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A REVIEW ON ASSESSMENT AND REHABILITATION OF PAIN IN PAEDIATRICS

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ABSTRACT
Pediatric pain assessment is vital for optimal practice in paediatric patient. According to demonstration, the response came as that almost half of them were not using any pain scale in their daily practice. These findings highlighted the need for a new strategy of implementation. Pediatric pain control programmes need to be established by health care professionals. There is no standard or universal approach for pain management.[1]

KEYWORDS: Pain; pediatric patient; pain management; pain scale; pain control programmes.

INTRODUCTION

International Association for the Study of Pain (IASP) defines Pain as "an un-pleasant sensory and emotional experience associated with actual and potential tissue damage". It has also been defined as "existing whenever they say it does rather than whatever the experiencing person says". Pediatrics are the most under treated and presented to hospital for pain compared to adults; because of the wrong belief that they neither suffer pain nor they remember painful experiences .It is most difficult to assess and treat pain in paediatric age as compared to adults.[2] However, the treatment of pain in childhood is similar to the adult management practice which includes pharmacological and non-pharmacological interventions. On the other hand, it critically depends on in-depth understanding of the developmental and environmental factors that influence nociceptive processing, pain perception and the response to treatment during maturation from infancy to adolescence. Although the principles of pain evaluation and management apply across human lifespan, infants and children present unique challenges that necessitate the consideration of child's age, developmental level, cognitive and communication skills, previous pain experiences, and associated beliefs and i.e. why perception of pain in pediatrics is complex which entails physiological, psychological, behavioral, and developmental factors and it lead to the setting of numerous age related pain.[3]

In paediatric patients, if it is left undiagnosed for a period of time, it reduces quality of life of the patient imposing dreadful impact on family and careers which may lead to increased rates of hospital admission.[4]

Health care professionals' who care for children are mainly responsible for abolishing pain and suffering upto the extent possible. The lack of ability to notice pain, immaturity of remembering painful experiences and other reasons are the reflection of persistence of myths related to the infant's ability to perceive pain.[5]

For pediatric patients present in the emergency department, medical procedures are often painful, unexpected, and heightened by situational stress and anxiety leading to an overall unpleasant experience.[6] Before ongoing to the fact that how can we manage pain in children, first we must be reliable about how to assess the root cause of it. And for accomplishing this work various Pain Assessment Tools have been designed. It is found difficult for health care professionals to foresee which measurement systems apply for adequate measurement of pain in the pediatric population.[7] The practice of pediatric pain treatment protocol has made great progress in the last decade with the development and validation of pain valuation tools specific to pediatric patients. Almost all the major children hospitals now are dedicating pain services to provide evaluation and immediate treatment of pain in any child.[8] Practical methods are often prefered by health care professionals, which reliably track the child's pain experience and pain control over time whereas researchers tend to focus on tools, which are meticulously proven for reliability with different observers. There are various barriers to pain management in children which include inaccuracies regarding pathophysiological mechanisms of pain with statements such as "children do not feel pain the way adults do", fears regarding the use of pharmacological agents and deficits in knowledge of methods of pain assessment.[9] These myths along with other factors such

as personal values and beliefs, prevent adequate identification and alleviation of pain for all children . Paediatrics requires special attention to be paid at their developmental stage. The experience of pain and coping strategies from developmental perspective is also limited. In this paper, our aim is to address potential sources of pain measurement, and responses to pain control and distraction based on pediatric developmental stages.[10]

Pharmacological pain management will not be discussed, as it is beyond the intended scope of this article.

Classification of pain: Pain can be classified to various types according to different categories which are shown here.

1. Patho physiological pain : It is of two types
1.1 Noc iceptive pain:- It occurs due to the activation of pain receptors (nociceptors) which are sensitive to noxious stimuli. These receptors respond to different stimulus and chemical substances such as oxygen deprivation, tissue disruption and inflammation. It can be somatic or visceral based on site of activated receptors.
1.2 Neuropathic pain:- It arises due to abnormal processing of peripheral and central nervous system.
2. Based on Etiology: It is of two types:
2.1 Non-Malignant:- Pain due to chronic case of specific anemia, chronic musculoskeletal pain, neuropathic pain and visceral pain. Rehabilitation is the main treatment.
2.2 Malignant:- Pain which occurs in life-limiting diseases such as HIV/AIDS, Parkinsonism,chronic obstructive pulmonary disease, end stage organ failure, multiple sclerosis cancer and congestive heart failure. Treatment protocol is to diminish symptoms.
3. Based on duration: It is of two types
3.1 Acute pain:- *Acute pain* is pain of sudden onset, lasting for hours to days and disappears once the underlying cause is treated. It has a clear cause. It could result from any illness, trauma, surgery or any painful medical procedures.
3.2 Chronic pain:- *Chronic pain* is the pain that starts as an acute pain and continues beyond the normal time expected for resolution of the problem or persists or recurs for various other reasons. It is not therapeutically beneficial to the patient.

