PAIN FREE
PROGRAM
Transformasi Konsep Rawatan
Pelanggan Bebas Kesakitan

PAEDIATRIC PAIN MANAGEMENT GUIDELINES

Ministry of Health Malaysia
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Paediatric Pain Management Guidelines 2023

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FOREWORD

First and foremost, I would like to thank the Editorial Board and it is my pleasure to write the foreword for the Paediatric Pain Management Guidelines.

In paediatric population, Pain is frequently under-recognised and inadequately treated. Improved education and training of health care providers can positively impact the management of pain in children.

Th purpose of this guideline is to provide a practical clinical approach to the management of whether acute or chronic pain in the paediatrics population.

The publication of this Paediatric Pain Management Guidelines will become an important reference for our health care providers. My hope this will become a useful tool to aid clinicians in the safe and effective treatment of pain in children. Commitment and dedication of healthcare providers are essential in ensuring children have access to the safest, most effective pain relief possible during all phases of their illness or injury.

I sincerely hope that we will continue to provide the best and up to date guidelines for our clinicians to ensure the best quality of care is delivered to our paediatric population especially on pain management.

Dato' Dr Asmayani Khalib
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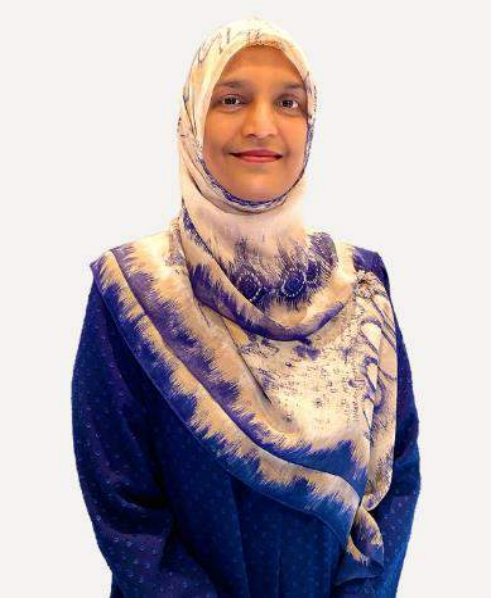
January 2023

PREFACE



Pain Free Program (PFP) initiative was launched by Minister of Health in 2008 which is inclusive of Pain as 5th Vital Sign (P5VS) and Pain Free Hospital (PFH). Pain as 5th Vital Sign (P5VS) is implemented for all health care facilities. Whereas Pain Free Hospital Certification is for hospital with specialist. The publication of this Paediatric Pain Management Guideline is an effort to focus on a more holistic approach on pain management for Paediatric patients for procedural pain, acute pain, cancer pain, chronic pain, in neurological impaired, in burns, and neonatal pain on top of the other guidelines and manuals provided.

Infants and young children can and do feel pain, untreated pain in children can have negative impacts for short and long-term consequences. Therefore, pain in children need to be recognised and managed. We must treat children's pain effectively to ensure fast recovery. Multimodal pain management, pre-emptive approach and involvement of non-pharmacological techniques is the key to ensure optimum pain management.

Paediatric pain should be understood and provide the basis for professional and parental education in pain management to improve the current work flow, that are essential to yield best practice in paediatrics pain management. This is where this comprehensive guideline come into place to help clinicians, nurses and other healthcare workers to have a better grasp in pain management focus on our young ones. Lastly, I would like to thank my Pain Free Program committees and contributors in their support and patience throughout the process of producing this Paediatric Pain Management Guideline.

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Chapter 1: Introduction to Paediatric Pain

1.1 MYTHS AND FACTS OF PAEDIATRIC PAIN

Any person including infants and children can experience pain. In the past, infants and children were thought to be unable to feel pain because they have an underdeveloped or immature central nervous system. As a result of this belief, pain in young infants and children have been traditionally under-recognised and hence poorly treated and managed.

However, scientific studies have now proven that pain pathways are already developed in foetuses by mid gestation, and that even premature babies have the capacity to feel and respond to pain. In addition, infants and young children are likely to feel more (and certainly not less) pain than adults as they tend to have a more robust inflammatory response and less of a central inhibitory influence.

Myths of pain in infants and children
Babies do not feel any pain as the nervous system is immature
Pain in infants and children is less than in adults
Infants have no memory of pain experiences in early life
Children will get used to pain
Pain helps builds character in a child
Children's explanation of pain experiences is unreliable
Opioid analgesics are dangerous and children may become addicted

1.2 CURRENT STATE OF PAEDIATRIC PAIN

Pain is often the leading symptom for a child's visit to the doctors. And yet, despite our advances in the understanding of pain in children, pain management among children presenting to hospital remains suboptimal. Children are often given minimal or no analgesia for procedures or conditions that would otherwise be aggressively treated in adults. Even when children are given analgesia, it is often inadequate. There seems to be a disturbing relationship between the age and analgesic prescription; the younger the child, the less likely they will be given adequate analgesia.

1.3 BARRIERS TO PAEDIATRIC PAIN MANAGEMENT

Multiple factors contribute to the challenges faced when assessing and managing pain in children and infants. These include:

- Children are often unable to communicate accurately on the location or severity of their pain
- Parents and children are sometimes reluctant to report pain
- There are wide varying physiological, cognitive, and developmental differences between the wide age groups
- Health care providers often have fears of side-effects of medication and its' potential effects on the developing brain
- Some health care workers may not be familiar with the dosages or have little experience with these analgesics
- Drug pharmacology varies with different ages

1.4 IMPORTANCE OF ASSESSING AND MANAGING PAEDIATRIC PAIN

Despite these challenges and difficulties, health care providers should not be dissuaded from assessing or managing pain properly. This is because firstly, it is only humane to treat pain. Secondly, untreated, or improperly treated pain in children can lead to a magnitude of negative impacts, both in the immediate and long-term period.

Immediate effects of pain	
Physiological	**Psychological**
Increase in heart rate and blood pressure, cardiac output, oxygen consumption, respiratory rate and reduction in oxygen saturation Reduced immune response Increased stress hormones and blood sugar levels Reduction in gastric and gut motility Increased muscle tension, spasm and fatigue Poor healing Disrupted sleep cycles Poor growth and development	Fear Anxiety Helplessness and depression Anger

Pain which is not recognised in the acute phase can become established and severe, which then makes it more difficult to control. This unrelieved pain may cause negative physical and psychological consequences leading to impairment in the child's function and quality of life. They may have prolonged hospital stay with resultant service and cost implications.

Pain in early life (e.g. in a premature baby) can have long lasting impact into adulthood. This is because pain in the very young can cause structural and physiologic changes to the developing nervous system which results in lifelong abnormal responses (lower pain threshold and central desensitization) to not only noxious and but also non-noxious stimuli.

Long term effects of pain	
Affects future pain processing	• Lifelong abnormal responses (especially increased sensitization, lower pain threshold) to noxious and non-noxious stimuli
Develop debilitating conditions	• Needle phobia • Post-traumatic stress disorder
Avoidant attitude to healthcare	• Avoid procedures, doctor's or dentist's visits, entering hospital or seeking medical care

There is certainly no evidence of the benefits in withholding pain management and the pain experience does not make a child stronger. Therefore, it is of utmost importance that healthcare providers:

- Become more sensitive and aware of the possible existence of pain in children (even when children are not able to verbalise it)
- Be able to assess pain in the different age groups
- Be able to institute more effective processes/ treatment to minimise pain

References:

1. Current state of pain management in children. Richard F Howard. JAMA Nov 12, 2003 vol 209. No 18, page 2464-2469
2. American Medical Association, Module 6 Pain Management: Pediatric Pain Management, September 2007
3. American Pain Society- APS: The assessment and management of acute pain in infants. http://www.ampainsoc.org
4. Atkinson, L (1996). Pain management for children and infants, Contemporary Paramedics, 5 (2) 64-70.
5. Taddio A et al (1997) Effect of neonatal circumcision on pain response during subsequent routine vaccination. The Lancet 349; 599-603
6. Tanne. BMJ 327;22 Nov 2003: 1185. Children are often undertreated for pain
7. Scheter NK et al (1993). Pain in infants, children and adolescents. Baltimore: Williams and Wilkins
8. Carter B. (1994) Child and Infant Pain, London: Chapman & Hall

Chapter 2: Classification of Pain

2.1 DEFINITION

- 'Pain is what the person says hurts'
  or
- The International Association for the Study of Pain (IASP), 2020 definition:
  Pain is "an unpleasant sensory and emotional experience associated with, or resembling that associated with actual, or potential tissue damage"

Notes

- Pain is always a personal experience that is influenced to varying degrees by biological, psychological, and social factors.
- Pain and nociception are different phenomena. Pain cannot be inferred solely from activity in sensory neurons.
- Through their life experiences, individuals learn the concept of pain.
- A person's report of an experience as pain should be respected.*
- Although pain usually serves an adaptive role, it may have adverse effects on function and social and psychological well-being.
- Verbal description is only one of several behaviours to express pain; inability to communicate does not negate the possibility that a human or a nonhuman animal experiences pain.

Etymology

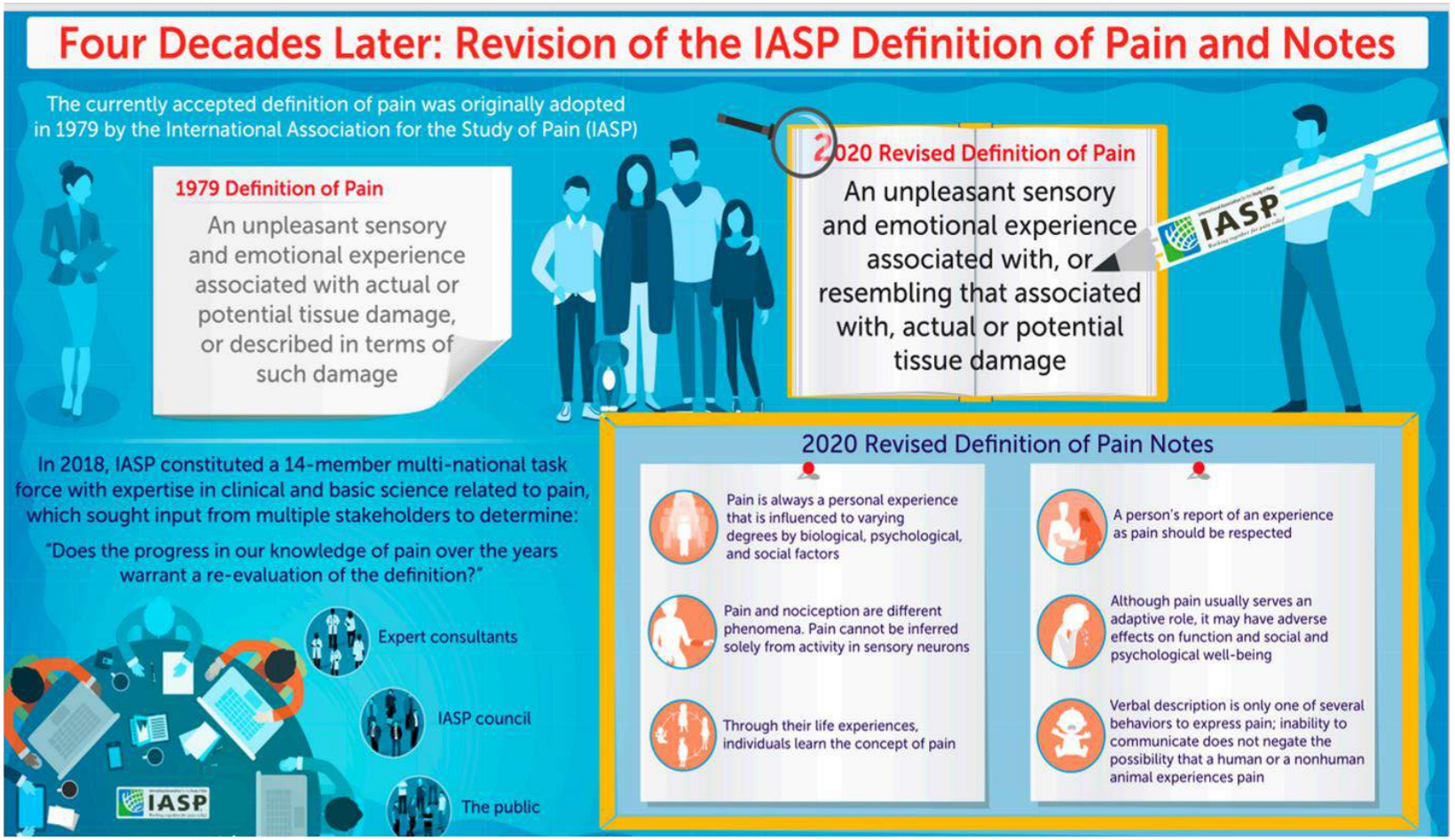
Middle English, from Anglo-French peine (pain, suffering), from Latin poena (penalty, punishment), in turn from Greek Poine (payment, penalty, recompense).

