Pediatric Analgesia in Anaesthetic Practice

Essay
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BY

Hesham Mohamed Abedo
(M.B., B.ch.)

Under the supervision of

Prof. Dr.
Azza Mohamed Shafek
Professor of Anaesthesia and Intensive Care
Faculty of Medicine
Ain Shams University

Dr.
Mohamed Anwar El-Shafei
Assistant Professor of Anaesthesia and Intensive Care
Faculty of Medicine
Ain Shams University

Dr.
Mohab Fathy Georgea
Lecture of Anaesthesia and Intensive Care
Faculty of Medicine
Ain Shams University

Faculty of Medicine
Ain Shams University

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هشام محمد عبيــدو

بكالوريوس الطب والجراحة

تحت إشراف

الأستاذ الدكتور

عزة محمد شفيق عبد المجيد

أستاذ التخدير والرعاية المركزة
كلية الطب – جامعة عين شمس

الدكتور

محمد أنور الشافعى

أستاذ مساعد التخدير والرعاية المركزة
كلية الطب – جامعة عين شمس

الدكتور

مهاب فتحى جورجى

مدرس التخدير والرعاية المركزة
كلية الطب – جامعة عين شمس

كلية الطب

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Introduction

Adults are frequently referred to anaesthesiologists for evaluation and treatment of acute or chronic pain, only recently there has been similar involvement of anaesthesiologists in pediatric pain assessment and only since 1986 there have been wide spread effort to establish multi-displinary approach to pain management in children ***(Berde et al., 1989)***.

Lesser verbal communicative capabilities, difficulty in handling abstract concepts, lack of experience of painful stimuli to make comparisons, and ignorance of their body image making the assessment of pediatric pain a difficult task. So, the assessment and management of pediatric analgesia is a topic that has received a great deal of attention ***(Dalens, 1991)***.

The primary goal of perioperative pediatric analgesia is to prevent or minimize the surgical stress response as the body responds to pain and injury by producing metabolic, hormonal and haemodynamic changes. These has been shown to work when the surgical team, anaesthiologist, nurses and family of pediatric patients work together within established clinical pathway ***(Bradshaw and Liu, 1998)***.

In order to provide more continuous analgesia, intravenous patient controlled analgesia (PCA) was introduced in the 1980's leading to the development of specialized pain management teams, most often under the direction of anaesthesiologists ***(Sullivan and Phillips, 2004)***.

Children should not be discharged after day surgery until pain is well controlled and staff are confident that oral medication will provide adequate analgesia at home. Severe postoperative pain should not be major problem after day surgery provided that local anaesthesia and non steroidal anti inflammatory drug (NSAID) have been used as part of the anaesthetic technique ***(Brennan and Prabhu, 2003)***.

Pain Pathways

Neuro-anatomy of pain:

Pain Pathway:

Pain is conducted through three neuron pathways that transmit noxious stimuli from the periphery to the cerebral cortex.

Some unmyelinated afferent (C) fibers have been shown to enter the spinal cord via the motor root, according to observation that some patients continue to feel pain even after transection of the dorsal nerve root (rhizotomy) and report pain after ventral root stimulation ***(Morgan et al., 2006)***.

* *First order neurons:*

Located in the dorsal root ganglia, the majority of first order neuron send the proximal end of their axons into the spinal cord via the dorsal (sensory) spinal root at each cervical, thoracic and sacral level. The first order neurons synapse with the second order neurons, it may synapse with interneurons, sympathetic neurons and ventral horn motor neuron ***(Morgan et al., 2006)***.

* *Second order neurons:*

As afferent fibers enter the spinal cord they segregate according to size with small unmyelinated fibers become lateral

and large myelinated fibers become medial (Fig. 1) ***(Morgan et al., 2006)***.

Pain fibers may ascend or descend one to three spinal cord segments in lissauer's tract before synapsing with second order neurons in the gray matter of ipsilateral dorsal horn ***(Morgan, et al., 2006)***.