4. Based on location
When pain is classified according to body site (e.g. on head, on the back or neck) or it can be the anatomic function of the affected tissue (e.g. vascular, rheumatic, myofascial, skeletal, and neurological). It does not provide a background to resolve pain, but it can be useful for differential diagnoses.[12,13]

Pain Assessment Tools: Pain assessment is critical to optimal pain management interventions. It is difficult to measure pain accurately in children. There are three main methods currently used to measure pain intensity: self report, behavioral, and physiological measures. Self-report measures are optimal and most valid. Both verbal and nonverbal reports require a certain level of cognitive and language development for a child to understand and give reliable responses. Children's ability to describe pain increases with age and experience, and changes throughout their developmental stages. Behavioral methods consist of assessment of crying, facial expressions, body postures, and movements. They are more frequently used with neonates, infants, and younger children where communication is difficult. Usually they are detected with the help of various different types of tools designed.

Pain assessment tools help in evaluation of reported pain and factors that alleviate or exacerbate it, as well as the response to treatment of pain. Intensity of pain is often assessed by pain scales. Physiological measures include assessment of heart rate, blood pressure, respiration, oxygen saturation, palmer sweating, and sometimes neuroendocrine responses. They are generally used in combination with behavioral and self-report measures, as they are usually valid for short duration acute pain and differ with the general health and maturational age of the infant or child. There are numerous scales but the most common used are Neonatal Facial Coding System (NFCS) and the Neonatal Infant Pain Scale (NIPS). Other scales used in infants are composite measurement scales, meaning they use a combination of behavioral and physiological measures. Some scales also take into consideration gestational age and general behavioral state of the infant. Examples of some of these scales are The Premature Infant Pain Profile (PIPP), Crying Requires Increased Vital Signs Expression Sleeplessness (CRIES), and the Maximally Discriminate Facial Movement Coding System.

Neonatal Facial Coding System (NFCS):- Used to monitor facial actions in newborns and was developed at the University of British Columbia, and the British Columbia children's hospital. The system focuses at eight indicators to measure pain intensity: brow bulge, eye squeeze, nasolabial furrow, open lips, stretched mouth (horizontal or vertical), lip purse, tout tongue, and chin quiver. The indicators are then recorded on videotape, coded, and scored. This scale has been proven reliable for short duration, acute pain in infants and neonates.

Neonatal Infant Pain Scale (NIPS). It was developed at the Children's Hospital of Eastern Ontario & is a behavioral assessment tool to measure pain. The scale takes into account pain measurement before, during and after painful procedure, scored in one-minute intervals. The indicators include: face, cry, breathing pattern, arms, legs, and state of arousal. Results are obtained by summing up the scores for all the six indicators (where 0 indicates no pain, and 2 indicates pain), with a maximum sore of 7.

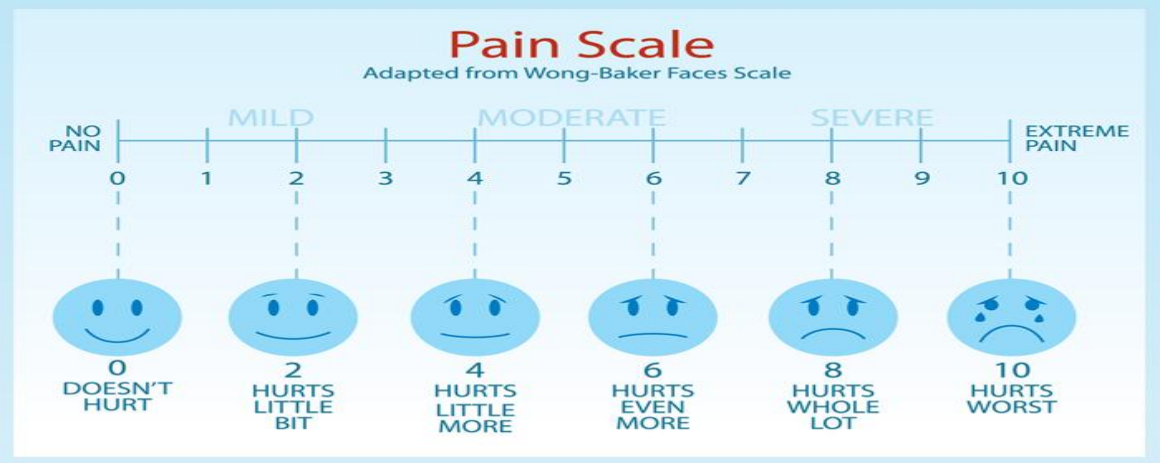
The Premature Infant Pain Profile (PIPP): It is a 7-indicator composite measure that was developed at the