*The Declaration of Montreal, a document developed during the First International Pain Summit on September 3, 2010, states that "Access to pain management is a fundamental human right"

2.2 CHARACTERISTICS OF PAIN

- Pain is subjective and this is important especially in children where verbalization of pain may be an issue.
- Pain must be viewed as multidimensional; not just a sensation with a physiologic basis, but affected by cognition, affect, behaviour with spiritual influence.
- Pain may sometimes be hidden, and the child may not be seen to be clearly in pain, and the only way to find out is to ask.

2.3. GRAPHIC ON IASP DEFINITION OF PAIN, 2020



The revised IASP definition of pain: concepts, challenges, and compromises
Raja *et al.* (2020) | Pain
DOI: 10.1097/j.pain.0000000000001939

PAIN

2.4. CLASSIFICATION OF PAIN

- Not all pain is the same. It is helpful to try to classify pain as that can sometimes help guide our choice of medications and type of treatment. However, note that management of nociplastic pain is slightly different whereby medication is often not the main modality of treatment.
- Pain can be classified according to :
    - pathophysiology (nociceptive, neuropathic and nociplastic)
    - duration (acute, chronic or breakthrough)
    - aetiology (malignant and non- malignant)
    - anatomic location.
- A child may sometimes have a combination of different types of pain at the same time. For instance, a child may have nociceptive and neuropathic pain. Another child may have nociceptive and nociplastic pain together. This combined presence of different types of pain is called 'mixed pain'. Mixed pain can exist all at the same time or each occur separately at different times in the same person.
- When managing pain in children, important questions to ask include :
    - Is this acute or chronic pain?
    - Is this cancer or non-cancer pain?
    - Is this nociceptive, neuropathic, nociplastic or mixed?

2.4.1. PAIN CLASSIFICATION ACCORDING TO DURATION

Pain duration	
Acute	• Onset usually sudden, felt immediately after injury • Usually resolves when injury heals. • Up to 90 days. Example: pain due to burns, fractures
Chronic	• Lasting more than 90 days or pain which persist after tissue injury has healed • May be persistent or recurrent Example : post amputation pain, post-operative site pain

2.4.2 PAIN CLASSIFICATION ACCORDING TO PATHOPHYSIOLOGY

Pain Pathophysiology	
Nociceptive	• Commonest pain following tissue injury • Sometimes called *inflammatory* or *physiological* pain • Due to stimulation of nociceptors by actual or threatened damage to non-neural tissues (nociceptors can be activated by heat, cold, vibration, stretch and chemical substances) • Often acute and severe, resolves when tissue injury heals • Has a protective function • Character: sharp, throbbing, aching, often well-localised • Can be further divided into somatic and visceral pain. Somatic pain arises from surface tissues (e.g. skin, mucosa) and deep tissues (e.g. bone, joints, connective tissue). Visceral pain arises from internal organs that are enclosed within a cavity (thoracic or abdominal). • Examples: skin cuts, muscle sprains, arthritis, appendicitis
Neuropathic	• Caused by structural damage or nerve cell dysfunction; either to the peripheral or central nerves (lesion or disease in the somatosensory system) • Sometimes called *pathological* pain • Tissue injury may not be obvious • No protective effect • Character: shooting or burning pains. May have numbness or tingling. Often not well localised. • Neuropathic pain is common in children with neurological impairment and cancer patients • Examples: Trigeminal neuralgia
Nociplastic	• Distinct from nociceptive pain and neuropathic pain • Mechanism unclear but thought contributed by augmented CNS pain and sensory processing and altered pain modulation • Applies only to chronic pain • Commonly present with pain and hypersensitivity • Pain usually multifocal and more widespread or intense or both, than would be given the amount of identifiable tissue and nerve damage. • Also, other CNS-derived symptoms, such as fatigue, sleep, memory and mood problems. • Can occur in isolation or with other types of pain • Examples: Fibromyalgia, Complex regional pain syndrome, irritable bowel syndrome, chronic low back pain, tension headache

Reference:

1. World Health Organization. Persisting pain in children package: WHO guidelines on the pharmacological treatment of persisting pain in children with medical illnesses. Geneva: World Health Organization; 2012.
2. Raja SN, Carr DB, Cohen M, Finnerup NB, Flor H, Gibson S, Keefe FJ, Mogil JS, Ringkamp M, Sluka KA, Song XJ, Stevens B, Sullivan MD, Tutelman PR, Ushida T, Vader K. The revised International Association for the Study of Pain definition of pain: concepts, challenges, and compromises. Pain. 2020 Sep 1;161(9):1976-1982
3. Kosek, Evaa; Cohen, Miltonb; Baron, Ralfc; Gebhart, Gerald F.d; Mico, Juan-Antonioe; Rice, Andrew S.C.f; Rief, Winfriedg; Sluka, A. Kathleenh Do we need a third mechanistic descriptor for chronic pain states, PAIN: July 2016 - Volume 157 - Issue 7 - p 1382-1386

Chapter 3: Pain Assessment in Children

3.1 APPROACH TO PAIN MANAGMENT IN CHILDREN

- Use the 'aRAT' approach – 'Anticipate, Recognise, Assess and Treat' when dealing with children in pain.

a	Anticipate	• Anticipate and prevent pain where possible
R	Recognise	• Children can feel pain • Children can tell pain (acquired words for pain by 18 months) • Children react and report pain in different ways
A	Assess	• Assess pain using A,B,C,D,E approach
T	Treat	• Treat pain using multimodal approaches

- Pain assessment is not just about measuring the severity of pain (i.e. getting a pain score) but involves making a clinical judgement based on the observation of the nature, significance and context of a child's pain experience plus child's response to any treatment which has been instituted.
- There are various ways to assess a child in pain and one is to use the acronym 'ABCDE'

ABC of Pain Assessment in children

A	Ask the child and Assess Pain Score
B	Use Behavioural and Biological Measures
C	Find the Cause
D	Decide and Deliver treatment in a timely manner
E	Evaluate outcome

3.1.1 A – ASK THE CHILD AND ASSESS PAIN SCORE

Ask the child

- It is important to always take a pain history as every child is different
- Always start by asking the child first. If a child is not able or unwilling, then seek the caregiver's opinion
- Allow ample opportunities for children to express their pain
- Provide enough time and encouragement to a child (especially important in a busy ward)
- Listen and always believe children as their descriptions of pain (location, nature) are often accurate

Taking a pain history in child

- Start by asking *"Does anything hurt"*
- Use the acronym of PAIN

  - P: Place or site pain, *"Where does it hurt"*
  - A: Aggravating factors, *"What makes the pain worse"*
  - I: Intensity, *"How bad is the pain"*
  - N: Nature and neutralising factors,
    "What does it feel like" (a body chart might help)
    "*What makes the pain better"*

- Remember that a child's pain expression is affected not only by chronological age or cognitive development, but also by individual differences (e.g. personality) and cultural factors.
- Some groups of children may especially have difficulty in communicating their pain and requires special attention. These include:
    i. preverbal children
    ii. children on ventilators
    iii. children with cognitive impairment
    iv. psychotic or severely emotionally disturbed children
    v. children who do not speak the same language or have significantly different family/cultural background from the health care provider.
- Always involve parents in their child's pain management. Parents can often accurately judge their child's pain and are therefore useful for early recognition and more accurate assessment of their child's pain.
- However, a parents' assessment should not override the child's self-report.
- Although children may verbalise or display more pain in the parents' presence, parental involvement especially their presence is comforting and helps lessens pain.

Assess the pain score

- Children as young as 4 years of age can reliably report their pain using 'self-report tools'.
- The choice of the pain reporting scale or tool must be individualised for each child. It should be chosen not just based on chronological age but also taking into consideration of the child's developmental level, personality and condition.
- Pain scores should never be interpreted singly. Always use in conjunction with the child's self-report, together with parents' and health care provider's assessments of the child's pain.
- Refer pain tools in section 3.3

3.1.2 B - USE BEHAVIOURAL AND BIOLOGICAL MEASURES

- Behavioural and physiological measures are important proxy measures for pain especially in children who are either unable or refuse to communicate with health care providers e.g. neonates, infants or younger children.

	Examples	Comments
Behavioural	• Facial expression • Crying • Body posture • Activity • Appearance	• Changes in behaviour may indicate changes in pain intensity. • Beware that some children may not exhibit pain by crying but by being unduly quiet or withdrawn
Biological/ Physiological	• Heart rate • Respiratory rate • Blood pressure • Oxygen saturation • Palmar sweating	• Can be affected by other causes and thus should never be used singly as a measure of pain

3.1.3 C- FIND THE CAUSE

- Before starting any treatment for pain, always consider the possible cause/s of pain.
- Pain may be due to simple reversible causes, which when removed will alleviate pain without requiring treatment.
- Example: Pain can be just due to a tissued intravenous line.
  Abdominal pain in a post-operative patient may be due to a distended bladder.

3.1.4 D – DECIDE AND DELIVER TREATMENT IN A TIMELY MANNER

- Never ignore any complaints and every complaint of pain should be assessed.
- If pain is present, discuss with the child/caregiver if any intervention is required.
  - Do you want me to do something to help?
  - Do you think we need to do something to relieve the pain? (parents)
- Interventions do not necessarily mean drugs and can be non-pharmacological methods like massaging or touching for mild pain.
- Sometimes, just reassurance that the pain is accounted for and that it does not signify anything more serious might suffice.

3.1.5. E – EVALUATE OUTCOME

- Always reassess for response after any intervention.

3.2 WHEN SHOULD PAIN BE ASSESSED?

It is recommended that pain should be assessed under the following situations:

1. At regular intervals – as the 5th vital sign
   - Assessment of pain is done when undertaking other vital signs (blood pressure, heart rate, respiratory rate and temperature)
   - This is to avoid unnecessary disturbance or distress to the child

2. At other times when indicated:
   - Occurrence of unexpected intense pain especially if associated with altered vital signs
   - When indicators of pain are present in an otherwise previously pain-free child
   - After procedure

3.3 TOOLS FOR ASSESSING PAIN IN CHILDREN

- There are many different tools or pain rating scales in children.
- Choose a tool that is appropriate not only for chronological age but also developmental age. For example: if there is a child who is 8 years old but developmentally only 3 years old, a FLACC scale should be used.
- When possible, self-reporting is favoured as pain is a subjective experience.
- Self-report tools are appropriate for most children aged 4 years and older.
- A numerical rating scale can be used for those who can understand the concept of order and number (usually older than 7 or 8 years).
- Behavioural measures can be used for those who are unable or refuse to verbalise pain.
- However, caution when interpreting pain behaviour as pain expression can be affected by the child's physical state (e.g. cognitive impairment), emotional state (e.g. depressed), coping style as well as family and cultural expressions.
- When assessment pain in children, always ensure that ample opportunities and sufficient time is provided.

The following are the tools which are suggested to be used:

Age	Pain rating scale
1 month to 4 years	**FLACC** • Observe the child's behaviour in 5 dimensions (Face, Legs, Arms, Cry, Consolability) for 2 to 5 minutes, and assign a score (maximum 10)
4 years to 7 years	**Revised FACES** • Picture based scale where the child selects 1 of 6 faces to represent their pain experience
≥ 7 years	**Numerical rating scale** • Ask the child to assign a number to their pain, with '0' being no pain, and '10' being the worst imaginable pain

*The choice of a pain assessment tool should take into consideration of both the **child's chronological age** and **developmental age**

For special populations of children, an alternative pain tool may be more appropriate:

Special population	Pain rating scale
Neurologically impaired	**Revised FLACC** • Incorporates individualised pain behaviours which are unique to a child
Critically ill	**COMFORT-Behavioural scale** & **FLACC**
Neonates	**Neonatal / Infant Pain scale (NIPS)** • Combines 6 behavioural to a total score of 7

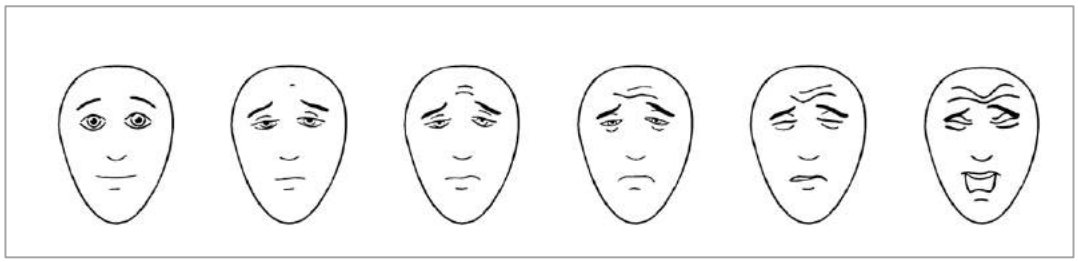
3.3.1. FLACC Scale

Category	Score		
	0	1	2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant quivering chin, clenched jaw
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid or jerking
Cry	No cry (awake or asleep)	Moans or whimpers; occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging or being talked to distractible	Difficult to console

FLACC is a behavioural observer rated pain scale

- Observe patient for 2 to 5 min or longer (if asleep observe for a minimum of 5 minutes)
- Observe body and legs uncovered
- Reposition patient (if possible, when asleep) or observe activity
- Assess body for tenseness and tone (if asleep, touch to assess tone)
- Each category is scored 0-2, giving a total of 10

3.3.2. FACES-Revised pain scale, IASP



FPS-R : FACES pain scale revised, 2001

- In the following instructions, say 'Hurt' or 'Pain' whichever seems right for a particular child: **"These faces show how much something can hurt. This face** (*point to the left most face)* **shows no pain. The faces show more and more pain** *(point to each from left to right)* **up to this one.** *(point to the right most face*)**. It shows very much pain. Point to the face that shows how much you hurt** *(right now)"*
- Do not use words like 'happy' or 'sad'. This scale is intended to measure how children feel inside, not how their face looks.

