

Management of Pain In Children: A Review Of The Literature

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ABSTRACT

Background: Pain is a very common situation encountered in clinical practice. It is as common in children as in adults and often it is underevaluated and undertreated. The aim of this review is to stimulate and sensitize Paediatricians and other child health care providers to the importance and necessity of adequate appreciation, evaluation, and management of pain in children.

Methods: Review of the pertinent literature. Selected references to highlight the mechanism of pain, pain assessment tools and therapeutic approach to management, were included in this review.

Results: Pain in children is underevaluated and under treated. This is so even in developed countries. A study put the prevalence of pain among children at 26%, and that two out of every three patients with pain were not detected, and that one out of three patients detected received no treatment. Popular dogma held that the human child does not feel pain and that giving the child powerful analgesics may lead to addiction. Despite the availability of several pain assessment tools, they are under used in Paediatric practice. Pain pathways develop in the second trimester, so the smallest neonate is able to respond to noxious stimulation.

Conclusion: Childhood pain is still underevaluated and under treated. The adequate management of pain in children is an important factor in better outcome of childhood illnesses.

KEYWORDS: Pain; Children; Evaluation; Assessment tools; Pharmacotherapy.

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INTRODUCTION

Pain, as defined by the International Association for the Study of Pain (IASP), is an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage¹. Perception of pain is always subjective with each individual learning the application of the word through experience related to injury in early life².

Popular dogma has suggested that the human child does not feel pain and that it is dangerous to

give him powerful analgesic because of the risk of addiction². However the actual problem is that the child has a limited ability to communicate with adults and lack relevant previous experience. The greatest advance in the past decade about pain is the paradigm shift in the recognition that pain not only exists in infants and children but also is a significant cause of morbidity and even mortality³.

In developed countries, despite recent progress, childhood pain is still under-evaluated and under-treated and its treatment vary among clinicians and other health care providers^{4,5}. Michel *et al* found the prevalence of pain among paediatric patients aged 5 to 15 years in France to be 26%. They also found out that two out of three patients in pain were not detected by both nurses and physicians; one out of three patients was given no treatment in medical wards and one out of five in surgical wards⁶.

Pain has adverse physiological and emotional effect and research suggests that pain management is an important factor in better outcome of patient's managements^{7,8}. The experience of pain in early life may lead to long term consequences and there now exists evidences that long-term behavioural changes can extend far beyond what would be considered the normal period of post injury recovery⁹.

The aim of this review is to stimulate and sensitize Paediatricians and other health care providers to the importance and necessity of adequate appreciation, evaluation, and management of pain in children. Various available therapeutic measures will be discussed.

Mechanism Of Pain

Pain is indeed a complex phenomenon with psychosocial and behavioural parameters interacting with the physical pathology to produce an integrated perceptual experience and behavioural response. The transmission of pain is an interplay between a number of transmitter systems, both excitatory and inhibitory, at many levels, of the central nervous system, but which converge especially on the spinal cord.

Clinical pain can be either inflammatory due to injury produced during surgery and infections, or neuropathic due to damage to the nervous systems and ischaemic pains. They are both characterized by changes in the sensitivity namely:

Allodynia: a reduction in the intensity of stimuli necessary to initiate pain so that stimuli that would not normally produce pain begin to do so.

Hyperalgesia: exaggerated responsiveness to noxious stimuli.

Secondary Hyperalgesia: spread of hypersensitivity to non-injured tissue.

There are two mechanisms that are involved in producing these alterations in sensitivity found in inflammatory pain. These two kinds of nervous system response are known as peripheral and central sensitization¹⁰. Some of these mediators are K⁺, H⁺ ions, lactic acid, substance P, bradykinin, prostaglandins, histamine and serotonin¹¹.

The smallest neonate is able to respond to noxious stimulation with signs of stress and distress as pain pathways in the peripheral nervous system, spinal cord and even at the cortex and thalamus are said to develop in the second trimester¹². The ontogeny of nociceptive pathways; their maturation, and their functionality during development are not completely understood. Painful sensations primarily involve the child's own experience but can be modified, influenced by his/her parents and the psychosocial environment with their own experience of pain and anxiety⁴. In general, pain transmission develops before pain modulation¹².