University of Toronto and McGill University to diagnose acute pain in preterm and term neonates. It has been validated in studies using synchronized videotaping of infants passing through painful procedures. The indicators include (1) gestational age, (2) behavioral state before painful stimulus, (3) change in heart rate during stimulus, (4) change in oxygen saturation, (5) brow bulge during painful stimulus, (6) eye squeeze during stimulus, and (7) nasolabial furrow during painful stimulus. Scoring is initially done before painful procedure. Firstly the infant is observed for 15 seconds and vital signs recorded. They are then observed for 30 seconds during the procedure where physiological and facial changes are recorded and scored. The score range from 0–21, with the higher score indicating more pain. This is is however burdensome and time consuming for clinical purposes, especially in the emergency department, and its use for intubated neonates.

Crying Requires Increased Vital Signs Expression Sleeplessness (CRIES):- It is an acronym for five physiological and behavioral variables proven to indicate neonatal pain. It is commonly used in neonates in first month of life. It was developed at the University of Missouri and may be recorded over time to monitor the infant's recovery or response to different interventions. CRIES looks at five parameters: (1) crying, where high pitched cry is usually associated with pain, (2) increased oxygen requirements, as neonates in pain show decrease oxygen saturation, (3) facial expression where grimacing is the expression most associated with pain, (4) vitals signs, which are usually assessed last as to not awaken or disturb the child, and (5) sleeping patterns where increased sleeplessness is associated with pain. Indicators are scored from 0–2 with maximum possible score of 10,a higher score indicating a higher pain expression.

Maximally Discriminate Facial Movement Coding System (MAX). It is used in infants to assess emotions associated with facial expression. Indicators used are brow, eye, and mouth movements. MAX provides a system for measuring emotional signals, and also identifies nine fundamental emotions: interest, joy, surprise, sadness, anger, disgust, contempt, fear, and physical distress or pain. The scoring entails 68 MAX number codes, each representing different facial expression. The description of the expression of each number code is based on anatomically possible movements of the facial muscles and is a description of what the face looks like when the movements have taken place. Critical studies argue that it only includes measurements that are said to correspond with emotions and does not differentiate between anatomically distinct facial movements (inner and outer brow raise).

Faces Pain Scale. Developed by Wong and Baker and is recommended for children ages 3 and older. This scale requires health care professionals to point to each face and describe the pain intensity associated with it, and then ask the child to choose the face that most accurately describes his or her pain level. Most pain rating scales use faces that portray degrees of distress are divided into two categories: those starting with neutral face as the "no pain" indicator and those with a smiling face.[18] According to results children exposed to smiling scale had considerably higher pain scores in the no pain categories and lower scores for positive pain than children who used the neutral faces scale. A study by Chambers and colleagues indicated that children's pain ratings differ depending on the types of faces scale used, and that faces scales with smiling faces may lead to confusion of emotional states with pain ratings.



The Child Facial Coding System (CFCS). It is adapted from the neonatal facial coding system and is developed for use with preschool children (aged 2–5 years). Scale consists of 13 facial actions: brow lower, squint, eye squeeze, blink, flared nostril, nose wrinkle, nasolabial furrow, cheek raiser, open lips, upper lip raise, lip corner puller, vertical mouth stretch, and horizontal mouth stretch. They are found useful with acute short-duration procedural pain.