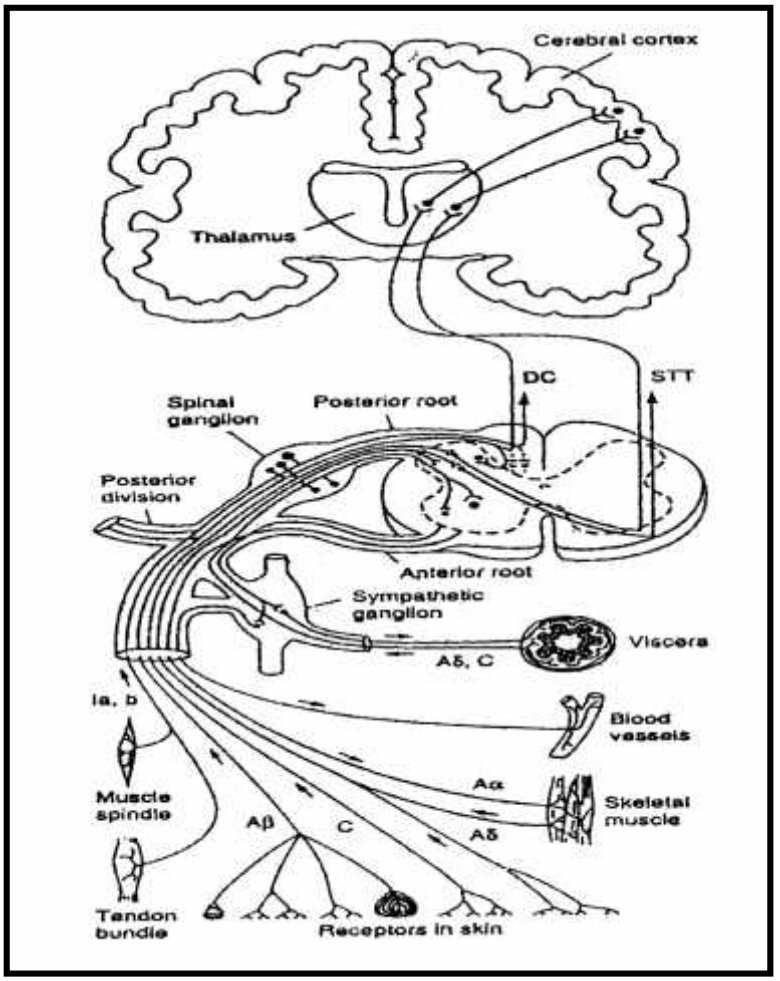

***Fig.* (1): Pain pathway *(Morgan et al., 2006)*.**

Across-section of the spinal cord shows 10 anatomical and physiologically distinct layers called Rexed Laminae. Lamina I responds primarily to noxious (nociceptive) stimuli from cutaneous and deep somatic tissues. Lamina II, also called the substantia gelatinosa, contains many interneurons and is believed to play a major role in processing and modulating nociceptive input from cutaneous nociceptors. It is also of special interest because it is believed to be major site of action for opioids. Laminae III and IV receive primarily non-nociceptive sensory input. Laminae VIII and IX make up the anterior (motor) horn. Lamina VII is called the intermediolateral column and contains the cell bodies of preganglionic sympathetic neurons (Table 1) ***(Morgan et al., 2006)***.

Table* (1):** Spinal cord lamina ***(Morgan et al., 2006).

Lamina	Predominant	Input	Name
I	Somatic nociception thermoreception.	A¢, C	Marginal layer
II	Somatic nociception thermoreception.	C, A¢	Substantia gelatinosa
III	Somatic mechanoreception.	A , A¢	Nucleus proprius
IV	Mechanoreception.	A , A¢	Nucleus proprius
V	Visceral and somatic nociception and mechanoreception.	A	Nucleus proprius
VI	Mechanoreception sympathetic.	A	Nucleus proprius
VII	Sympathetic.		Intermedio lateral column
VIII		A	Motor horn

IX	**Motor.**	**A**	**Motor horn**
X		**A¢**	**Central canal**

*** <u>Ascending tracts and supraspinal systems:</u>**

Most dorsal horn neurons project to the brain by ascending several segments in the spinal cord and joining one of the three major spinal systems ***(Morgan et al., 2006)***.

*** The spinothalamic tract:**

The axons of second order neurons cross the midline close to their level or origin (at anterior commissure) to contra lateral side of the spinal cord before they form the spinothalamic tract and send their fibers to the thalamus, reticular formation, the nucleus raphe magnus and the preaqueductal grey area. It lies antero laterally in the white matter of the spinal cord, and it is considered the major pain pathway ***(Grubb, 1998)***.

The ascending tract can be divided as lateral and medial:

- The lateral spinothalamic (neospinothalamic) tract projects mainly the ventral posterolateral nucleus of the thalamus and carries discriminative aspects of pain such as location, intensity and duration.
- The medial spinothalamic tract projects to the medial thalamus and is responsible for mediating the autonomic and unpleasant emotional perception of pain.

Some spinothalamic fibers also project to the

preaqueductal grey area and thus may be an important link between the ascending and descending pathways.

Collateral fibers also project to the reticular activating system and the hypothalamic, these are likely responsible for arousal response to pain ***(Grubb, 1998)***.

*** Alternate pain pathways:**

Pain fibers ascend diffusely, ipsilaterally, and contralaterally; hence, some patients continue to perceive pain following ablation of the contralateral spinothalamic tract. The spinoreticular tract is thought to mediate arousal and autonomic response to pain. The spinocervical tract ascends uncrossed to the lateral cervical nucleus which relays the fibers to the contralateral thalamas ***(Morgan et al., 2006)***.

*** Integration with sympathetic and motor system:**

Somatic and visceral afferents are fully integrated with skeletal motor and sympathetic systems in the spinal cord brain stem and higher centers.

Afferent dorsal horn nerves synapse directly and indirectly with anterior horn motor neurons ***(Morgan et al., 2006)***.

These synapses are responsible for reflex muscle activity whether normal or abnormal that is associated with afferent