Faculty of Medicine
Department of Anesthesia,
Intensive Care and Pain Management

Postoperative Pain Management in Paediatric Cancer Patients

An Essay

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in Anaesthesia

By

Radwa Saleh Osman
M.B.,B.Ch.
Faculty of Medicine, Cairo University

Supervised by

Prof. Dr. Mohamed Mohamed Nabil El-shafei
Professor of Anaesthesia, Intensive Care and Pain Management
Faculty of Medicine - Ain Shams University

Prof. Dr. Ashraf El-Sayed El-Agamy
Assistant Professor of Anaesthesia, Intensive Care and Pain Management
Faculty of Medicine - Ain Shams University

Dr. Heba Fouad Abd El -Aziz Toulan
Lecturer of Anesthesiology, Intensive Care and Pain Management
Faculty of Medicine - Ain Shams University

Faculty of Medicine
Ain Shams University
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Radwa Saleh

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List of Abbreviations

Abb.	Full term
5-HT	5-hydroxy tryptamine
ART	Antiretroviral therapy
CA	Controlled analgesia
CCK	Choleycysto kinin
CNS	Central nervous system
COX	Cyclo oxygenase
CPNB	Continuous peripheral nerve block
GABA	Glyciene and amino butyric acid
HTM	High threshold mechano receptors
IASP	International association for study of pain
INRS	Indivdualise numeric rate scale
LAST	Local anesthetic systemic toxicity
NMDA	N-methyl D- aspartate
NO	Nitrous oxide
NRM	Nucleus raphe magnus
NRS	Numerical rating scale
NSAID	Non steroidal anti inflammatory drugs
PAG	Periaqueductal grey area
PBCL	Poker behavous check list
PIPP	Premature infant profile
PMN	Polymodal nociceptors
SSC	Single shot caudal

SSRI	Selective serotoning reuptake nhibitor
STT	Spinothalamic tract
TCA	Tricyclic anti depressant
TRP	Transient receptor potential
VAS	Visual analogue scale
VIP	Vasoactive interstinal peptide
VRS	Verbal rating scale
WDR	Wide dynamic range

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Postoperative Pain Management in Paediatric Cancer Patients

Abstract

Pain is a physiological response that warns us of danger. It is usually starts by the detection of noxious stimuli which has a specialized role of the somatosensory system. Nociceptors belong to primary afferent neurons, which synapses with second order neurons to modulate onward transmission of pain signal at dorsal horn. The process of nociception describes the normal processing of pain and the responses to noxious stimuli that are damaging or potentially damaging to normal tissue

A proactive approach to pain assessment can reduce pain, increase patient comfort and satisfaction. Evaluation of pain in children is influenced by the age of children and their perception of pain. Many assessment tools has been developed and validated for children

Patient-controlled analgesia is ideal for postoperative analgesia .but it is probably not practical until the child is five years or older. In which morphine is the drug of choice. This is used in hospital setting

Interventional therapies such as regional analgesia, the regional block can be single shot caudal analgesia or a continuous caudal or epidural block for postoperative analgesia. A peripheral nerve blocks can be used to treat a wide variety of acute pain condition.

Keywords: Nociceptors, analgesia, morphine, drug

Introduction

Pain is a complex phenomenon which is even more challenging to manage in the pediatric population. It's perhaps the most feared symptom of disease, which a human being is always trying to alleviate and conquer since ages. It is defined by the international association for study of pain as an "unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage **(Pillai Riddell et al., 2009).**

Children are special in this regard because it is also very difficult to differentiate restlessness or crying due to pain from that of hunger or fear in the children. Cancer related pain may be due to cancerous lesion itself, metastatic disease, complications such as: neural compression or infection. Treatment such as chemotherapy or radiation therapy or surgery which may prolong survivorship for patients with cancer. However, survivorship may be accompanied by pain **(McClaine and Suresh, 2011).**

Treatment of this pain is an area of ongoing search. Pain after surgery results from inflammation caused by tissue trauma (i.e., surgical incision, dissection, burns) or

direct nerve injury (i.e., nerve transaction, stretching, or compression). An effective pain therapy to block or modify the different physiologic responses to stress has become an essential component of modern pediatric anesthesia and surgical practice. The society of Pediatric anaesthesia annual meeting at **New Orleans, Louisiana (2001)** clearly defined the alleviation of pain as a "basic human right", irrespective of age, medical condition, treatment **(Lim et al., 2012).**

The post-operative pain treatment must be included in the anesthetic planning even before induction of anesthesia, adopting the idea of "Managing pain before it occurs". Now, post-operative pain management is an integral part of practice of pediatric anesthesia in all major hospitals **(Anand et al., 2007).**

Aim of Work

This essay is mainly directed towards explaining the different types of pain and the different methods of controlling postoperative pain in paediatric cancer patients.