Visual Analogue Scale (VAS): is a horizontal line, 100mm in length, attached to word descriptions at each end, "not hurting" or "no pain" to "hurting a whole lot" or "severe pain". The patient are asked to mark on the

line the point that they feel represents their pain at this moment. A color analogue scale can also be used, where darker & more intense colors (i.e., red) represent more pain.[11,17,18]

- **Assessment:** Position. Where is the pain
- Cuality. what does the pain feel like?
- Radiaton. Does the pain move anywhere?
- Severity. Rate the pain on a scale between 0 and 10.
- Timing. when did the pain start.
- Aggravating factors. What makes it worse?
- Alleviating factors. What makes it better?
- Associated symptoms. e. g. nausea

Minimizing pain during procedures: Non-Pharmacological methods

Pain is the fifth vital sign reported and is one of the most frequent complaints presented in paediatric emergency which itself is a very stressful place for them. Organized and routine pain assessment using the standardized and validated measures is accepted as a corner stone for effective pain management in patients, unrelatedly to the age or other conditions. Its important for health care providers to follow a child centered or individual approach in their assessment and management of pain and painful procedures. This approach promotes the right of child to be fully involved in the procedure, to choose, associate, and communicate. It allows freedom for the children to think, experience, explore, question, and search for answers, and allows them to feel proud for doing things for themselves. It is essential to focus on a child rather than the procedure and avoid statements such as "let's just get it over with". (23) The child and family should be active participants in the procedure in fact, allowing parents or family members to act as positive assistants rather than negative restraints will help to reduce stress in both children and parents and minimizes the pain experience. It is also essential to ensure that all procedure are truly necessary, and can be performed safely by experienced persons. Ideal procedures should be done in a child-friendly environment, using appropriate pharmacologic and non-pharmacologic interventions with routine pain assessment and reassessment.

- **Distraction** helps your child learn to focus his or her attention on something other than pain. Distraction includes activities such as painting, playing board or video games, or watching TV. Visiting with friends or playing with animals may also be a form of distraction.
- **Cognitive Interventions**. They are mostly used with older children to direct their attention away from procedure-related pain (e.g., counting, listening to music, non procedurerelated talk).

1. Guided imagery teaches your child to imagine a picture in his or her mind. Your child learns to focus on the picture instead of his or her pain. It may help your child learn how to change the way his or her body senses and responds to pain.
2. Music may help lift your child's energy levels and mood. It may help reduce pain by triggering the release of endorphins. Endorphins are natural body chemicals that decrease pain. Music may help take your child's mind off his or her pain. Help your child pick songs that make him or her happy, calm, or relaxed. You may play your child's favorite songs just before a procedure or when he or she is in pain. Music may be used with any of the other techniques, such as relaxation and distraction.
3. Hypnosis or hypnotherapy may help your child block out pain and other distractions.

- **Behavioral Interventions**. They are methods used to guide the child's attention away from procedure-relatedpain. (e.g., videotapes, games, interactive books).

1. Physical therapy helps your child with exercises to improve movement and strength, and decrease pain.
2. Positive reinforcement involves praising your child for being brave during a procedure or surgery, or while healing from an illness. Rewards, such as toys, games, or stickers, may also be used.
3. Relaxation exercises teach your child to breathe in deeply until his or her stomach rises a bit and then breathe out slowly. To relax muscles, the exercises teach your child to tense his or her muscles and then relax them. Guide your child through this exercise starting from foot muscles, slowly going up the leg. Then move to the muscles of the middle body, arms, neck, and head.
4. Modeling positive coping behaviors. The child may watch another child or any adult going through the procedure, and rehearse these behaviors.

➢ Other techniques used are :

- **A transcutaneous electrical nerve stimulation (TENS)** is a portable, pocket-sized, battery-powered device that attaches to your child's skin. It is usually placed over the area of pain. It uses mild, safe electrical signals to help control pain.(15)
- **Heat** helps decrease pain and muscle spasms. Apply heat to the area for 20 to 30 minutes every 2 hours for as many days as directed.
- **Ice** helps decrease swelling and pain. Ice may also help prevent tissue damage. Use an ice pack, or put crushed ice in a plastic bag. Cover it with a towel and place it on the area for 15 to 20 minutes every hour or as directed.
- **Massage therapy** may help relax your child's muscles and decrease pain

Pharmacological Treatment: Multimodal analgesia practice should be considered in patient with pain by concomitant use of the opioids, NSAIDs and other adjuvant therapies Depending on severity of pain, non-opioids and opioids are the most common analgesic agents used as a "step-wise" approach in management of pain in both children and adults.