3.3.3 Numerical scale (MOH Pain Scale)

- Ask the child to report their pain severity based on numbers where '0' is no pain and '10' is the worst pain experienced.

3.3.4. Revised FLACC

ASSESSMENTS	SCORES		
	0	**1**	**2**
FACE **Individualised behaviour :**	No particular expression or smile	Occasional grimace or frown, withdrawn or disinterested; appears sad or worried	Consistent grimace or frown; frequent/constant quivering chin; clenched jaw; distressed-looking face; expression of fright or panic
LEGS **Individualised behaviour :**	Normal position or relaxed; usual tone & motion to limbs	Uneasy, restless, tense; occasional tremors	Kicking, or legs drawn up; marked increase in spasticity, constant tremors or jerking
ACTIVITY **Individualised behaviour :**	Lying quietly, normal position, moves easily, regular & rhythmic respirations	Squirming, shifting back/forth, tense or guarded movements, mildly agitated, shallow splinting respirations, intermittent sighs	Arched, rigid or jerking, severe agitation, head banging, shivering, breath holding, gasping or sharp intake of breaths, severe splinting
CRY **Individualised behaviour :**	No cry/verbalization	Moans or whimpers, occasional complaint, occasional verbal outburst or grunt	Crying steadily, screams or sobs, frequent complaints, repeated outbursts, constant grunting
CONSOLABILITY **Individualised behaviour :**	Content or relaxed	Reassured by occasional touching, hugging or being talked to, distractible	Difficult to console or comfort, pushing away caregiver, resisting care or comfort measures

**Individualised pain behaviours unique to each child with severe neurological impairment as identified by carers or staff can be inserted into the most appropriate category in the left column and its severity graded accordingly to encompass pain behaviours not covered by the existing table.*

3.3.5. COMFORT Behavioural Scale

Alertness	• Deeply asleep (eyes closed, no response to changes in the environment)	❑ 1
	• Lightly asleep (eyes mostly closed, occasional responses)	❑ 2
	• Drowsy (child closes his or her eyes frequently, less responsive to the environment)	❑ 3
	• Awake and alert (child responsive to the environment)	❑ 4
	• Awake and hyperalert (exaggerated responses to environmental stimuli)	❑ 5
Calmness–Agitation	• Calm (child appears serene and tranquil)	❑ 1
	• Slightly anxious (child shows slight anxiety)	❑ 2
	• Anxious (child appears agitated but remains in control)	❑ 3
	• Very anxious (child appears very agitated, just able to control)	❑ 4
	• Panicky (child appears severely distressed, with loss of control)	❑ 5
Respiratory response (score only in mechanically ventilated children)	• No spontaneous respiration	❑ 1
	• Spontaneous and ventilator respiration	❑ 2
	• Restlessness or resistance to ventilator	❑ 3
	• Active breathing against ventilator or regular coughing	❑ 4
	• Fighting against ventilator	❑ 5
Crying (score only in children breathing spontaneously)	• Quiet breathing, no crying sounds	❑ 1
	• Occasional sobbing or moaning	❑ 2
	• Whining (monotone)	❑ 3
	• Crying	❑ 4
	• Screaming or shrieking	❑ 5
Physical movement	• No movement	❑ 1
	• Occasional (3 or fewer) slight movements	❑ 2
	• Frequent (more than 3) slight movements	❑ 3
	• Vigorous movements limited to extremities	❑ 4
	• Vigorous movements including torso and head	❑ 5
Muscle tone	• Muscles totally relaxed, no muscle tone	❑ 1
	• Reduced muscle tone, less resistance than normal	❑ 2
	• Normal muscle tone	❑ 3
	• Increased muscle tone and flexion of fingers and toes	❑ 4
	• Extreme muscle rigidity and flexion of fingers and toes	❑ 5
Facial tension	• Facial muscles totally relaxed	❑ 1
	• Normal facial tone	❑ 2
	• Tension evident in some facial muscles (not sustained)	❑ 3
	• Tension evident throughout facial muscles (sustained)	❑ 4
	• Facial muscles contorted and grimacing	❑ 5
	Total Score	
VAS (Visual Analogue Scale) Put a mark on the line below to indicate how much pain you think the child has **at this very moment.** no pain ⊢——————————⊣ worst pain **VAS Score**		

3.3.6. Neonatal/Infant Pain Scale (NIPS)

Neonatal/Infant Pain Scale (NIPS)[4] A score greater than 3 indicates pain		Score
Facial expression		
0 - Relaxed muscles	Restful face, neutral expression	
1 - Grimace	Tight facial muscles, furrowed brow, jaw, chin (negative facial expression – nose, mouth and brow)	
Cry		
0 - No cry	Quiet, not crying	
1 – Whimper	Mild moaning, intermittent.	
2 – Vigorous cry	Loud scream, rising, shrill continuous (note, silent cry may be scored if baby is intubated as evidenced by obvious mouth and facial movements)	
Breathing Patterns		
0 – Relaxed	Usual pattern for this infant	
1 – Change in breathing	In drawing, irregular, faster than usual, gagging and breath holding	
Arms		
0 – Relaxed/Restrained	No muscular rigidity, occasional random movements of arms	
1 – Flexed/Extended	Tense straight legs, rigid and/or rapid extension, flexion	
Legs		
0 – Relaxed/Restrained	No muscular rigidity, occasional random movements of arms	
1 – Flexed/Extended	Tense straight legs, rigid and/or rapid extension, flexion	
State of Arousal		
0 - Sleeping/awake	Quiet, peaceful sleeping or alert random leg movement	
1 - Fussy	Alert, restless and thrashing	

3.4 INTERPRETATION OF PAIN SCORES

- Interpretation for pain scores (for scales whose maximum score is 10, e.g. FLACC, FACES, Numerical scale) is as follows:

For FLACC, revised FLACC, FACES, Numerical scale (max score = 10)	
Pain score	Interpretation
1-3	Mild
4-6	Moderate
7-10	Severe

- For NIPS, the maximum pain score is 7 and interpretation is as follows:

For NIPS (max score = 7)	
Pain score	Interpretation
1-2	Mild
3-4	Moderate
5-7	Severe

- For critically ill children, the Comfort behavioural score is to be used in combination with FLACC score for pain assessment, and the interpretation is a combination of both scales plus nurses' assessment of NISS (Nurse Interpreted score for sedation) (Refer chapter 9)

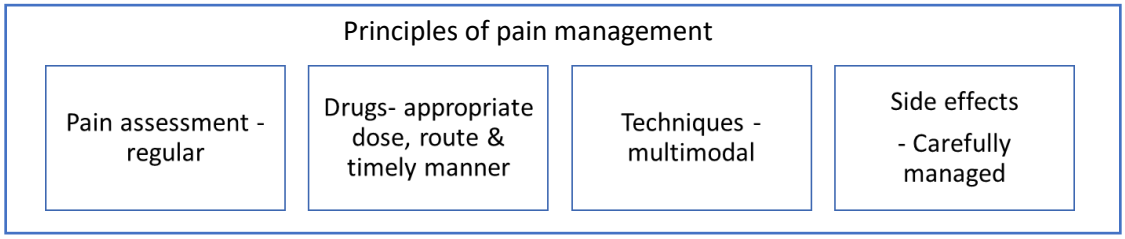
References:

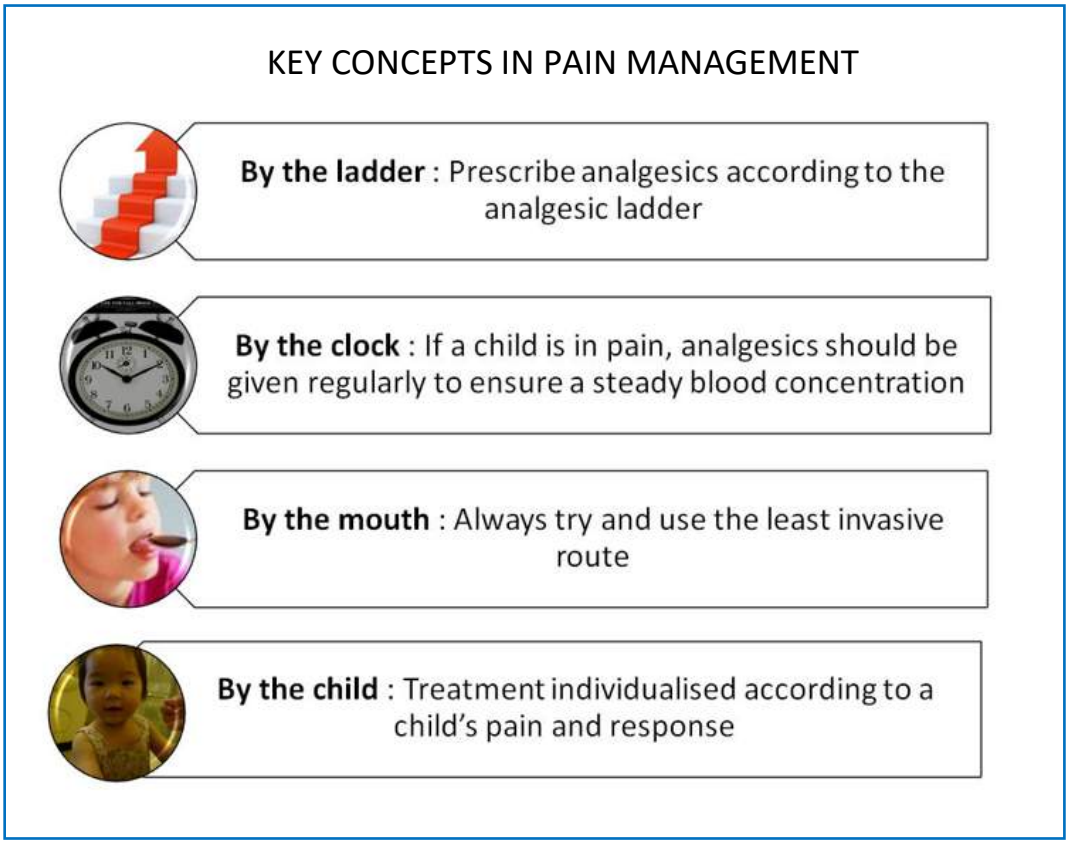
1. American Medical Association, Module 6 Pain Management: Pediatric Pain Management, September 2007
2. Carter B (1994). Child and Infant Pain. London: Chapman & Hall
3. Craft M & Denehy J (1990) Nursing Interventions for Infants and Children
4. Guidelines for Good Clinical Practice: Recognition and assessment of acute pain in children. RCPCH, UK.
5. McGrath et al. (1996). A new analogue scale for assessing children's pan: an initial validation study. Pain, 64(3) 435-43

Chapter 4: Principles of Pain Management

4.1 PRINCIPLES OF PAIN MANAGEMENT

Pain is best prevented rather than treated. Where possible, anticipate the likely occurrence of pain for e.g. after surgery, and allow children to wake up comfortable and pain free as the analgesic requirement will be less. Children should also be pre-treated before painful procedures.

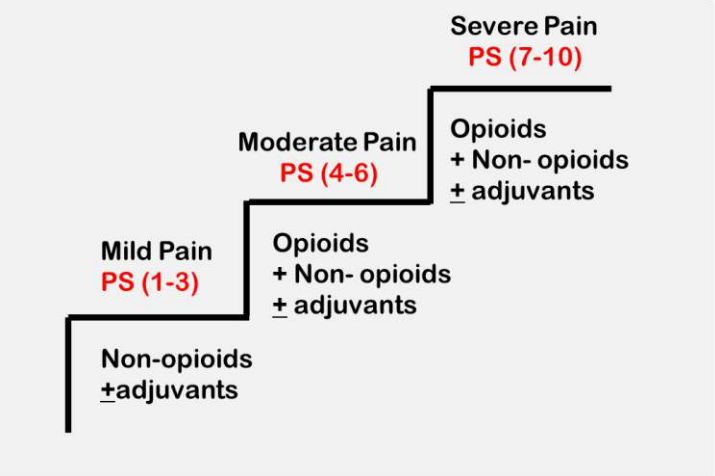




4.1.1. BY THE LADDER

- Use a stepwise approach to treatment (Refer modified Analgesic ladder)
- Start with a drug and dose that matches the pain assessment findings and pain score
- Titrate dose upwards if relief is inadequate
- Use multimodal analgesia as combination of different classes of analgesic (e.g. acetaminophen + opioid) which acts at different sites in the pain pathway. This promotes better pain relief, may reduce opioid requirements and helps to minimise side-effects ("balanced analgesia")
- Use adjuvants to manage side effects, minimise fear and enhance pain relief

Modified Analgesic Ladder



Non opioids
- Paracetamol
- NSAIDs
  - Ibuprofen, Naproxen, Diclofenac, Meloxicam

Opioids
- Weak opioid
  - Tramadol
- Strong opioid
  - Morphine, Fentanyl,
  - Oxycodone

Adjuvants
- Amitriptylline
- Gabapentin
- Ketamine
- Clonidine

4.1.2. BY THE CLOCK

- Promote pain relief with regular doses of analgesics timely ('by the clock') and not 'as needed' basis while monitoring side effects
- Modify intervals between doses in the presence of moderate and severe pain

4.1.3. BY THE APPROPRIATE ROUTE

- Oral formulations are the most convenient, least painful, most effective and the least expensive route.
- The choice of alternative routes of administration, such as intravenous (IV), subcutaneous (SC), rectal or transdermal when the oral route is not available should be based on clinical judgement, availability and patient preference.
- Severe acute pain is best treated by continuous administration of analgesics e.g. intravenous or PCA.
- The intramuscular (IM) route is to be avoided as it is not only painful, hence children deny pain to avoid the injection; but is also unpredictable and largely ineffective.

