Postoperative analgesia

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Abstract

Pain should be regarded as a complex experience consisting of sensory, affective, behavioural and physiological components. Pain management is therefore best achieved by an approach which acknowledges the complex interactions between biological, psychological and sociocultural factors. Effective pain management requires thorough patient preparation and education to manage expectations and a robustly structured inpatient service for postoperative pain management and continuous staff education. Postoperative analgesia is one component of postoperative pain management and is essential for achieving patient satisfaction and enhanced recovery. Effective pain management facilitates early mobilization and a reduction in respiratory and cardiac complications reducing the stress response to surgery in turn improving wound healing and recovery. Inadequate pain control can lead to higher morbidity and mortality, prolonged hospital stay and the development of chronic postoperative pain.

Keywords Multimodal analgesia; pain physiology; postoperative pain

Royal College of Anaesthetists CPD Matrix: 1A02 1D01 1D02 2E01

Learning objectives

After reading this article you should be able to:

- explain the mechanisms of acute postoperative pain
- discuss the targets for postoperative analgesics with a multimodal approach to the management of pain
- identify patients that may be challenging in terms of postoperative pain and develop potential strategies for effective management

Introduction

Pain is defined by the International Association for the Study of Pain as: 'an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage'.[1] Pain is also defined as: 'whatever the experiencing person says it is, existing whenever he/she says it does'. Pain is therefore a subjective experience and there are no objective tests or investigations which can prove whether a patient has pain or not.

Pain is a complex integrated response and consists of sensory, emotional, cognitive and behavioural components that may be described on the verbal-subjective, motor-behavioural, and physiological levels. These three levels of responses need to be considered in the analysis of pain. An integrated multidisciplinary approach needs to be taken to pain management that also considers patient preferences and prior experience.

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Normally the purpose of pain is to alert an animal about damage from injury or disease and to help the animal make decisions about what to do with regards to the injury/disease. It serves a useful purpose to protect the body from further harm and allow tissue healing. Acute pain normally resolves with healing of the underlying injury.

If pain is not treated, activation of sympathetic efferents can lead to cardiac ischaemia. Severe pain after thoracic and upper abdominal surgery for example contributes to an ineffective cough resulting in an increased incidence of pulmonary complications. Patients at greatest risk of adverse outcomes from undertreated acute postoperative pain include those at the extremes of age or who have concurrent medical illnesses. Inadequately treated acute pain is also a risk factor for poor wound healing, delayed discharge and the development of chronic pain.

Pain perception and tissue damage-sensing pathways

A useful model for understanding the experience of acute pain due to tissue injury consists of four processes: transduction, transmission, perception and modulation (Figure 1). An understanding of this model provides a cognitive map for implementing effective, bespoke, multimodal analgesia and can help guide an effective postoperative analgesic strategy.

Transduction

Transduction is the conversion of a chemical, thermal or mechanical stimulus into an electrical signal by nociceptors. Nociceptors exist on free nerve endings of primary sensory neurones present in skin, muscle, joints, viscera and meninges and are unprotected from chemicals secreted into or applied to tissue. They respond to relatively high magnitude or potentially tissue-damaging stimuli. Their cell bodies reside in the dorsal root ganglia (DRG).

Surgical trauma results in inflammation, degranulation of mast cells, secretion of inflammatory cells and induction of enzymes. Chemical mediators including ATP, bradykinin, substance P and prostaglandin E2 are released from these inflammatory cells at the axon terminal. These chemical mediators act either directly on their associated receptor present on the nociceptive afferent terminal to distort or depolarize the membrane of the nociceptor, or via metabotropic receptors, to result in receptor activation or sensitization.

The most numerous subclass of nociceptor is the C-fibre receptor which is polymodal, responding to a range of mechanical and chemical stimuli. C-fibres are thinly myelinated or unmyelinated with small diameter cell bodies and terminate in laminae I

