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PAEDIATRIC PAIN MANAGEMENT:- A LITERATURE REVIEW

Dr. Jagdish Dubal*

Assistant Professor, Department of Paediatrics, Gujarat Adani Institute of Medical Science, Bhuj, Gujarat.

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***Correspondence for Author**

Dr. Jagdish Dubal

Assistant Professor, Department of Paediatrics, Gujarat Adani Institute of Medical Science, Bhuj, Gujarat.

ABSTRACT

Good quality, effective management of pain in paediatric patients is an essential component of paediatric anesthesia. However, achieving this can be difficult for a variety of reasons that occur physiologically and psychologically throughout the range of ages encountered in the paediatric population. The main causes of acute pain in children are from procedures, surgery, trauma and acute medical illness. the aim of procedure related pain management is to minimize pain, physical discomfort and psychological distress. With regards to procedure related pain, both pharmacological and non-pharmacological methods need to be utilized. The choice of pain management technique will depend on the type of pain, its expected duration, developmental stage of the child, the pain management techniques available and the child's location. Multiple pharmacological therapies are available but as for adult practice, multi-modal analgesia should be used whenever possible. Local guidelines and protocols significantly aid the delivery of quality pain management and should be developed, implemented and audited to ensure optimum analgesia.

KEYWORD: Paediatric Pain, Etiology, Physiology, Management.

INTRODUCTION

Children are a special patient group for a number of reasons. Young children, neonates and infants in particular, have significant anatomical, physiological and psychological differences compared with adults.[1] Developmental issues influence all aspects of the child's pain experience, including biological responses, language and communication, comprehension, and choice and effectiveness of pain management techniques. The long-term effects of repeated acute pain and the impact of analgesic drugs on the developing nervous system are

issues of considerable concern that must also be taken into account when developing a pain management strategy for a child.[2]

Pain is very common in children. There is a vast array of complaints that increase with age. Common complaints include headaches, recurrent abdominal pain, recurrent musculoskeletal pain, back pain, chronic leg pains, spasticity-related pain, CRPS, Perthes disease and juvenile rheumatoid arthritis. In a study of 5,000 school children by Perquin et al. (2000), over 50% of the children surveyed had had pain in previous 3 months, half in multiple sites and 25% had chronic pain defined as pain present on most days for three months or more. Chronic pain was most frequent in 12-15yr olds with an incidence of 33%. Pain intensity was higher in those children who complained of multiple pains, chronic pain and in girls.[3]

Good quality, effective management of pain in paediatric patients is therefore an essential component of paediatric anaesthesia. However, achieving this can be difficult for a variety of reasons not least of which is the enormous variations that occur physiologically and psychologically throughout the range of ages encountered in the paediatric population. Firstly, some of the developmental neurobiological issues will be considered.

Development of Pain Pathways[3, 4]

All neural pathways required for nociception are present from birth and are also functional in premature neonates. However, many molecules, neurotransmitters and receptor-mediated systems are variably expressed depending upon developmental age. As a result, a noxious stimulus may provoke different patterns of activity dependent on the stage of maturity of the paediatric central nervous system. In the peripheral nervous system, C-fibres are mature in neonates although their cortical connections at the level of the dorsal horn are immature. However, interestingly, at the same stage A-Beta fibres show extended connections within the spinal cord that can produce nociceptive signalling from lower intensity stimuli. These A-Beta fibres only recede once C-fibres have matured. The result of this observation is that there is far less discrimination between the perception of noxious and non-noxious stimuli in the paediatric patient. Furthermore, and of added clinical importance, is that inhibitory pathways are not fully developed in the spinal cord during early life. The combination of widened receptive fields, lower sensory discrimination and reduced inhibitory pathways results in the immature nervous system in paediatric patients experiencing more pain in response to noxious stimuli and not less as was previously believed.

Aetiology of Paediatric Pain

The main causes of acute pain in children are from procedures, surgery, trauma and acute medical illness. Each of these has its own particular considerations but nonetheless, regardless of the cause of pain, a number of general factors are important and should be considered in all circumstances to aide successful pain management.[5] These include education of staff involved in caring for the patient, pain assessment, anticipation of pain, provision of a calm environment and the inclusion of parents.