4.1.4. BY THE CHILD

- Tailor treatment to the individual child, incorporating the child's developmental status, cultural influences, religious beliefs, personal preferences and previous pain experiences.
- There is no specific or maximum dose of opioids which is determined by the patient to achieve the best possible pain relief with side-effects acceptable to the patient.

References:

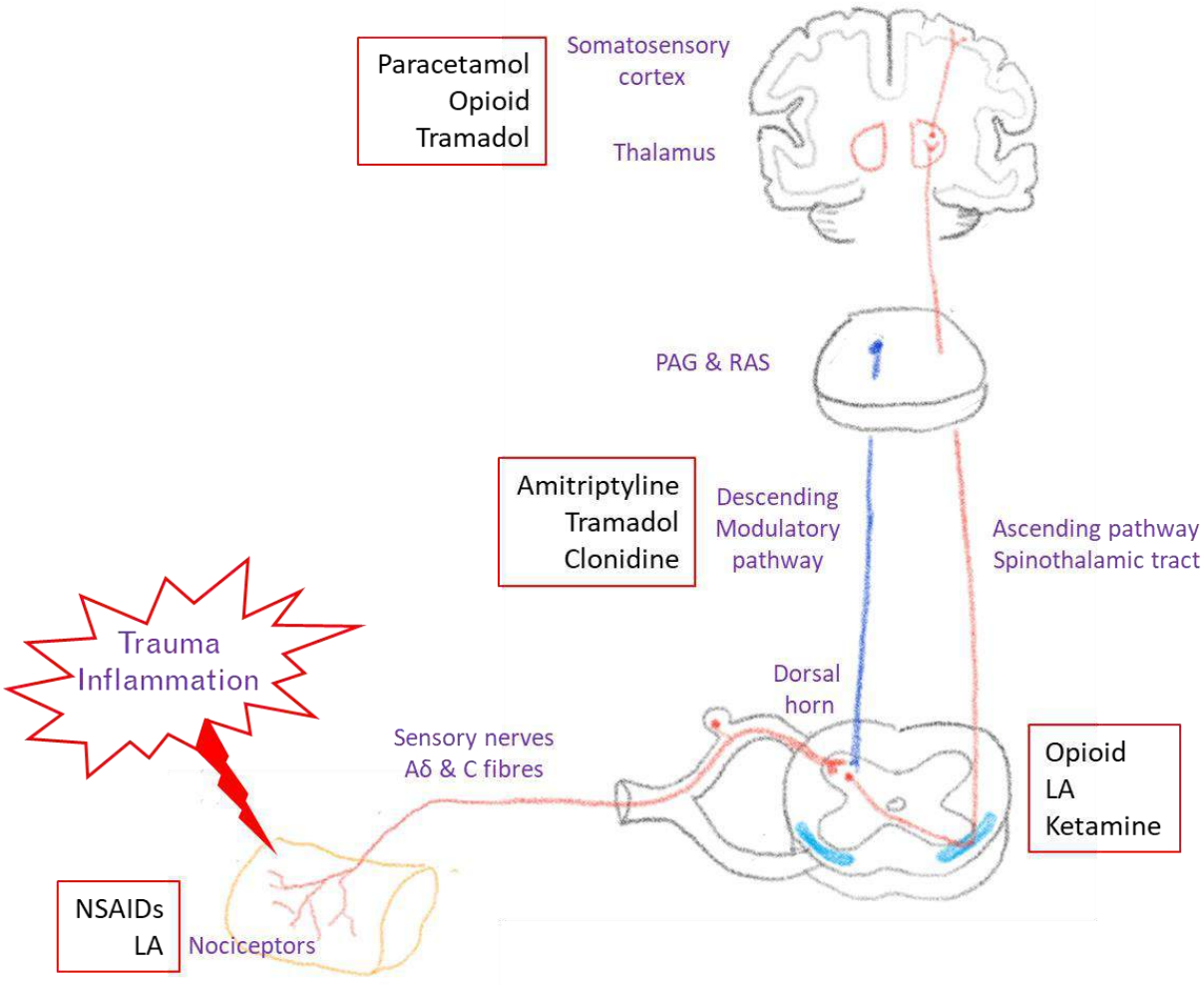
1. WHO guidelines on the pharmacological treatment of persisting pain in children with medical illnesses 2012
2. South Australian Paediatric Practice Guidelines – Pain Management and Opioid Safety 2015
3. Pain Management Handbook MOH/P/PAK/257.12 (HB) 2015

Chapter 5: Pharmacological Management of Pain

5.1 INTRODUCTION

Optimal management of pain includes a combination of nonopioid, opioid analgesics, adjuvants and non-pharmacological strategies. Combined analgesia is more effective than any single modality. It is important to consider the cause of pain when choosing appropriate analgesics based on sites of action and pathophysiology. e.g. neuropathic pain, one would choose anticonvulsants whereas inflammatory pain, NSAIDs would be an appropriate choice.

5.2 PAIN PATHWAY AND SITES OF DRUG ACTION



LA : Local anaesthetics; PAG : Periaqueductal grey matter; RAS : reticular activating system

5.3. ANALGESICS AND THEIR MECHANISMS OF ACTION

SIMPLE	**Paracetamol**	Acts both centrally and peripherally in part by inhibiting prostaglandin synthesis
	NSAIDs	Acts peripherally to reduce prostaglandin levels, thus reducing inflammation
OPIOIDS	**Tramadol**	Acts weakly on opioid receptors & also increases descending inhibitory signals in spinal cord
	Morphine, Fentanyl, Oxycodone	Act on opioid receptors in the brain and spinal cord
OTHER	**Tricyclic antidepressants**	Increase descending inhibitory signals in the spinal cord
	Anticonvulsants (GABA-nergic)	'Membrane stabilisers' probably work by reducing abnormal firing of pain nerves
	Local anaesthetics	Block signalling in pain nerves in periphery temporarily (e.g. infiltration or nerve block) or spinal cord (e.g. spinal block)
	Ketamine	Blocks NMDA receptors in the brain and spinal cord (especially in dorsal horn)
	Clonidine	Increases descending inhibitory signals in the spinal cord

5.4. THE EFFECTIVENESS OF ANALGESICS ON DIFFERENT TYPES OF PAIN

Types of pain	Acute mild nociceptive	Acute severe nociceptive	Acute neuropathic	Chronic non-cancer	Chronic cancer
Paracetamol	+++	++	+	+	+
NSAIDs	++	++	+	+/-	+/-
Tramadol	++	++	++	+	+
Morphine	Not indicated Or not useful	+++	++	Not useful, may be harmful	+++
TCAs		Not indicated Or not useful	++	++	++
Anticonvulsants			++	+	+

5.5. TYPES OF PHARMACOLOGICAL TREATMENTS

Simple	Opioid	Adjuvants

• Paracetamol
• NSAIDs
  • Ibuprofen, Naproxen, Diclofenac, Meloxicam
• Selective COX 2-Celecoxib
	• Weak
	  • Tramadol
	• Strong
	  • Morphine, Oxycodone, Fentanyl
		• Tricyclic antidepressants
		  • Amitriptyline
		• Anticonvulsants
		  • Gabapentin, Pregabalin, Carbamazepine, Sodium valproate
		• Others
		  • Ketamine
		  • Nitrous oxide
		  • Clonidine
		  • Local anaesthetics

5.6. COMMONLY USED ANALGESICS AT A GLANCE

Drug	Features	Risks	Contraindication	Comments
Paracetamol	Safe and effective	Liver toxicity	Liver impairment	Higher risk hepatotoxicity in fasting, dehydrated, sepsis, malnourished. Care in renal impairment and G6PD deficiency
NSAID	Ceiling effect Different drugs have slightly different profile	GIT bleed Renal impairment Platelet function inhibition	Coagulopathy Peptic ulcer disease Renal impairment	Avoid dehydration. Caution in very young, renal disease and concomitant nephrotoxic drugs
Tramadol	Good oral biovailability Ceiling effect	Nausea Drowsiness Seizures	Concomitant SSRI MAO inhibitors in past 14 days Seizure history	Caution in liver and renal impairment. Check interactions with other drugs
Morphine	Poor oral bioavailability No ceiling effect	Nausea/vomiting Constipation Pruritus Respiratory depression Sedation Hypotension	Liver and renal impairment	Caution when used with other sedative drugs

5.7. ANALESICS IN CHILDREN

5.7.1. PARACETAMOL

Introduction

- The most commonly used analgesic in children
- Excellent safety profile and lack of significant side effects

Indication

- Mild to moderate pain, for both acute and chronic pain (proven efficacy for migraine and musculoskeletal pain)
- In severe pain, can be combined with an opioid. Paracetamol is synergistic with NSAIDs and can reduce opioid requirement

Route

- Oral
- Rectum
- Intravenous

Risks

- Hepatotoxicity (fulminant hepatic failure) in overdose

Contraindications

- Hypersensitivity to paracetamol
- Hepatic failure or severe hepatocellular insufficiency

Precautions

- Risk of hepatotoxicity increased if
    - Prolonged fasting
    - Vomiting/diarrhoea/dehydrated
    - Systemic sepsis/febrile illness
    - Chronic malnutrition
    - Prior intake of Paracetamol
- Severe renal insufficiency (creatinine clearance ≤ 30 mL/min).
- G6PD deficiency (may lead to haemolytic anaemia)

Notes

- There is a delay between dosing and peak analgesic effect of about 2 hours, so may to administer before painful procedures
- Do not use on a regular basis for more than 48 hours without medical review (chronic usage can develop hepatotoxicity even at therapeutic dosages)
- If require prolonged usage or in a high-risk patient, liver function tests need to be monitored
- For obese children, dosages should be based on child's adjusted body weight.
  Adjusted body weight = ideal body weight + 0.4 (actual body weight – ideal body weight)

5.7.2. NSAIDs

Introduction

- NSAIDs vary in the selectivity of inhibition of the COX enzymes. The traditional NSAIDs inhibit both COX-1 and COX-2 enzymes while selective COX-2 inhibitors (Coxibs) inhibit mainly the COX-2 enzyme
- All NSAIDs and Coxibs are used for their analgesic and anti-inflammatory effects
- Coxibs have the same analgesic efficacy compared to traditional NSAIDs and are mainly used in patients who are unable to tolerate the side effects of NSAIDs. It provides a better overall side effect profile in terms of GI side effects and effects on platelet function but do not prevent renal impairment
- Some NSAIDs, e.g. low-dose aspirin, are also used for their anti-platelet effect. Aspirin is generally not recommended in children due to risk of Reye's syndrome except in certain cardiology or rheumatology patients

Indication

- Mild to moderate pain, especially in relation to an inflammatory process
- Combination with paracetamol is efficacious in acute pain management

Route

- Oral
- Rectal
- Intravenous/ Intramuscular
- Topical

Risks

- All NSAIDs have similar side effects, which are independent of the route of administration.
    1. Gastrointestinal (less with COX2 inhibitors):
        - Nausea, anorexia, abdominal pain, gastritis, ulcers, gastrointestinal haemorrhage, perforation, diarrhoea
    2. Haematological (less with COX2 inhibitors)
        - Inhibition of platelet function
    3. Renal
        - Reduced renal blood flow, deterioration of kidney function, salt and water retention, oedema
        - Analgesic nephropathy with long term use
    4. Hypersensitivity reactions including anaphylactic shock

Contraindications

- Coagulopathy or bleeding tendencies
- Peptic ulcer disease, ulcerative colitis or Crohn's disease
- Renal impairment, diuretic therapy or situations of decreased renal perfusion
- Hypersensitivity to NSAIDS
- Severe asthma, especially if exacerbated by aspirin
- Intracranial or spinal injuries

Precautions

- Young infants (different NSAIDs has difference specifications – please refer to glossary for details on individual drugs)
- Febrile illness with risks of dehydration
- Renal disease or on concomitant nephrotoxic medications
- Asthma with previous hypersensitivity to NSAIDs

