurs after three months which is the expected time for normal tissue healing to occur. Some examples are postoperative pain, arthritis, nociceptive back pain states, pancreatitis, etc.

Neuropathic pain

Pain diseases caused by damage to the somatosensory nervous system.[7,9] It can be due to central or peripheral mechanisms and some of the examples include phantom limb pain, post-stroke pain, post-herpetic neuralgia, trigeminal neuralgia, diabetic neuropathy, post-viral neuropathy, alcoholic neuropathy, drug-induced neuropathy, complex regional pain syndrome (CRPS) type 2, neuropathic radicular pain/radiculopathy, etc.

Nociplastic pain

Pain diseases that result from altered nociceptive function leading to hyperactivity of the central neurons and decreased function of the descending modulatory/inhibitory pathways.[9,10] Examples include widespread fibromyalgia, CRPS type 1, tension-type headaches, myofascial disease, irritable bowel syndrome, bladder pain, vulvodynia, chronic fatigue syndrome, etc.[11]

It is important to note that while both nociceptive and neuropathic pain states are sometimes amenable to interventional procedures, nociplastic chronic pain states are characterised by a decrease in response to most peripherally directed pharmacological therapies, peripheral minimally invasive procedures, and surgery.

Procedures for chronic nociceptive and neuropathic pain states

Interventional procedures are procedures that are devoted to the diagnosis and management of chronic, persistent, and intractable pain and related disorders which are seldom independently used or often used in conjunction with other modalities of treatments.[12]

The scoring system in Table II grades the strength of recommendation and quality of evidence in clinical guidelines that has specifically been adapted for pain procedures to ensure their practical value for pain clinicians, patients, and researchers and thus this scoring system, at length, also acts as a medico-legal shield when adhered to.[13,14]

The evidence for effectiveness of interventional chronic pain procedures varies from 1B+ to 2B-. Patients' chronic pain states should therefore be carefully screened for eligibility of 1A+ to 2B+ interventional chronic pain procedures. Procedures that are scored 2B+/- and 2C+ may be considered but should only be repeated if they provided long-term pain relief of longer than three months after the first intervention.[13,14]

Indications and contraindications of interventional procedures must also be considered to improve efficacy and avoid adverse events.[15] Commonly performed interventional pain procedures are briefly discussed below.

Targeted pharmacotherapy

A myriad of chronic pain states with challenging peripheral mechanisms can have their diagnosis confirmed or even managed by needle placement of drugs in the targeted nerves.[15] Local anaesthetics (LAs) and/or corticosteroids are commonly used. LAs reversibly inhibit nociception by binding voltage-gated sodium channels in the nerve plasma membrane. Corticosteroids reduce the neurogenic inflammatory cascade via inhibition of synthesis and release of pro-inflammatory substances. Corticosteroids also suppress sensitisation of dorsal horn neurons.

Table II: Grading the strength of recommendation and quality of evidence in clinical guidelines

Score	Description	Implication
1A+	Effectiveness demonstrated in various randomised controlled trials (RCTs) of good quality. The benefits clearly outweigh risk and burdens.	Positive recommendation
1B+	One RCT or more RCTs with methodological weaknesses, demonstrate effectiveness. The benefits clearly outweigh risk and burdens.	Positive recommendation
2B+	One or more RCTs with methodological weakness, demonstrate effectiveness. Benefits closely balanced with risk and burdens.	Positive recommendation
2B+/-	Multiple RCTs, with methodological weaknesses, yield contradictory results better or worse than the control treatment. Benefits closely balanced with risk and burdens, or uncertainty in the estimates of benefits, risks, and burdens.	Considered, preferably study-related
2C+	Effectiveness only demonstrated in observational studies. Given that there is no conclusive evidence of the effect, benefits closely balanced with the risk and burdens.	Considered, preferably study-related
0	There is no literature, or there are case reports available, but these are insufficient to prove effectiveness and/or safety. These treatments should only be applied in relation to studies.	Only study-related
2C-	Observational studies indicate no or too short-lived effectiveness. Given that there is no positive clinical effect, risk and burdens outweigh the benefit.	Negative recommendation
2B-	One or more RCTs with methodological weakness, or large observational studies that do not indicate any superiority to the control treatment. Given that there is no positive clinical effect, risk and burdens outweigh the benefit.	Negative recommendation

Adhesiolysis with hyaluronic acid is sometimes performed epidurally to eliminate the effects of scar formation which prevents direct application of drugs to nerves.[16]

Neuroablation

Neuroablation of targeted fibres and plexuses can be achieved by using thermal, chemical, or surgical neurolytics. Radiofrequency (RF) neuroablation is the most performed neuroablative method. It involves the passage of high frequency, high temperature current down a thermocouple probe. The passage of this destructive current is done aseptically following location of the targeted nerve by first passing a stimulating current down the same probe.[17]

Most peripheral mechanisms of chronic pain can be denervated with RF neuroablation as part of multimodal management. The denervating RF techniques include, but are not limited to RF of peripheral nerves (lateral femoral cutaneous nerve, occipital nerve, suprascapular nerve, etc.), medial branches of the posterior primary rami innervating the facet joints (cervical, thoracic, lumbar and the sacroiliac joint), dorsal root ganglia (cervical, thoracic, and lumbar) and sympathetic ganglia (stellate ganglion, ganglion impar, thoracic and lumbar ganglia etc.).[17]

Neuromodulation

Neuromodulation is achieved via implantation of intrathecal infusion pumps or spinal cord stimulators.

Intrathecal infusion pumps are implantable systems that consist of a pump and a catheter both of which are surgically implanted under the skin and then deliver drugs such as ziconotide, morphine and baclofen directly to spinal cord receptors. Intrathecal pumps are done after careful selection of patients and only when effectiveness of the drug has been tested and found to be beneficial. Intrathecal infusion pumps can modulate pain, manage spasticity, and provide analgesia by using only a fraction of the dose required when using other conventional routes and as a result the patients may experience fewer side effects.[18]

Spinal Cord Stimulators (SCS) – the mechanism of action of SCS is based on Melzack and Wall's Gate Control Theory of Pain. Mild electrical current applied to the ventral surfaces of the spinal cord stimulates large, low-threshold A-beta fibres and will result in closure of the gate and subsequently prevent transmission of nociceptive stimuli via C and A-delta fibres.[19,20] Initially, a patient trial is carried out and if this successfully relieves pain, then a permanent Implantable Pulse Generator is implanted.

Conclusion

The wide variation in effectiveness of chronic pain procedures behoves on pain clinicians that in performing a procedure, one should always bear in mind that these procedures are not the be-all and end-all on their own, and therefore pain clinicians should always endeavour to perform only the recommended procedures in conjunction with other reliable and validated interventions for that specific chronic pain mechanism.

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