Procedure related pain

The pain associated with planned medical procedures can be distressing for the patient, parents and medical staff.[6] Unlike acute pain of other causes, procedure related pain often involves a strong element of anticipation. Multiple procedures are frequently required and uncontrolled pain at the time of the first procedure can adversely affect the level of pain and distress experienced on subsequent occasions. Therefore, the aim of procedure related pain management is to minimize pain, physical discomfort and psychological distress. With regards to procedure related pain, both pharmacological and non-pharmacological methods need to be utilized. Firstly, a number of simple non-pharmacological strategies should be employed to successfully manage paediatric patients in this situation. Prior to any planned procedure both child and parent should be adequately prepared as to what procedure is planned and how this will be conducted. The child should be provided with age and developmentally appropriate information about the procedure and what sensations to expect.[7] Engaging with parents and gaining their confidence is essential in the preparation of children for a procedure as they can provide additional information and reassurance to the child. This can be further aided by giving older children a chance to ask any questions and younger children the opportunity to act out the procedure with a toy medical kit It is preferable that any planned procedure should take place in a dedicated treatment room in a comfortable, calm and friendly environment. Ideally all staff should have knowledge of simple, effective coping strategies to use with children of any age. Staffs experienced and trained in psychological techniques such as Play Therapists have an important role in this regard. Equipment for distraction should be available. This includes toys, interactive books, puppets, bubbles and electronic games that will quickly distract the child and hold their attention. A variety of pharmacological methods and techniques are available and include the use of analgesia with or without sedation.[8] The exact method chosen depends on a multitude of factors such as the nature of the planned procedure, age (physiological and developmental)

of the child and experience of the responsible Anaesthetist. Some commonly used analgesic techniques utilise topical anaesthesia, local infiltration, peripheral nerve blockade, Bier's block, nitrous oxide, ketamine or intra-nasal fentanyl. Regardless of the technique chosen monitoring is mandatory and emergency equipment should be readily available.[9]

Post-operative pain

Post-operative pain should be discussed pre-operatively with the carers and, where appropriate, with the child. The aim of pain management in this setting is to control pain as early as possible and therefore the initial choice of drug and dose should be appropriate and titrated to response.[10] Early and preventative treatment is more effective resulting in better pain control and less distress. Regional anaesthetic techniques are commonly utilized in this setting and will be discussed in a separate article.[11] As with post-operative pain management in adults, paediatric pain management includes the principles of multi-modal analgesia whereby different classes of drug are utilised to gain maximum effect. Analgesic treatment should include proper dosing according to body weight, physiologic development, and the clinical situation. Dosages and the interval between doses should be adjusted based on the assessment of the patient's response.

Trauma

Trauma related pain should be addressed in the emergency department as part of initial assessment and treatment. The complex clinical issues present at the time of admission will determine pain management, including choice of drug, dosage, route and mode (continuous vs intermittent).(10) These must be tailored to the requirements of the individual patient and the nature of the injury involved. Morphine is still the most commonly used first line analgesic for severe pain and can be administered incrementally up to a dose of 0.1mg/kg. However, it should be realised that a higher dose than this may be required to achieve adequate pain control. Other important therapies in the emergency setting include the use of topical anaesthesia, inhaled 50% N20/ 50% 02, IV regional anesthesia and inhalational or transmucosal opioids have all been used to good effect.[12]

Types of pain[13]

As in adults, pain in children can be classified into several subgroups.

Acute pain includes

- Disease-related pain.
- Treatment-related pain e.g. i.v. cannulae, NGTs, invasive monitoring.

- Procedural pain e.g. bone marrow and other biopsies, lumbar puncture, radiology procedures, investigations.
- Acute recurrent pain in cancer pain and burn pain.

Treatment-related pain is particularly important in children and must be treated effectively. Poorly managed procedures sensitise children for future procedures so that they are more anxious and pain management more difficult.

Chronic/persistent pain includes

- Chronic disease e.g. juvenile rheumatoid arthritis, inflammatory bowel disease.
- Complex regional pain syndrome.
- Neuropathic pain e.g. spinal cord or nerve injury.
- Recurrent abdominal pain.
- Headache.
- Somatisation disorders.

Pain assessment[14]

Sensible pain management should be based on and directed by pain assessment. However, pain assessment in children is not necessarily straight forward. There are a number of factors that have variable impact. These include.