Notes

- Always ensure that patients are adequately hydrated when using NSAIDs
- NSAIDs have a ceiling effect: All NSAIDs should offer the same degree of analgesia if given at maximally therapeutic doses (i.e. no advantage of IV ketorolac over PO ibuprofen/naproxen). For sustained use, ibuprofen may offer the safest side-effect profile
- When prescribing NSAIDs, prescribe short term only and to protect against GI side effects (consider proton pump inhibitors)
- PR / IV / topical NSAIDs may still produce GI side effects as they are absorbed systemically

5.7.3. OPIOIDS

Introduction

- Opioids are among the most effective known analgesics and have been a mainstay in the management of pain in children
- Morphine is the principle opioid used in the management of acute pain

Indications

- Moderate to severe pain

Route

- Oral
- Intravenous
- Transdermal
- Subcutaneous

Types

- Weak: Tramadol, Dihydrocodeine
- Strong: Morphine, Fentanyl, Oxycodone

Risks

- Nausea and vomiting
- Sedation
- Bronchoconstriction
- Respiratory depression
- Ileus / constipation
- Urinary retention
- Pruritus
- Hypotension

Precautions

- Hypersensitivity to opioids
- Concomitant use of sedative drugs
- Renal impairment
- Liver impairment
- Impaired respiratory function e.g. Obstructive Sleep Apnoea (OSAS), acute severe asthma
- Head injury

Interactions with other medicines

- Amitriptyline – possibly increases sedation, and it may increase the plasma concentration of morphine
- Chlorpromazine – enhances sedative and hypotensive effects
- Ciprofloxacin – when ciprofloxacin is used for surgical prophylaxis, the plasma concentration is reduced
- Diazepam / Benzodiazepines and chloral hydrate – enhances sedative effects
- Haloperidol – enhances sedative and hypotensive effects
- Metoclopramide – antagonises metoclopramide effects on gastrointestinal activity
- Opioid antagonists/partial agonists – may precipitate opioid withdrawal symptoms
- Naloxone* - precipitates opioid withdrawal symptoms
- Naltrexone* - precipitates opioid withdrawal symptoms
- Ritonavir* - possible increases plasma concentration of morphine

* Indicates severe

Notes

Tips for using opioids in children	
Safe for all ages	Opioids may be used safely in children of all ages, including neonates. Calculate dosages based on the child's ideal body weight. Dosages for neonates and some ex-preterm infants require further adjustments as they are more sensitive to opioids.
Titrate to pain intensity	Titrate opioid dose to pain intensity, so that adequate analgesia is provided with the lowest dose with minimal side-effects. Take into consideration the patient's assessment, pharmacology (duration of action, peak effect and half-life) and route of drug e.g. titrate dose by 25-50%.
No ceiling effect	There is no ceiling effect for opioids, thus there is no "maximum dose". Opioids can be titrated safely for increased analgesic effect but may be limited by the accompanying side-effects.
Anticipate & treat side-effects	Anticipate and treat opioid side-effects proactively. Most opioid side-effects are easily treated with simple interventions. e.g. constipation, emesis and itch
No addiction	Treating pain with opioids does NOT lead to psychological dependence/addiction
Tolerance can happen	Prolonged use of opioids may result in tolerance: requiring increasing doses if the cause of pain does not diminish over time

Monitoring during iv opioid administration in children

Indications for continuous SpO2 monitoring during opioid administration	
High risk patients with acute pain	Others with increased risk for over sedation especially if on continuous iv or high dose oral opioids
• Are receiving intravenous opioids • Are less than 1year and receiving opioids via any route • Have a sedation score 2 or more (hard to rouse) • Have significant cardio-respiratory impairment • Has obesity, a history of sleep apnoea, snoring or airway obstruction (or increased potential for sleep apnoea e.g. cerebral palsy, craniofacial disorders, muscular dystrophy) • Have spot oximetry less than 94% • Are receiving concurrent sedative medications	• Patients following surgery related to the airway e.g. tonsillectomy and/or adenoidectomy • Pre-existing respiratory co-morbidity e.g asthma, other chronic respiratory conditions e.g. cystic fibrosis • Ex-premature infants corrected age 52 weeks post conceptual age • Limited neck mobility • Pre-existing conditions e.g. renal or hepatic impairment or concurrent medication which reduce/increase drug metabolism or excretion • Previous adverse reactions to opioid medications

5.7.3.1. TRAMADOL

- Synthetic analgesic that acts centrally on mu opioid receptors and in addition inhibits neuronal monoamine uptake
- Rapidly and almost fully absorbed after oral administration
- Effect may be unpredictable due to wide variability in metabolism e.g higher risk of adverse events in ultra-rapid metabolisers and lack of effect in children who are poor metabolisers
- Has a ceiling effect, therefore unsuitable for severe pain or escalating mild-moderate pain
- Has less sedation, respiratory depression or slowing of gastrointestinal mobility than opioid medications
- Works most effectively with regular paracetamol
- Reputation for causing nausea but well tolerated by many, especially pre-pubertal children
- Wean tramadol gradually as abrupt discontinuation may result in withdrawal

Do Not Use in the following patients:

- Those with a history of seizures (may lower seizure threshold)
- Concurrently on SSRIs → serotonin syndrome
- Received MAO inhibitors in the last 14 days → serotonin syndrome

Use with caution in patients who:

- Are also taking warfarin (may increase anticoagulant effects)
- Have hepatic or renal impairment as dose adjustment may be required
- Are taking tricyclic antidepressants
- Are taking carbamazepine as it may reduce tramadol's activity
- Are taking stimulants (both methylphenidate and dexamphetamine) as these might contribute to developing serotonin syndrome
- Taking fentanyl or pethidine

5.7.3.2. CODEINE

- Is a prodrug which is metabolised in the liver to morphine
- **No longer prescribed for children**
- The wide variability in metabolism due to cytochrome P450 2D6 polymorphisms make its effect unpredictable with resultant deaths in ultra-rapid metabolisers and lack of effect for children who are poor metabolisers
- Codeine has been associated with deaths in children following tonsillectomy &/or adenoidectomy

5.7.3.3. MORPHINE

- Gold standard for analgesics
- Types of morphine
  1. Oral form:
     - Immediate release e.g aqueous morphine
       - Widely used and highly effective
       - It has a low bioavailability (30-40%), hence oral doses are 2-3 times larger than parenteral doses
     - Slow-release formulations
       - Used in those requiring on-going analgesia e.g burns or following major trauma
       - Not for acute pain or breakthrough pain
       - When prescribing slow-release preparations, useful to prescribe an immediate acting opioid as PRN basis for 'break through pain'. This dose is usually 10% of daily morphine requirement
  2. Parenteral
       - Requires dose adjustment for liver and renal impairment

5.7.3.4. OXYCODONE

- Is a semi-synthetic mu agonist whose metabolite, oxymorphone has a higher opioid receptor binding affinity
- Has good bioavailability up to 80%
- Metabolism is via liver enzymes CYP2D6 which is subject to phenotypic variation
- Dose must be adjusted in hepatic and renal impairment
- Releases significantly less histamine than morphine
- Analgesic effects similar to morphine, although in adults reported to have more rapid onset of action and longer duration
- **Not recommended in general to children less than 1 years of age. For those less than 1 year, to consult pain specialist/ anaesthetist.**
- Types of oxycodone

1. Oral preparations
    - immediate release (IR) e.g. Oxynorm
    - controlled release (CR) e.g. Oxycontin (only available in tablet form, generally for older children)
2. Parenteral formulation may be used for acute postoperative pain management

5.7.3.5. FENTANYL

- Highly soluble synthetic opioid with almost 100x more potent than morphine
- Rapid onset, short duration and potent
- Has a low propensity to cause histamine release
- Dose must be adjusted in liver and renal impairment
- Preferred for renal impairment patients
- Types of fentanyl

1. Parenteral
    - Parenteral formulation is used for acute pain, IV and intrathecal.
2. Transdermal (TD) preparation
    - Only for use in chronic cancer pain and not acute pain
    - Not to be used in opioid naive patients
3. Intranasal
    - Can be used as initial analgesia for children from 1 year old for acute severe pain e.g. fractures, wound exploration
    - Contraindicated if altered conscious state, head injury or if they have upper respiratory or nasal tract infection, as absorption may be affected

Fentanyl should be used in conjunction with a specialist who is trained or experienced in using it.

5.7.4. ADJUVANTS

- Adjuvants are medications which are not typically used for pain but may have analgesic effects in specific conditions
- Used to improve the quality of analgesia being delivered by a primary analgesic drug
- May help relieve pain by elevating mood, reducing anxiety levels or minimising the dose of primary analgesic drugs
- Adjuvants [e.g. anticonvulsants (gabapentin), tricyclic anti-depressants (amitriptyline), ketamine, clonidine] are important in the treatment of neuropathic pain.
- Consult an expert prior to commencement and continued assessment important to guide use in acute and chronic pain

5.7.4.1. TRICYCLIC ANTIDEPRESSANTS (Amitriptyline)

Introduction

- Tricyclic antidepressants (TCA) are helpful in neuropathic pain especially if given early

Route

- Oral, once daily dose at night

Indication:

- Neuropathic pain (in low doses, lower than used to treat depression)
- Chronic non cancer pain, depression and improve sleep

Risks:

- May cause morning drowsiness for the first few days
- Sedation, dizziness, somnolence
- Postural hypotension
- Cholinergic side-effects: dry mouth, urinary retention, constipation

5.7.4.2. ANTICONVULSANTS

Gabapentin & Pregabalin

- Given orally, no significant drug interactions
- Indicated for neuropathic pain and also used in acute pain where there is potential for neuropathic pain e.g. spinal surgery
- Risks: dry mouth, peripheral oedema, weight gain, abnormal gait, amnesia

Carbamazepine

- Given orally
- Useful in neuropathic pain
- Risks: sedation, unsteadiness, confusion in high dose

Sodium valproate

- Given oral or iv
- Useful in neuropathic pain
- Side effects: gastro-intestinal

5.7.4.3. CLONIDINE

Introduction

- Is an alpha2-adrenergic agonist that produces analgesia in a non-opioid mechanism (exact site unclear)
- Has analgesic, sedative, and some antispasmodic properties
- Has a role in facilitating opioid weaning
- Antihypertensive

Indication

- As adjunct in treating difficult pain cases
- As adjunct in epidural analgesia

Route

- Oral
- Intravenous
- Epidural

Risks

- Bradycardia
- Sedation
- Hypotension

5.7.4.4. NITROUS OXIDE (N_2O) ANALGESIA

Introduction

- An inhaled anaesthetic agent with rapid onset
- Produces significant analgesia and some amnesic and anxiolytic properties
- Predictable onset and offset and can safely be titrated to produce a state of conscious sedation

Indication:

- Procedural sedation and analgesia e.g. wound dressings, lumbar puncture
- Acute pain

Risks

- Over sedation
- Airway obstruction
- Diffusion hypoxia
- Rapid expansion of air-filled spaces
- Nausea and vomiting
- Dizziness
- Bone marrow suppression with chronic use (interferes with folate and B12 metabolism, may need supplementation)

Contraindications

- Closed head injury/raised ICP or impaired level of consciousness
- Respiratory distress or an impending airway obstruction
- A gas-filled cavity may cause deterioration e.g. undrained pneumothorax, recent middle ear surgery or intracranial surgery (N_2O) diffuses into gas-containing cavities
- Bowel obstruction
- Intoxicated/ drug overdose
- Known cobalamin-dependent (e.g. MTHFR deficiency) inborn errors of metabolism

Relative contraindications

- Infants (requires the presence of an anaesthetist)
- Facial/ airway burns
- Difficult airway
- Extubated within the last 24 hours

Precaution

As nitrous oxide may obtund conscious levels,

- Adequate fasting is required to prevent vomiting
- Monitoring is essential including pulse oximeter
- Resuscitative equipment should be available

Procedures

- Have a dedicated person to deliver N_2O who should not perform any part of the procedure
- Fast patients adequately – 2 hours clear fluids, 4 hours for breast milk, 6 hours formula milk and solids
- Monitoring with a pulse oximeter is essential
- The sedationist must maintain verbal contact with the patient throughout the procedure
- Administer N_2O for 3-4 minutes before the start of the procedure
- If N_2O is removed for > 30 seconds at any stage, provide 100% oxygen for 3 minutes to prevent diffusion hypoxia
- At the end of procedure, give 100% oxygen for 3 minutes to prevent diffusion hypoxia
- Beware during immediate transfers post procedure, that gait and coordination may be affected
- Keep patients post procedure till fully awake and tolerating oral fluid

5.7.4.5. KETAMINE

Introduction

- Has both anaesthetic and analgesic properties (dose dependent)
- Can produce profound analgesia with somewhat preservation of pharyngeal/laryngeal reflexes and stimulation of respiratory and cardiovascular system
- Can result in hallucinations and emergence phenomenon if used as a sole agent for anaesthesia (higher doses)
- In sub-anaesthetic doses (<0.5 mg/kg/dose iv), it is analgesic and amnesic. If given >1 mg/kg/dose, it produces a state of dissociative anaesthesia

Route

- Oral
- Parenteral

Indications:

- Procedural sedation and analgesia (in combination with midazolam or fentanyl)
- Adjunct in certain circumstances of acute or chronic pain