Non-Opoids Used for Management of Pain in Pediatrics

Acetaminophen is the most frequently used pain relieving agent in pediatric patients. It has lack of significant side effects and has excellent safety profile with benefit to all levels of pain in children. According to common guideline of different institutions, initially a

loading dose of 30 mg/kg should be given, then 10-15 mg/ kg every four to six hours as maintenance with maximum dose of 90 mg/kg/day for children. But, for neonates of less than ten days 60 mg/kg and 45 mg/kg for premature infants. Neonates have a slower clearance rate that's why the drug must be given less frequently.It is manly used for mild to moderate pain independently and in combination of opioids for patients with severe pain for example acetaminophen with codeine. Rectal preparations of this analgesic is used for infants and toddlers who are unable or unwilling to take orally. However, several studies have proved that rectal absorption is comparatively inefficient and slow. (20)

Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

NSAIDs are commonly used analgesics with less contraindication in relation to opioids. Mainly these are used as analgesic regimen in mild to moderate pain by preventing the conversion of arachidonic acid to prostaglandins and thromboxane. Prostaglandins are pro inflammatory mediators that sensitize nociceptors to alleviate afferent nociceptive signal to pain. Diclofenac, ketoprofen and ibuprofen arecommonly used NSAIDs in pediatric practice. An observational study on the use of (NSAIDs) was done in a sample of 51 patients in Italy which resulted that ibuprofen was the most (68.6%) used NSAID followed by ketoprofen 9.8% and acetylsalicylic acid 7.8% for pain management of in pediatrics. The use of NSAIDs is now well established in clinical pain management in patients.

Opioids

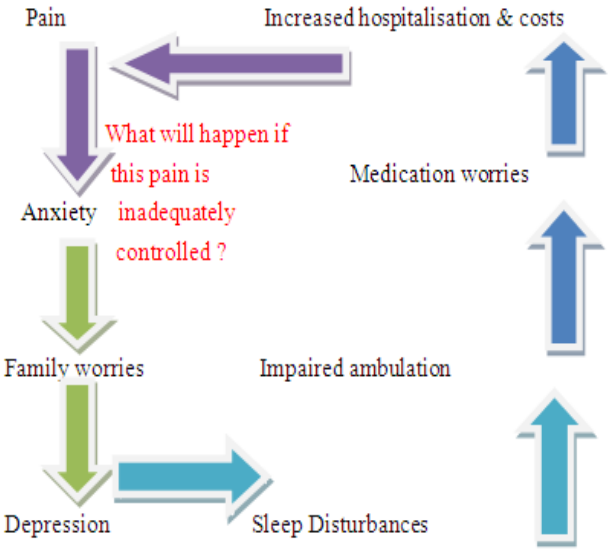
Likewise adult population, management of acute pain in pediatric is also targeted with opioids. The analgesic effect comes through binding the mu-opioid receptor which is widely distributed at sites of the peripheral inflammation and throughout the CNS. The variation in pharmacological response of opioids in pediatrics leads to dose adjustment based on clinical response, age and presence of side effects. Indications for opioids include postoperative pain, pain due to sickle cell disease, and pain due to cancer]. According to a study in the Canadian teaching hospitals confirms that opioids are mainly used in severe pain and shows an improvement in all patients from the their experience of severe pain received an opioid treatment.[16]

Morphine: It is the most commonly used phenanthrene derivative opioid in children present with severe pain. Pharmacokinetics disparity exists for this drug between age groups because the plasma concentrations of morphine in neonates and infants display a prolonged half-lives (2-3fold) difference even after administration of constant infusion.[21]

Codeine: It is a prodrug which is activated to morphine by the enzyme cytochrome CYP2D6. However, activity of this enzyme is highly variable and shows inter-individual variation which leads to a variation in analgesic effect of codeine.[23]

Tramadol: It is structurally related to that of morphine which has a central analgesic effect by the formation of O-desmethyl-tramadol with a mu-opioid receptor affinity 200 times greater due to biotransformation in the liver by cytochrome P450. A dose of 50–100 mg every 4 hours to a maximum of 400 mg per day is recommended to children between 12–18 years. However, now a day's tramadol is not recommended for pediatrics under 12 years of age.[24]

Pain Worsening Effects



CONCLUSION

Although there is an huge devastating amount of data regarding effective paediatric pain assessment and management, it is often not being effectively applied. Numerous clinical practice guidelines have been published during last decade. Current studies demonstrate that pain management in children remains undertreated. It is the responsibility of health care professionals to educate their peers and advocate for appropriate pain treatment in children as improved management is contingent and reliable for measurement of pain. It is a difficult task to assess pain in children still we are having excellent paediatric pain measures which are also classified further according to age group. Assessment tools are a plus point for the health care professionals in managing it and serve as a great source of help. It is very much difficult to diagnose and evaluate pain in some age groups such as infants, children with disabilities but got that new policies and guidelines for paediatrics.[14,22]

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