In clinical practice, children should be evaluated under the following conditions and situations for pain and efforts should be made to satisfactorily manage them:

1. Sickle cell Anaemia patients in vasoocclusive crisis
2. Trauma patient (Road traffic or domestic accidents)
3. Burns patient
4. Acute herpes zooster
5. Post operative
6. Acquired immune Deficiency Syndrome (AIDS)
7. Rheumatological disorders
8. Cancer patients
9. Headache
10. Toothache
11. Common investigative or therapeutic procedures like venesection, injecting of drugs, lumbar puncture and tissue/organ biopsy can produce such severe pain that may necessitate management.

Clinical assessment of pain

Pain management must start with assessment using tools that are age appropriate and well suited to the clinical situation¹³. The most difficult aspects of pain management is the assessment of pain in

children. As pointed out earlier, the major problem is the limitation in communication of their pain experiences with adults. Whenever feasible, pain is best assessed by asking children about the character, location, quality and intensity of their pain. Behavioural (i.e. body movement, cries, facial expressions) and physiological (i.e. tachycardia, hypertension, tachypnoea, palmar sweating, hypoxaemia) responses have been suggested for use particularly in infants and children younger than two years; these are useful but can be misleading in certain situations¹².

Many scales have been developed for use in pain assessment, these include:

- A. Post operative pain/comfort scale
- B. Objective pain scale
- C. The faces scale (Oucher scale)
- D. Visual Analogue scale (VAS)
- E. Children's Hospital of Eastern Ontario Pain scale (CHEOPS)
- F. Maunuksela pain scale

The features, advantages and limitations of these scales are shown in Table I. But the use of these scales in clinical practice may have to be guarded because of the limited knowledge and understanding of these scales by child health care providers in our environment and the child's ability to understand them. Pain assessment tools are reliable but not used enough within Paediatric wards¹⁴.

The ability to understand, rationalize and form relationships between the cause and effect is not fully developed until 7 years¹². Children under this age may thus not be able to express their feeling and describe the amount of pain, it's quality, location, duration and changes over time. For the most part, children should still be believed, and self-report in verbalizing children is the most useful guide to assessment¹².

Management of pain

Objectives

Pain management is always important whether to relieve or to prevent the discomfort, which would happen during diagnosis or therapeutic procedures¹⁵.

These objectives include:

1. eliminating patients discomfort
2. initiating early recovery
3. avoiding or minimizing therapeutic side effect
4. controlling the cost-effectiveness of treatment

Therapeutic Approaches

Therapeutic approach to management of pain is

broadly divided into two: Non drug and pharmacological approaches

Non drug approaches, include supportive, cognitive, behavioural or physical methods¹⁶.

The main thrust of this write-up is the pharmacological approach, but often times there is need to combine the different approaches in the management of acute pain^{13,17,18}. This practice has been found to be complementary, thereby bringing physicians closer to optimal care of children with pain¹⁹. Massage therapists, biofeed back technicians, physician-acupuncturists, child-life specialists, psychologists, and physical or occupational therapists can all be used as allies to battle acute pain in children¹⁹.

Pharmacological Approach To Management Of Pain

The optimal approach to pain management in children includes drug therapy, with analgesic drugs being considered the main stay of treatment. The correct use of analgesic drugs will relieve pain in most children and relies on the following four key concepts¹⁸:

- "By the ladder"
- "By the clock"
- "By the appropriate route"
- "By the child"

The correct use of analgesics "By the ladder" concept involves a three-step approach to analgesic, described as an analgesic ladder (Fig. 1). Pain is classified according to this concept as mild, moderate, and severe, and analgesic choices are adjusted accordingly. The sequential use of analgesic drugs is based on the child's level of pain, and the first step in controlling mild pain is a non-opioid analgesic. Paracetamol is the drug of choice for children who can take oral medication. If pain persists, the opioid for mild to moderate pain like codeine should be the drug of choice for the purpose. Children should continue to receive Paracetamol -or a non-steroidal anti-inflammatory drug (NSAID) if appropriate for supplementary analgesia. When an opioid for mild to moderate pain combined with a non-opioid fails to provide relief an opioid for moderate to severe pain should be substituted, again, paracetamol (or NSAID if appropriate) should be continued. Morphine is the drug of choice in this instance.