1. The type of pain

- Acute, recurrent acute, persistent/chronic
- Planned, unplanned
- Clinical or experimental
- Disease-related
- Treatment-related: procedural, post-operative

2. Who is reporting- the child, the parent, the health professional, other outside observers

3. Assessment tools available for children

Gold standard still self report. However this is not easily obtained for pre- or non-verbal children, seriously ill children in NICU or PICU

Techniques- a combination may be required

i. Behavioural
ii. Physiological
iii. Self report

Specific tools- numerous tools are available depending on the developmental age of the child and their situation. Some examples include:

i. FLACC
ii. Wong Baker Faces
iii. Pain thermometer
iv. Numerical rating scale
v. Visual Analogue Scale

4. Child factors
5. Situational factors
6. Interactions with healthcare professionals

Pain Management Techniques[15,16]

The choice of pain management technique will depend on the type of pain, its expected duration, developmental stage of the child, the pain management techniques available and the child's location (home, community or hospital). A combination of bio-behavioural and pharmacological techniques is generally recommended.

Bio-behavioral techniques

There is a wide variety of techniques available. Many can be performed by children themselves or with coaching from parents or health care professionals and vary from very simple to those based on cognitive-behavioural techniques and requiring formal training. Psychological preparation of the child and education of the child's parent or carer can enhance the use of these techniques and potentially reduce the amount of pharmacological treatment necessary.

Techniques include

- Blowing bubbles.
- Reading stories.
- Listening to favourite music.
- Deep breathing.
- Progressive relaxation.
- Meditation.
- Guided imagery.

- Hypnosis.

Pharmacological techniques

Medications available for adults are the mainstay of pain management in children as well. However, problems arise in using new medications coming on to the market as many pharmaceutical companies still do not provide evidence of efficacy in the paediatric population so the drug cannot be licensed for use in children. As a result, children are often called "therapeutic orphans" and, some drugs may be used off-licence. In addition, drug formulation is often focused on the adult consumer so the drug may require serial dilution or fractional drug calculations that increase the risk of drug administration errors in paediatric patients.

Before deciding on which medication is appropriate for a given situation, developmental aspects affecting the pharmacodynamics and pharmacokinetics of analgesics must be considered. Immaturity of hepatic enzyme systems, lower renal blood flow, glomerular filtration and tubular secretion as well as differences in body composition, especially body water, in the neonate result in reduced clearance of many drugs. Children two to six years old have higher rates of drug metabolism by cytochrome P-450 related to the larger liver mass per kilogram body weight compared with adults. This may result in faster drug clearance and have an affect on dosing intervals. There are also age-related changes in protein binding of drugs and brain lipid content that affect drug partitioning from blood to CSF independent to the permeability of the blood-brain barrier. Genetic variations in drug metabolism can also affect children.

Medication choice will be influenced by route of administration, the child's ability to take a particular formulation (e.g. syrup or tablets), and the availability of a suitable formulation and equipment. The principles of multimodal analgesia apply to children similarly to adults. Simple analgesics such as paracetamol and NSAIDs are used for mild to moderate pain. Codeine phosphate is often added for moderate pain as it is available in a syrup formulation. However, the availability of oxycodone and tramadol (not licensed for use in children under 12 years) in a liquid formulation has provided more choices and more effective analgesia for moderate pain. Severe pain requires the addition of opioids. Morphine and fentanyl are commonly chosen. Pethidine is not recommended for more than a few single doses over 24 hours due to the potential accumulation and toxicity of its active metabolite, norpethidine. Intravenous boluses of morphine are commonly prescribed for postoperative pain or trauma.

However, for severe pain that is expected to last for more than a few hours, intravenous infusion of an opioid will be required. This can be by continuous infusion or patient-controlled analgesia. Children are quite capable of using patient-controlled analgesia from the age of 5 or 6 years old, depending on their ability to understand the technique. For younger children or children not able to press the PCA button, nurse-controlled or parent-controlled analgesia may be suitable.

Special groups

Pre-verbal children including neonates and premature infants, non-verbal children including those with disabilities who cannot communicate verbally or have limited language, children with serious illness, especially those in intensive care units and children for whom English is a second language may provide particular challenges in pain assessment and management demanding innovative approaches.[17, 18]

CONCLUSION

Paediatric pain management is a challenging area of anaesthesia and pain medicine. There are a multitude of reasons for this including the diverse range of developmental and physiological changes that occur throughout childhood, a lack of education and awareness of the importance of pain management and regular pain assessment. Multiple pharmacological therapies are available but as for adult practice, multi-modal analgesia should be used whenever possible. Local guidelines and protocols significantly aid the delivery of quality pain management and should be developed, implemented and audited to ensure optimum analgesia.

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