Risks

- CNS: euphoria, sedation, hallucination, delirium, emergent reactions, nystagmus, disorientation, lacrimation
- Respiratory system: hypersalivation, bronchodilatation
- CVS: tachycardia, hypertension, myocardial depression in absence of autonomic control
- GIT: nausea and vomiting
- GUT: bladder dysfunction on long-term use

Contraindications

- Severe systemic hypertension
- Raised intra-ocular pressure
- Recent history of epilepsy
- Recent history of psychosis
- History of hypersensitivity to ketamine
- Hepatic impairment
- Thyrotoxicosis

Precautions

- Cardiac arrhythmia and hypertension
- Raised intracranial pressure
- Concurrent respiratory infection (increased secretions)
- Neonates and infants < 3 months (higher risk of airway complications)

Ketamine should only be used by a specialist or trained personnel who are familiar with the drug and have the capability of managing advanced airway appropriately

5.7.4.6. LOCAL ANAESTHETICS

Introduction

- Commonly used local anaesthetic include lignocaine. Others by anaesthetist in children include bupivacaine, levobupivacaine and ropivacaine
- Metabolised in the liver and rarely cause allergic reactions

Routes

- Topical
- Infiltration for procedures
- Transdermal
- Intravenous regional block
- Epidural / Spinal

Indications:

- Topical analgesia – EMLA
- Infiltration for procedures e.g. wounds, lumbar puncture
- Local anaesthesia of body cavities e.g. oral ulcers
- Surface anaesthesia: bronchoscopy
- Nerve blocks – central or peripheral
- Intravenous regional anaesthesia
- Neuropathic pain

Contraindications

- Allergy to local anaesthetic agent
- Porphyria (for lignocaine only)

Risks

Local anaesthetic toxicity and possibly systemic toxicity occurs with either an overdose or an accidental intravascular injection

1. **Local**

- Allergic reaction to para-aminobenzoic acid (PABA): ranging from urticaria to anaphylaxis

2. **Systemic**

- ***Immune system***
  - Allergic reaction to metabolic break-down of anaesthetic agents and preservatives (PABA) can cause anaphylaxis
- ***Hematologic***
  - Methemoglobinemia – caused by lignocaine and more notably, prilocaine
- ***Central Nervous System***
  - CNS symptoms are progressive as the level of the LA in the blood rises.
  - Initial symptoms suggest CNS excitation: ringing in the ears (tinnitus), metallic taste in the mouth, perioral tingling or numbness.
  - Advanced symptoms include motor twitching in the periphery followed by grand mal seizures, coma, and eventually respiratory arrest
- ***Cardiovascular***
  - Myocardial depression, bradycardia and cardiac arrhythmias
  - Cardiovascular collapse

Safety Tip: These are cardiac depressants, therefore before administration, please calculate the maximum allowable safe dose to avoid overdose in children.

References:

1. WHO guidelines on the pharmacological treatment of persisting pain in children with medical illnesses 2012
2. South Australian Paediatric Practice Guidelines – Pain Management and Opioid Safety 2015
3. Pain Management Handbook MOH/P/PAK/257.12 (HB) 2015
4. CPG on Pain Management- Hospital for Sick Children 2017
5. MOH Pain as the 5th Vital Sign Guidelines: 2nd Edition
6. Essential Pain Management 2nd edition 2016, Dr Wayne Morris and Dr Roger Goucke
7. PAMI Learning Module
8. Pain Management Practise guideline – HCW. The children's hospital at Westmead. 2006-8215v14

Chapter 6: Non-Pharmacological Management of Pain

6.1. SIGNIFICANCE OF NON-PHARMACOLOGICAL MANAGEMENT

Pain experiences in infancy and childhood are always the combinations of biological and emotional suffering that may result in long-term changes in physiological, cognitive and behavioural responses to pain[1]. Pharmacological management of pain focuses on controlling the physiological pathways of pain, while non-pharmacological methods complement in reducing both the physical and emotional (such as anxiety and fear) aspects of pain suffering for children. There is evidence that different non-pharmacological interventions can be used to manage pain behaviours especially those associated with acutely painful procedures (most common cause of pain experience in hospital) for preterm baby, neonates and older infants[10]. Cognitive-behavioural therapy in adolescents with chronic pain was reported to improve physical, psychological, and social functions effectively, with a return to full time school in 40%[11]. Non-pharmacological management has been proven in studies to reduce the amount of medications needed to treat pain in children[23].

6.2. CLASSIFICATION OF NON-PHARMACOLOGICAL MANAGEMENT

Different non-pharmacological pain interventions vary in their frequency of usage, effectiveness and level of training required for medical staff in hospital[2]. Each of these interventions have distinctive characteristics and methodology and offer a wide variety of choices to suit various kinds of pain (acute, post operation, peri-procedural pain and chronic pain) and different ages of patients[24]. Table 1 shows the diverse types of common non-pharmacological management. These are classified based on two different strategies, which are[3,4]:

6.2.1. COGNITIVE-BEHAVIOURAL STRATEGIES

- Cognitive strategies involve identifying and altering negative thinking styles related to anxiety about the medical procedure, and replacing them with more positive beliefs and attitudes, leading to more adaptive behaviour and coping styles[5].
- Behavioural strategies are based on targeting specific overt behaviours.
- Both cognitive and behavioural strategies are used together to enhance and compliment the effects of each strategy[15].

6.2.2. PHYSICAL STRATEGIES

- Physical strategies focus on using various forms of physical energy to stimulate and control the body's own self-defence mechanisms and systems[12]. It also includes physiotherapy and rehabilitation approaches to assess and manage acute and chronic pain conditions [13].
- For acute pain, physical interventions focus on addressing the pain generator, using temporary relative rest, and also education for stretching & strengthening muscles, and improving fitness and biomechanics.
- For chronic pain, physical interventions focus on therapeutic exercise, functional training in home and work activities, manual therapy, prescription and application of devices, and other passive modalities.

6.3. USEFUL STRATEGIES FOR DIFFERENT AGE GROUPS

- Children of different ages are at differing stages of development. As such, different strategies may be required for different age groups.

Age	Useful distractions
Neonates & Infants	Minimise number of painful procedures Provide soothing environment Passive distraction (cartoons, phone, mirrors) Non-nutritive sucking Skin to skin contact Swaddling & holding
Toddlers & Preschoolers	Explanation of procedure Provide opportunities to ask questions Active distraction (blow bubbles, sing song)
School aged & Adolescents	Provide choice of procedural positions Allow decision on presence of which family members Discuss prior pain experience and coping mechanisms Active distraction e.g. listening to songs Passive distraction

Table 1: Cognitive-Behavioural Strategies in Pain management in children

Strategies & Method		Type of Pain			Age group		
		Acute/ Post-op	Proce-dural	Chronic	N & I	T	S & A
Distraction [17]	Diverting attention from the painful stimuli through *toy-mediated distraction* (e.g. play dough [6], soap bubbles[18]) or *video-mediated distraction* (e.g. computer tablet distraction [7], virtual reality glasses [8])	√	√		√	√	√
Hypnosis [9]	Suggestion of either *dissociation* (e.g. asking the child not to feel the painful body part), *substitute* pain sensory with numbness (e.g. magic glove) or *reinterpreting* the sensations of pain as being less unpleasant, or less harmful (e.g. a huge spider can become a smaller insect, much less frightening).		√	√		√	√
Imagery [14]	Uses *patient's own imagination* to form a mental representation of an object, place, event, or situation, perceived through the senses. It can be done through audio recording, videos or therapists themselves. Usually combine with relaxation techniques, before the therapist suggests a relaxing, calm and comforting image[16].	√	√	√		√	√
Relaxation training [19]	*Diaphragmatic breathing*[20] and *progressive muscle relaxation*[21], or combined with imagery and music-assisted, to achieve relaxation, reduce pain and anxiety[22].	√	√	√		√	√
Thought stopping	Process by which replacing unhealthy thoughts with more positive thoughts through yelling "stop" to yourself[25].			√		√	√
Environment Modification	Environmental factors such as lighting, natural landscape, music, visual video are modified to promote adaptive responses to pain[26].	√	√	√	√	√	√

**N – Neonate, I-Infant, T-Toddler, S-School –aged, A-Adolescent*

Table 1: Cognitive-Behavioural Strategies in Pain management in children (continued)

Strategies & Method		Type of Pain			Age group		
		Acute/ Post-op	Proce-dural	Chronic	N & I	T	S & A
Art Therapy	Using visual art, dance, drama and body movements to explore underlying issues that aggravated the pain through *metaphor* that link to patient's internal thought process[27,28].			√			√
Play Therapy	Individual or group direct/indirect real or false medical equipment play would allow patients to share their pain experiences and discuss their feelings[29].	√	√			√	√
Music Therapy	*Active* (compose song, play music instrument) or *passive* (listen to music) music therapy alone or combine with other modalities were proven in RCT to reduce pain score and fear[30,31].	√	√	√	√	√	√
Desensitisation	A step-by-step approach introduction to the procedure and tasks involved, and effectively dealing with easier tasks before moving to the next one[32].			√		√	√
Behavioural modelling	Patient is witnessing a model (another child or adult) whom responds to the painful stimuli with relaxation rather than fear, will create a reference framework for imitating his/her fear/anxiety to the pain confrontation after repeat rehearsing[33].			√		√	√
Positive reinforcement	Reward with positive statements or concrete gifts, after the painful procedure (e.g., stickers, toys, games, small trophies)[34].	√	√			√	√
Rehearsal Mindfulness	Structured Mindfulness curriculum with continued home practice to improve the patients' consciousness of body sensations and the feelings triggered with the aim to increase the pain tolerance and lessen the pain anxiety.[35,36]			√			√

Table 2: Physical strategies in pain management in children

Strategies & Method		Type of Pain			Age group		
		Acute/ Post-op	Proce-dural	Chronic	N & I	T	S & A
Comfort and positioning [37]	Parental holding and positioning of children were proven to reduce the pain and distress during intravenous line insertion[38]. Non-nutritive sucking with good positioning were shown to be effectively in reducing neonatal procedural pain[39].	√	√		√	√	
Heat/Cold Therapy	Small number of trials suggested heat wrap and cold-induced analgesia provide short term pain relief for acute and subacute musculoskeletal pain[40], although insufficient evidence to be recommended from Cochrane review [41].	√	√	√			√
Massage	Massage was shown to reduce anxiety and stress hormone levels induced by cancer pain and joint pain in children [42, 43].	√	√	√	√	√	√
Transcutaneous Electrical Nerve Stimulation (TENS)	Few small studies suggested TENS maybe useful for children with procedural pain and post-op pain [44]. TENS is often useful only in localized pain.[45]	√	√			√	√
Acupuncture	Limited evidence of efficacy of acupuncture in paediatrics especially in post-op pain. It is low risk but mechanism unknown. Systematic reviews have shown that existing data often lack adequate control groups and sample sizes [47].	√				√	√

**N – Neonate, I-Infant, T-Toddler, S-School –aged, A-Adolescent*

References:

1. Anand, K. J., & International Evidence-Based Group for Neonatal, P. (2001). Consensus statement for the prevention and management of pain in the newborn. Archives of Pediatrics and Adolescent Medicine, 155, 173–180
2. Bandstra NF, Skinner L, LeBlanc C, Chambers CT, Hollon EC, Brennan D, Beaver C. The role of child life in pediatric pain management: a survey of child life specialists. The Journal of Pain.2008 Apr 1;9(4):320-9.
3. Chen E, Joseph MH, Zeltzer LK. Acute pain in children: Behavioral and cognitive interventions in the treatment of pain in children. Pediatric Clinics of North America 2000;47(3):1–13
4. Uman LS, Chambers CT, McGrath PJ, Kisely S. Psychological interventions for needle-related procedural pain and distress in children and adolescents. Cochrane Database Syst Rev. 2006 Jan 1;4.
5. Barlow DH, Durand VM. Abnormal Psychology: An Integrative Approach. California: Brooks/Cole Publishing Company, 1999.
6. Aydın GB, Yüksel S, Ergil J, Polat R, Akelma FK, Ekici M, Sayın M, Odabaş Ö. The effect of play distraction on anxiety before premedication administration: a randomized trial. Journal of clinical anesthesia. 2017 Feb 1;36:27-31.
7. Burns-Nader S, Joe L, Pinion K. Computer tablet distraction reduces pain and anxiety in pediatric burn patients undergoing hydrotherapy: A randomized trial. Burns. 2017 Sep 1;43(6):1203-11.
8. Wint SS, Eshelman D, Steele J, Guzzetta CE. Effects of distraction using virtual reality glasses during lumbar punctures in adolescents with cancer. InOncology Nursing Forum 2002 Jan 1 (Vol. 29, No. 1).
9. Wood C, Bioy A. Hypnosis and pain in children. Journal of pain and symptom management. 2008 Apr 1;35(4):437-46.
10. Pillai Riddell RR, Racine NM, Turcotte K, Uman LS, Horton RE, Din Osmun L, AholaKohut S, Hillgrove Stuart J, Stevens B, Gerwitz-Stern A. Non-pharmacological management of infant and young child procedural pain. Cochrane Database Syst Rev. 2011;10.
11. Eccleston C, Malleson PN, Clinch J, Connell H, Sourbut C. Chronic pain in adolescents: evaluation of inter-disciplinary cognitive behaviour therapy (ICBT). Arch Dis Child (in press).
12. Szopinski JZ. The Biological Action of Physical Medicine: Controlling the Human Body's Information System. Academic Press; 2014 May 3.
13. Stanos S, Prather H, Press JM, Young JL. Physical medicine, and rehabilitation approaches to pain management. InSPEC-Essentials of Pain Medicine and Regional Anesthesia (Reprint) 2005. Elsevier Inc.
14. Dos Santos Felix MM, Ferreira MB, da Cruz LF, Barbosa MH. Relaxation Therapy with Guided Imagery for Postoperative Pain Management: An Integrative Review. Pain Management Nursing. 2017 Dec 15.
15. Hsieh YC, Cheng SF, Tsay PK, Su WJ, Cho YH, Chen CW. Effectiveness of Cognitive-behavioral Strategies on Pain, and Fear in School-aged Children Undergoing Intravenous Placement: A Randomized Clinical Trial. Asian nursing research. 2017 Oct 26.
16. Ball TM, Shapiro DE, Monheim CJ, Weydert JA. A pilot study of the use of guided imagery for the treatment of recurrent abdominal pain in children. Clinical Pediatrics. 2003 Jul;42(6):527-32.
17. Bukola IM, Paula D. The Effectiveness of Distraction as Procedural Pain Management Technique in Pediatric Oncology Patients: A Meta-analysis and Systematic Review. Journal of pain and symptom management. 2017 Oct 1;54(4):589-600.
18. Caprilli S, Vagnoli L, Bastiani C, Messeri A. Pain, and distress in children undergoing blood sampling: effectiveness of distraction with soap bubbles: A randomized controlled study. Children's Nurses: Italian Journal of Pediatric Nursing Science/Infermieridei Bambini: GiornaleItaliano di ScienzeInfermieristichePediatriche. 2012 Mar 1;4(1).