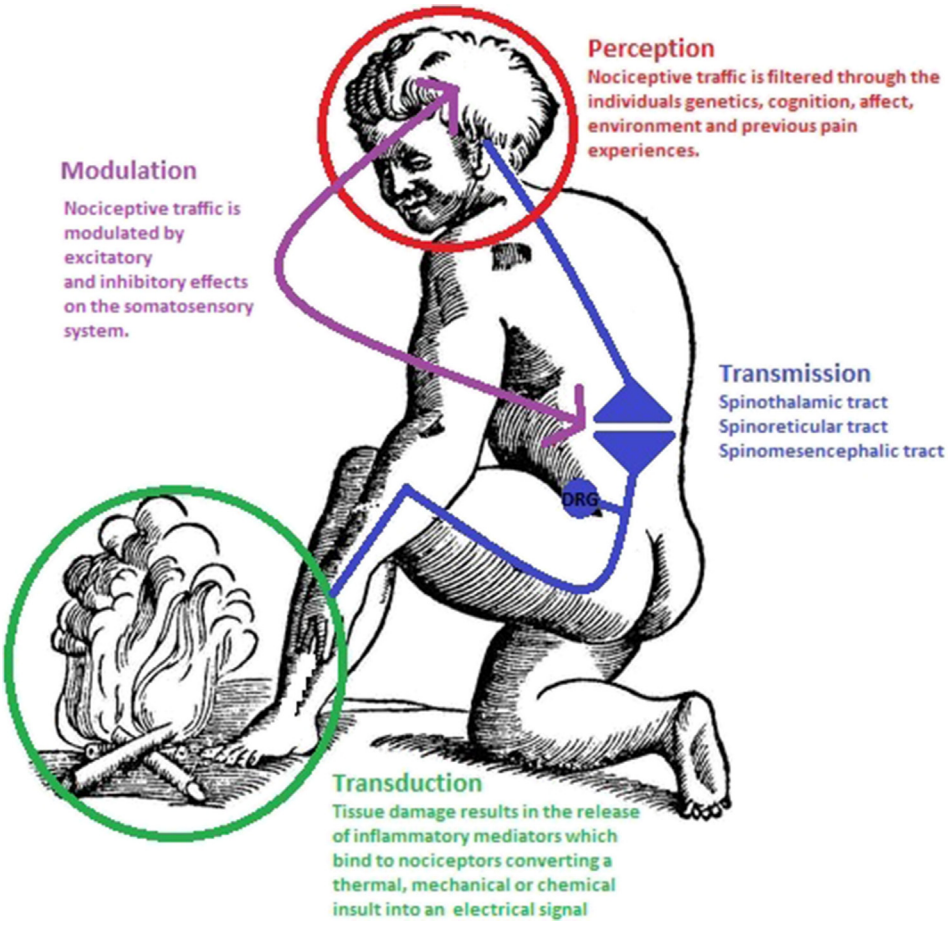

Figure 1 A physiological model of the pain experience.

and II of the dorsal horn (DH). They have a slow conduction velocity of less than 3 m/second and relate to the perception of a slow 'burning' pain. Aδ fibres are mechanical and thermal nociceptors and generally terminate in laminae I and III–V. They are the predominant receptor type involved with the perception of 'sharp' pain, and have a fast conduction velocity of 5–30 m/second.

Transmission

Action potentials generated at the nociceptor are transmitted to the structures of the central nervous system concerned with the perception of pain. Impulses generated in the primary sensory neurons are conducted to the dorsal horn (DH) of the spinal cord. Here they synapse with second order neurones and are relayed to the brain.

The spinothalamic tract is classically considered the major nociceptive pathway originating from neurons in laminae I and III–V of the DH. Over 85% of spinothalamic axons cross and ascend contralaterally where they project to the thalamus and then to the somatosensory cortex to provide information on the site and type of nociceptive stimulus.

The spinoreticular and spinomesencephalic tracts project to the medulla and brainstem and integrate nociceptive information with homeostatic and autonomic responses as well as projecting to central areas to mediate the emotional component of pain.

Other connections include those to the periaqueductal grey matter of the midbrain and rostroventromedial medulla which are necessary for flight or fight responses, and projections to the reticular formation which play an important role in the regulation of descending pathways to the spinal cord.

Perception

Nociception is the signal produced following tissue damage but this does not constitute pain. The perception of pain is the conscious awareness of the experience of pain and results from the processing and modulation of the information received via transduction and transmission.

When the information about tissue damage reaches the brain this information is processed through the individual's genetics, environment, culture, beliefs and previous pain experiences as well as mood and psychological constructs including for example self-efficacy and catastrophizing. Self-efficacy is defined as a personal conviction that one can successfully execute a course of action to produce a desired outcome in a given situation. Maladaptive appraisals of pain and its duration and one's personal efficacy may reinforce the experience of demoralisation, inactivity, and overreaction to nociceptive stimulation. Catastrophizing consists of extremely negative thoughts about one's plight, even with minor problems being interpreted as major