Anatomy and Physiology of Pain

What is pain?

Pain is not just a sensory modality but an experience. The "Standard" definition of pain of the International Association for the Study of Pain (IASP) is "An unpleasant sensory or emotional experience associated with actual or potential tissue damage, or described in terms of such damage" **(Serpell, 2006).**

Pain is always subjective. Yet describing pain as experience separates pain from nociception. Each individual learns the application of the word through experiences related to injury in early life. It is unquestionably a sensation in a part of the body, but it is also unpleasant, and therefore also an emotional experience **(Stanko et al., 2013).**

Many people report pain in the absence of tissue damage or any likely patho-physiological cause; usually this happens for psychological reasons. There is no way to distinguish their experience from that due to tissue damage. The IASP definition avoids typing pain to the stimulus, yet it is important to recognise that the whole experience of

pain is far more than physical stimulus triggering neural signal **(Merskey and Bogduk, 1994).**

The term *nociception* is derived from the *noci* (Latin for harm or injury) and it is usually used to describe neural responses to traumatic or noxious stimuli involving transduction and transmission of noxious stimulus to brain via pain pathway **(Marshall and Obermayer, 1984).**

Pain pathways:

Pain receptors and primary afferents

Pain is conducted along three neuronal pathways that transmits noxious stimuli from the periphery to the cerebral cortex. The cell bodies of primary afferent neurons are located in the dorsal root ganglia which lie in the vertebral foramina at each spinal cord level. Each neuron has a single axon that bifurcates, sending one end to the peripheral tissues it innervates, and the other into the dorsal horn of the spinal cord. In the dorsal horn, the first afferent neuron synapses with a second order neuron whose axon crosses the midline and ascends in the contralateral spinothalamic tract to reach the thalamus, second order neurons synapses in thalamic nuclei with third order neurons, which in turn send projections through the internal capsule and corona

radiate to the postcentral gyrus of the cerebral cortex **(Chopko et al., 2010).**

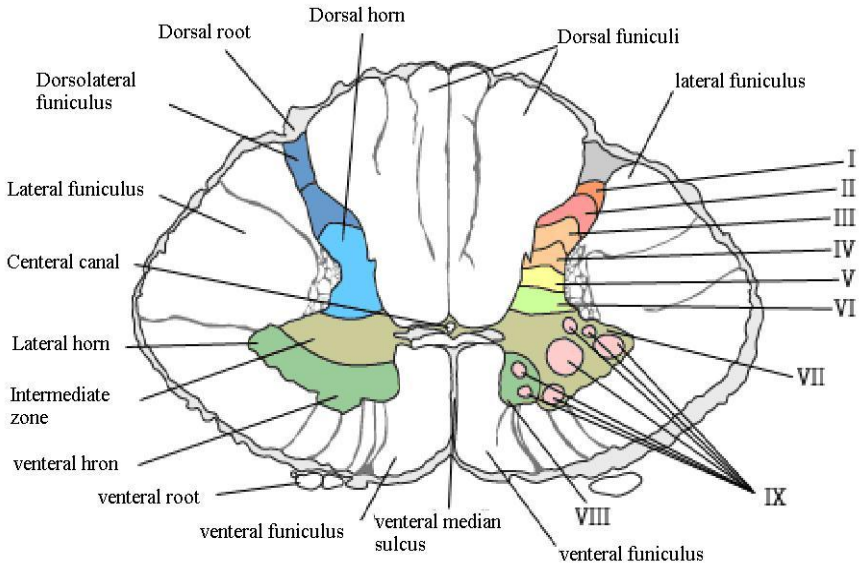

Figure (1): A cross section of the lower cervical segment of the spinal cord, showing cytoarchitectural lamination **(Rosenow and Henderson, 2003).**

Nociceptors are receptors in tissue which are activated specifically by painful stimuli:

The "noxious" information is transduced by the receptors into an electrical signal and transmitted from the periphery to the central nervous system along axons **(Van Oosterwijck et al., 2013).**

There are two types of nociceptors:

- High-threshold mechanoreceptors (HTM), which responds to mechanical deformations.
- Polymodal nociceptors (PMN) which responds to variety of tissues damaging inputs:
  - Hydrogen ions (protons).
  - 5 hydroxy tryptamine (5-HT).
  - Cytokines.
  - Bradykinin.
  - Histamine.
  - Prostaglandin.
  - Leucotriens.

(Kidd and Urban, 2001)

The inflammatory mediators bathe the nociceptors, activating and sensitizing them. Prostaglanding and bradykinins sensitize nociceptors to activation by low intensity stimulus **(Aronoff, 2016).**

Histamine & 5-ht cause pain when directly applied to nerve ending. Hydrogen ions, 5-HT act directly on ion channels on the cell membrane. Nociceptors are there for the free nerve ending **(Zaki et al., 2016).**