19. McGrath PJ, Humphreys P, Goodman JT, Keene D, Firestone P, Jacob P, Cunningham SJ. RELAXATION PROPHYLAXIS FOR CHILDHOOD MIGRAINE: A RANDOMIZED PLACEBO-CONTROLLED TRIAL. Developmental Medicine & Child Neurology. 1988 Oct 1;30(5):626-31.
20. Kaushik R, Kaushik RM, Mahajan SK, Rajesh V. Biofeedback assisted diaphragmatic breathing and systematic relaxation versus propranolol in long term prophylaxis of migraine. Complementary therapies in medicine. 2005 Sep 1;13(3):165-74.
21. Kwekkeboom KL, Hau H, Wanta B, Bumpus M. Patients' perceptions of the effectiveness of guided imagery and progressive muscle relaxation interventions used for cancer pain. Complementary therapies in clinical practice. 2008 Aug 1;14(3):185-94.
22. Walco GA, Varni JW, Ilowite NT. Cognitive-behavioral pain management in children with juvenile rheumatoid arthritis. Pediatrics. 1992 Jun 1;89(6):1075-9.
23. Rusy LM, Weisman SJ. Complementary therapies for acute pediatric pain management. Pediatric Clinics. 2000 Jun 1;47(3):589-99.
24. Short S, Pace G, Birnbaum C. Nonpharmacologic Techniques to Assist in Pediatric Pain Management. Clinical Pediatric Emergency Medicine. 2017 Dec 1;18(4):256-60.
25. Bufford, R. K. (1985). Thought stopping technique. In David G. Benner (Ed.), Baker encyclopedia of psychology, pp.ll56-1157 Grand Rapids, MI: Baker.
26. Ulrich RS, Zimring C, Zhu X, DuBose J, Seo HB, Choi YS, Quan X, Joseph A. A review of the research literature on evidence-based healthcare design. HERD: Health Environments Research & Design Journal. 2008 Apr;1(3):61-125.
27. Angheluta AM, Lee BK. Art Therapy for Chronic Pain: Applications and Future Directions. Canadian Journal of counselling and psychotherapy. 2011;45(2):112-31.
28. 2012.03.030Stinley, N. E., Norris, D. O., & Hinds, P. S. (2015). Creating mandalas for themanagement of acute pain symptoms in pediatric patients. Art Therapy: Journalof the American Art Therapy Association, 32(2), 46–53
29. Scarponi D. Play therapy to control pain and suffering in paediatric oncology. Frontiers in pediatrics. 2016 Dec 8;4:132.
30. Nguyen TN, Nilsson S, Hellström AL, Bengtson A. Music therapy to reduce pain and anxiety in children with cancer undergoing lumbar puncture: a randomized clinical trial. Journal of Pediatric Oncology Nursing. 2010 May;27(3):146-55
31. Shah SR, Kadage S, Sinn J. Trial of Music, Sucrose, and Combination Therapy for Pain Relief during Heel Prick Procedures in Neonates. The Journal of pediatrics. 2017 Nov 1;190:153-8.
32. 2006. [77] L. L. Cohen, R. L. Blount, and G. Panopoulos, "Nurse coaching and cartoon distraction: an effective and practical intervention to reduce child, parent, and nurse distress during immunizations," Journal of Pediatric Psychology, vol. 22, no. 3, pp. 355–370, 1997.
33. Boerner KE, Chambers CT, McGrath PJ, LoLordo V, Uher R. The effect of parental modeling on child pain responses: The role of parent and child sex. The Journal of Pain. 2017 Jun 1;18(6):702-15.
34. R. L. Blount, P. J. Bachanas, S. W. Powers et al., "Training children to cope and parents to coach them during routine immunizations: effects on child, parent, and staff behaviors," Behavior Therapy, vol. 23, no. 4, pp. 689–705, 1992.
35. Hesse T, Holmes LG, Kennedy-Overfelt V, Kerr LM, Giles LL. Mindfulness-based intervention for adolescents with recurrent headaches: A pilot feasibility study. Evidence-Based Complementary and Alternative Medicine. 2015;2015.
36. Zucker N, Mauro C, Craske M, Wagner HR, Datta N, Hopkins H, Caldwell K, Kiridly A, Marsan S, Maslow G, Mayer E. Acceptance-based interoceptive exposure for young children with functional abdominal pain. Behaviour research and therapy. 2017 Oct 1;97:200-12.
37. Wente SJ. Nonpharmacologic pediatric pain management in emergency departments: a systematic review of the literature. Journal of Emergency Nursing. 2013 Mar 1;39(2):140-50.
38. Taddio A, Appleton M, Bortolussi R, Chambers C, Dubey V, Halperin S, Hanrahan A, Ipp M, Lockett D, MacDonald N, Midmer D. Reducing the pain of childhood vaccination: an evidence-based clinical practice guideline. Canadian Medical Association Journal. 2010 Dec 14;182(18):E843-55.

39. Stevens B, Johnston C, Franck L, Petryshen P, Jack A, Foster G. The efficacy of developmentally sensitive interventions and sucrose for relieving procedural pain in very low birth weight neonates. Nursing research. 1999 Jan 1;48(1):35-43.
40. Ernst E, Fialka V. Ice freezes pain? A review of the clinical effectiveness of analgesic cold therapy. Journal of pain and symptom management. 1994 Jan 1;9(1):56-9.
41. French SD, Cameron M, Walker BF, Reggars JW, Esterman AJ. A Cochrane review of superficial heat or cold for low back pain. Spine. 2006 Apr 20;31(9):998-1006.
42. Post-White J, Fitzgerald M, Savik K, Hooke MC, Hannahan AB, Sencer SF. Massage therapy for children with cancer. Journal of Pediatric Oncology Nursing. 2009 Jan;26(1):16-28.
43. Field T, Hernandez-Reif M, Seligmen S, Krasnegor J, Sunshine W, Rivas-Chacon R, Schanberg S, Kuhn C. Juvenile rheumatoid arthritis: benefits from massage theraphy. Journal of pediatric Psychology. 1997 Oct 1;22(5):607-17.
44. Lander J, Fowler-Kerry S. TENS for children's procedural pain. Pain. 1993 Feb 1;52(2):209-16.
45. Zempsky WT, Schechter NL. What's new in the management of pain in children. Pediatrics in review. 2003 Oct 1;24(10):337-47.
46. Deyo RA, Walsh NE, Martin DC, Schoenfeld LS, Ramamurthy S. A controlled trial of transcutaneous electrical nerve stimulation (TENS) and exercise for chronic low back pain. New England Journal of Medicine. 1990 Jun 7;322(23):1627-34.
47. Jindal V, Ge A, Mansky PJ. Safety and efficacy of acupuncture in children a review of the evidence. Journal of pediatric hematology/oncology. 2008 Jun;30(6):431.

Chapter 7: Management of Acute Procedural Pain

7.1. INTRODUCTION

Most (80-90%) children in hospitals experience pain which is commonly due to painful procedures[1-3]. Painful procedures are defined as medical procedures that cause short-lived, acute pain. These include intravenous cannulation, heel and finger prick, immunisations, suturing and dressing changes, lumbar punctures, chest tube insertions and bone marrow aspirations. It is well known that repeated painful experiences can lead to adverse, long-term effects on both the child and the family[4].

Many children will experience feelings of anxiety and distress before a procedure which is commonly referred to as anticipatory anxiety. Factors that can cause anticipatory anxiety include:

- pre-existing anxiety
- underlying difficult temperament
- previous experiences with pain
- parents' cognitive level, anxiety and emotions
- previous experiences with pain

Anticipatory anxiety has been shown to lead to future avoidance of potentially important medical procedures in healthcare. Thus, optimal procedural pain management should always include interventions targeting these factors to reduce anticipatory anxiety[5]. In addition, pain and anxiety which is managed well will enhance patient cooperation and parental satisfaction, and also improve outcomes.

Pain, anxiety and distress experienced by children during painful procedures can be reduced by using both non-pharmacological and pharmacological strategies. These strategies should be carried out not only before and during but also after each procedure.

Sites of action for pharmacological and non-pharmacological interventions used in procedural pain

Pharmacological

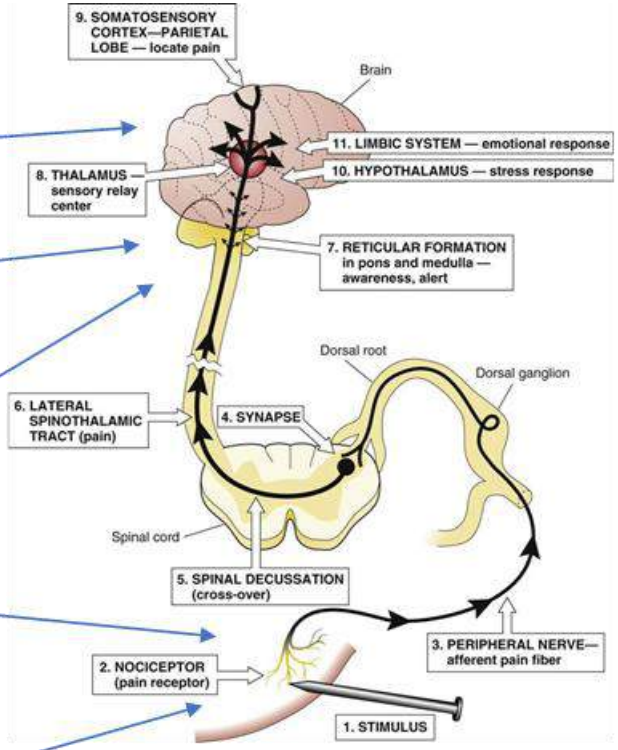
Oral sucrose
- Mediates release of endogenous opioids

Opioids
-Agonist effect on central opioid receptors

Ketamine
- NMDA receptor antagonist

Ethyl chloride spray
- vapocoolant that makes peripheral nerve endings insensitive to pain

Eutectic mixture of prilocaine, lidocaine
- inhibits impulse at dermal pain receptors



Non-Pharmacological

Distractions
Breathing exercises
Positions of comfort

7.2. APPROACH TO MANAGEMENT OF PROCEDURAL PAIN IN CHILDREN

Management strategies	
Before	Plan the painful procedure Prepare the child Prepare the parents/ caregiver Prepare staff Prepare the equipment and environment
During	Pharmacological interventions Non-pharmacological interventions
After	Reevaluate Reinforce coping behavior Plan next procedure

7.2.1. BEFORE A PROCEDURE

7.2.1.1. PLANNING A PROCEDURE

- Is the procedure necessary?
- Are there multiple procedures planned? (e.g., bone marrow aspiration and skin biopsy). Consider doing them at the same time.
- Ensure proper timing of procedures to minimise distress e.g., avoid multiple venepuncture in a day, try to schedule invasive procedures in one sitting when possible, e.g., bone marrow aspiration and skin biopsy
- Assign only appropriately skilled personnel for the procedure
- Choose appropriate analgesia/anaesthesia depending on complexity and duration of procedure
- Provide adequate information to the child and parents/caregiver
- Allow sufficient time for child and parents/caregiver to prepare for the procedure
- Allow adequate time for the procedure so that analgesic drugs and other analgesic measures have time to work

7.2.1.2. PREPARING THE CHILD

- Provide honest information and educate about the procedure in a developmentally appropriate language. (Not just about the pain)
- Best to answer the 5 questions: What? Why? Who? When? Where?
- Never say it won't hurt! Always inform of potential discomfort

  e.g., "Some children say the needle going in feels like a little pressure, others say it hurts a bit….Some say it's like an ant bite or kitten scratching… I'm not sure how it would be like for you. Maybe you could tell us after the procedure."