There should be no hesitation in moving up to the next step of the analgesic ladder if pain control is inadequate, but only one drug from each of the group should be used at the same time. If a drug for

example codeine ceases to be effective, a drug that is definitely stronger (e.g. morphine) should be prescribed, rather than an alternative drug of similar efficacy. When an opioid for moderate to severe pain is used, its dose may be increased until pain is relieved or there are signs of toxicity; an alternative drug from the same category should then be substituted.

The other concept of "by the clock" means that drugs should be administered according to a regular schedule, i.e. "by the clock" rather than on a *pro re nata* (prn) or as required bases. The "by the appropriate route" concept implies that drugs should be administered to children by the simplest, most effective, and least painful route. Analgesics are usually given orally in the form of tablets and elixirs. Intravenous, subcutaneous and transdermal administration may also be appropriate.

Patient controlled analgesic (PCA) is a novel approach to intravenous or subcutaneous administration of drugs; it allows children over 7 years of age to push a button to give themselves "rescue" doses of analgesic for break through pain. A pre-set dose is delivered into an infusion line by a computer driven pump. For safety, there is a timed lock-out period after each dose so that additional doses cannot be delivered before a specified time has elapsed. PCA may be used alone or with concurrent continuous infusion^{20,21}.

The "by the child" concept implies that doses of all medications must be based upon each child's circumstances; there is no single dose that will be appropriate for all children. The goal is to select a dose that prevents the child from experiencing pain, before the next dose is due to be administered.

Many of the available drugs in the developed world are not available in the Nigerian market. And even for most of the new drugs experience with its use in paediatrics is limited because of lack of clinical trials in children. A list of commonly available drugs for the different levels of severity of pain, their mechanisms of action, dosages, route of administration, and side effects are provided (Tables II-IV)^{8,12,18,22-24}.

Table III. Drugs for moderate Pain

Drugs	Dose	Route	Half - life
Codeine	0.5 - 1 mg/kg every 3 - 4 hrs	oral	2.5 - 3 hrs
Dihydrocodeiene (DF118)	0.5 - 1 mg/kg every 4-6 hrs	oral	3 - 4 hrs
Oxycodine	0.2mg/kg every 3 - 4 hrs	oral	2 - 3 hrs

Table I. Pain Measurement Tools¹²

Name	Feature	Age Range	Advantages	Limitations
Visual Analog Scale (VAS)	Horizontal 10cm ruler, subject marks between "no pain" and "worst pain imaginable"	8 yr and older	Good psychometric properties; gold standard	Cannot be used in younger children or those with cognitive limitations
Faces scales (e.g. Wong-Baker, Oucher, Bierl, McGrath scales)	Subjects compare their pain to line drawings of faces or photos of children	4 yr and older	Can use at younger ages than VAS	Choice of anchors affects responses (neutral vs smiling)
Color analog scales	Horizontal or vertical ruler, on which increasing intensity of red signifies more pain	4 yr and older	Can use at younger ages than VAS Converges to VAS at older ages	Cannot be used in toddlers or those with cognitive limitations
Behavioural or combined behavioural-physiologic scales (e.g. GHEOPS, OPS, FACS, NIPS)	Scoring of observed behaviors (e.g. Facial expression, limb movement), heart rate and blood pressure	Some work for any age, some are specific for age groups	Can be used even for infants and nonverbal children	Overrates fear in toddlers and preschool children Underates persistent pain Some measures are convenient; others require videotaping and complex processing
Autonomic measure (e.g. heart rate, blood pressure, or measures heart rate spectral analysis)	Scores changes in heart rate, blood pressure, or measures of heart rate variability (e.g. "Vagal tone")	All ages	Can be used at all ages Useful for patients receiving mechanical ventilation	Nonspecific; changes can occur unrelated to pain
Hormonal-metabolic measures	Plasma or salivary sampling of hormones (e.g. cortisol epinephrine)	All ages	Can be used at all ages	Nonspecific; changes can occur unrelated to pain Inconvenient; cannot provide "real-time" information

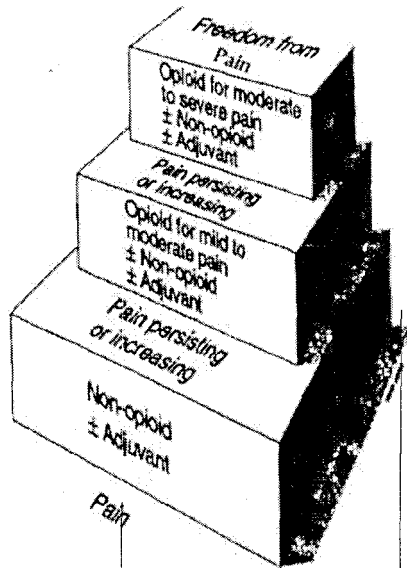


Fig 1. The three-step analgesic ladder.

Table II. Drugs for mild Pain

Drugs	Mechanism of action	Dose	Route	Side effect
Paracetamol	Directly act on the CNS causing a selective depressant action on pain perception	10 -15 mg/kg every 4-6hrs.	orally	Liver damage with prolonged use or overdose.
		20- 30mg/kg every 4 -6hrs.	Rectally	Renal impairment
		Neonate: maximum of 30- 45mg/kg/ 24 hrs.	oral	
NSAID (Ibuprofen, Naproxen, Diclofenac, Ketoprofen)	Inhibit prostaglandin synthesis in peripheral tissues by inhibiting cyclooxygenases (COXs)	Ibuprofen: 10mg/kg every 6-8hours	oral	Gastrointestinal ulceration and hematological side effects like prolong bleeding.
		Naproxen: 5mg/kg every 8- 12 hours	oral	
		Diclofenac Na: 1-3mg/kg/day 2-3 divided doses.	oral	
		Ketoprofen: 2mg/kg every 6- 8hrs	IV/IM Rectally	

[NSAID =Non-steroidal anti-inflammatory drugs]

Table IV: Drugs for severe Pain

Drugs	Dose	Route	Half - life
Pentazocine	1mg/kg every 3-4 hrs.	i.m/sc	3 hrs
	500µg/kg	i.v	
Pethidine	0.5- 2 mg every 3-4 hrs	i.m/s.c	3 hrs
	0.75mg/kg every 2-4 hrs	i.v.	
Morphine	0.05- 0.1mg/kg every 2-4hrs	i.v	2.5- 3hrs
Hydromorphone	0.015 mg/kg every 2- 4 hrs	i.v	2- 3hrs
Methadone	0.1 mg/kg every 4- 8 hrs	i.v	12- 53hrs.

(i.v = intravenous; i.m. =intramuscular; s.c. =Subcutaneous.)

Note on opiate analgesics

Mechanism of action: They act by stimulating opiate receptors in the central nervous system thereby inhibiting the release of excitatory transmitters from terminals of nerves containing nociceptive stimuli.

Side effects: These include constipation, nausea and /or vomiting, pruritus, respiratory depression, confusion and/or hallucination, myoclonus, somnolence, dependence and tolerance. These side effects vary from drug to drug.

Strong opioid analgesics are required to relieve severe pain in children. They provide effective pain relief in the majority of children. They can be used either alone or in combination with non - opioid analgesics.

Tramadol is not recommended in children because safety and efficacy in children less than 16 years have not been established.

CONCLUSION

Pain is an unpleasant sensory and emotional experience with adverse physiological and emotional effects that may produce long term consequences in sufferers. Since pain pathways develops in the intrauterine life, it will be preposterous not to give due attention to pain in neonates. The adequate management of pain in children is an important factor in better outcome of childhood illnesses.

Perhaps a good starting point in the better management of pain in this environment will be to do

an appraisal of the depth of knowledge about pain evaluation and management among child health care providers. Evaluation of the safety and efficacy of newer analgesics in children will also contribute to better management of pain in children. Making these drugs available in the market will also help.

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