- Avoid statements that provide a false sense of having an option such as *"Can we insert a cannula in your hand?".* Instead, you can say *"You will need a cannula in your hand, would you like it on your right or left hand?"*. This latter statement tells the child that the cannula insertion is not negotiable, but he/she can still be in control of the situation by having a say in where the cannula will be placed.
- Explore together options to minimise pain and distress:
  - what you can do (e.g., EMLA, hypnosis)
  - what the child can do (e.g., favourite toy for comfort, positions of comfort, having a parent around)
  - what would the child like?
- Be open and talk about past pain experiences and coping strategies; explore what worked and what did not work in the past
- Answer any questions that the child may have
- Address their fears and concerns

7.2.1.3. PREPARING THE PARENT/CAREGIVER

- Parents can influence a child's pain experience through their presence and also transference of their own beliefs and values
- Although parental presence alone has not been consistently shown to reduce a child's distress, active parental involvement is useful in achieving effective pain management
- Parental behaviours may affect their child's level of distress, thus encourage 'coping promoting behaviours'.

Parental behaviours affecting a child's distress during a painful procedure

'Coping promoting' behaviour	Distress promoting behaviour
1. Talk about non-procedural matters 2. Using humour 3. Practise breathing techniques 4. Facilitate the use of distraction strategies 5. Encourage child to use coping strategies	1. Reassuring comments - "it'll be alright" 2. Emphatic comments - "sorry", "I know this is hard" 3. Apologising 4. Criticising /Comparing 5. Agitation 6. Bargaining

Preparing parents/caregiver by:

- Provide adequate information on the procedure and what to expect
- Advise to stay calm and use their normal voice
- Allowed to acknowledge a child's pain but avoid using terms/words which are found not to be helpful
    - High anxiety words : Hurt, pain, shot
    - Reassuring words : It'll be over soon, It's okay, It doesn't hurt
    - Apologising : I'm so sorry you have to be in pain
    - Criticising : Don't be such a baby, Big boys don't cry
- Identify appropriate and assign parents' role:
    - Holding the child in a comfort position
    - Helping in active distractions e.g., blowing bubbles, reading a story book
    - Helping in breathing exercises
- Practice 'coping promoting' behaviours [6]

What not to say to a child during a procedure

Don't worry
You'll be okay
You can do this
You are a brave boy/girl
You can do this for mummy/daddy
That girl /boy didn't cry
I know this is hard
You are used to this
Don't be a sissy, it's only a small prick

7.2.1.4. PREPARING THE STAFF

- Staff should remain calm and confident at all time
- Be aware of the procedure specifics
- Be able to manage any deviations from original plan
- Be able to manage any emergencies or complications which arise during the procedure
- Be in constant communication with child and caregiver

7.2.1.5. PREPARING THE EQUIPMENT AND ENVIRONMENT

- Ensure 'Pain management kit' is available and visible (serve as a reminder). Pain management kit should amongst other things contain different local anesthetics and different types of distractors.
- Environment should be quiet, comfortable (not too cold) and not overstimulating. Soft music in the background may be helpful.

7.2.2. DURING THE PROCEDURE

- Pain can be managed during the procedure using a combination of both pharmacological and non-pharmacological methods
- Of the non-pharmacological methods, distraction is particularly useful for procedures

Methods for managing procedural pain	
Non-pharmacological	**Pharmacological**
Physical • Touch: massage, stroking, vibration • Local application of warm/cold	Local analgesia • Topical- applied to skin/mucosa e.g. EMLA, ethyl chloride spray • Injection – infiltration into area
Distraction	Inhaled Nitrous oxide
Cognitive behavioural strategies • Cognitive therapy • Progressive muscle relaxation • Deep breathing	Intravenous analgesia e.g. Ketamine
Self-regulation • Hypnosis • Biofeedback	Peripheral nerve block/ regional anaesthesia
	Oral sucrose

7.2.2.1 Non-pharmacological strategies

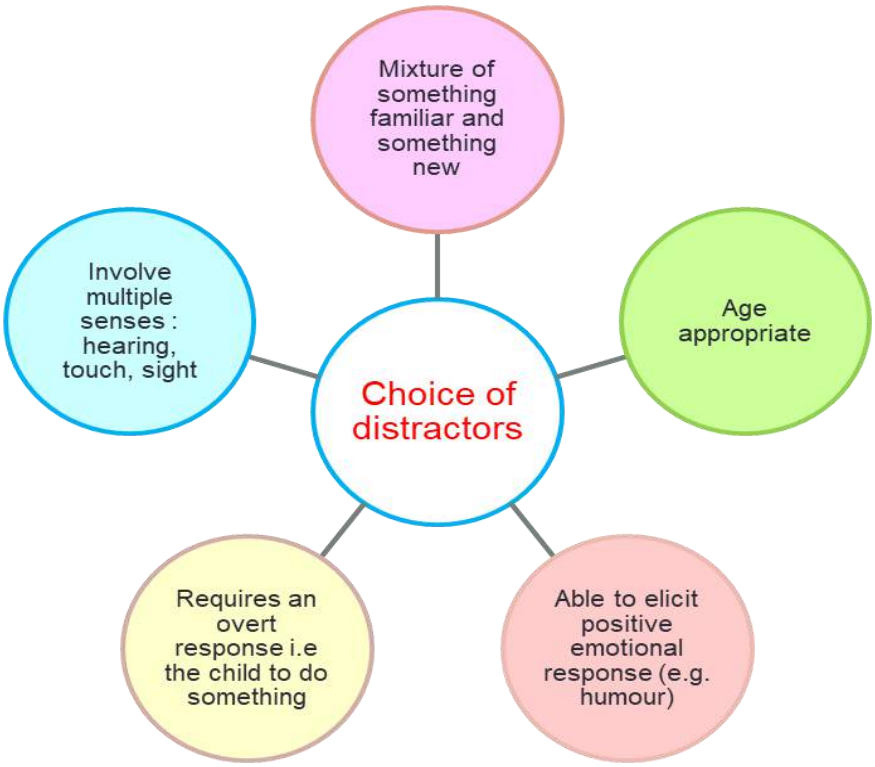
a. Positions of Comfort

- All children should NOT be restrained during painful procedures
- They should be placed in positions of comfort which is also sometimes known as '*hugging hold*'. These are different positions that allows a parent to hold their child during the painful procedures which:
    - maximises the child's comfort
    - gives the child a sense of control especially if help upright
    - minimises the child's movements thus allowing a safe and speedy procedure
    - provides an active role for the parents in supporting their child
- Refer diagrams on 'Positions of Comfort' in the following page

b. Distraction

- Works by refocusing the attention from negative to something more positive
- Proven effective in reducing pain and distress in needle procedures up to 50%, reduces procedural time and number of staff required
- Distraction can be external (e.g., toy, iPad) / internal (e.g., imagery) or combination of both (e.g., story telling)
- Recommended for all age groups, must be employed before a child is too distressed
- Distraction should start immediately before (when child enters treatment room), during procedure and for a few minutes after
- Can be practiced by anyone, requires little training
- Have several distractors at hand for the child to choose from (refer examples of distractors in following page)

Factors to consider in choosing your distractor



Examples of things that can be used for distracting children


Toys


Electronic gadgets

Story books


Movies/cartoon


Blowing spinners


Blowing bubbles


Stress balls


Hidden pictures

Positions of Comfort

Provide comfort, security and sense of control, close physical contact

"Back to front bear hug"

- Especially good for bigger children who needs to be held but wants to remain upright.
- Can be used for bigger babies too.
- Good for iv, blood taking, injections, NG tube, port access, examination

"Chest to chest bear hug"

- Allows the children to turn their head away and not watch the procedure.
- Child straddles parent to feel more secured.
- Good for iv, blood taking, injections

"Frog hold"

- Parent at the head end and can provide distraction
- Good for catheterisation, pelvic examination, chest tube removal, dressing change

"Side-support hold"

- Suitable for lumbar puncture

Illustration by Dr Gan Wen Chiam

c. Physical

- Various physical measures can be used to reduce pain like stroking, touching, massage, vibration
- In addition, applications of heat or cold can also be used to reduce pain

d. Self-regulation

- Applicable especially for older children who are taught to control bodily functions affected by pain e.g., heart rate, respiratory rate through methods like yoga, meditation, biofeedback.

7.2.2.2. PHARMACOLOGICAL STRATEGIES

a. Local analgesics

- It is a myth that giving local analgesics delay procedures, increase procedure time and results in procedure failure

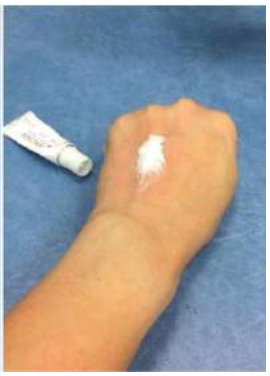
- Types of local analgesics
    i. Topical: EMLA cream, ethyl chloride spray
    ii. Local injection: lignocaine infiltration

- When using local analgesics, consider:
    i. Use only on intact skin
    ii. Contraindicated in life threatening situations where there is no time for analgesia to work
    iii. Caution in those with skin allergy especially to topical analgesics (erythema and blanching of skin is an expected outcome of topical analgesics)
    iv. Caution for EMLA in children with idiopathic methemoglobinemia and in those less than 3 months or with G6PD deficiency (risk of methemoglobinemia)

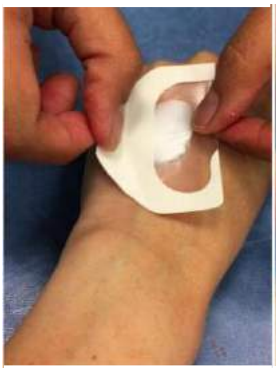
USING EMLA

- Method of using EMLA according to the steps on the right
- For best effect, keep EMLA on for 60 minutes before any procedure
- Duration of action:
  2-4 hours
- Expected Response:
  Transient local blanching followed by local erythema
- Possible Adverse Reactions:
  Severe erythema
  Itching
  Blistering
- Caution:
  Infants < 3/12
  G6PD deficiency

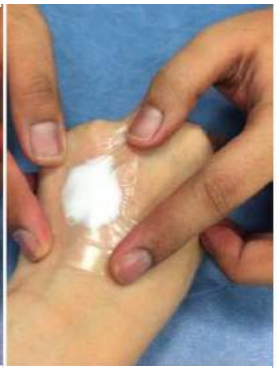
1. Squeeze EMLA



2. Apply to site



3. Apply occlusive dressing



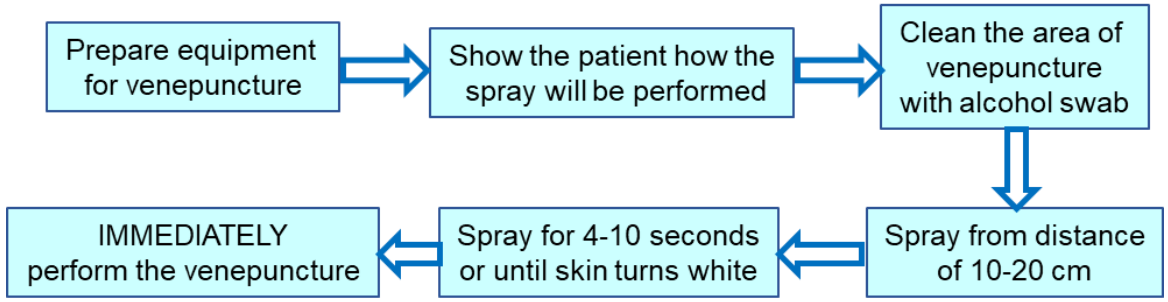
4. Keep EMLA for 60 minutes

Dosages for EMLA according to age group

General dose: Approximately 1g/10 cm^2 for 1 hour

Age group	Dosage and Application times	Frequency
0-2 months	Up to 1g and 10cm^2 for 1 hour	1 dose/24 hours
3-11 months	Up to 2g and 20cm^2 for 1 hour	Max 2 doses/24 hours separated by 12 hours
1-5 years	Up to 10g and 100cm^2 for 1-5 hours	
6-11 years	Up to 20g and 200 cm^2 for 1-5 hours	

USING ETHYL CHLORIDE SPRAY



Note : Numbing effect only lasts for a few seconds!
Do not delay venepuncture, respray if required!

* Some doctors choose not to use ethyl chloride as the process itself can cause pain!

LOCAL INFILTRATION OF ANALGESIC AGENT

- Infiltrate into skin or subcutaneous tissue
- Used in minor surgical and dental procedures

- Drugs:
  Lignocaine – most common
  Prilocaine
  Mepivacaine

- Dose:
  Lignocaine (1%, 0.5%): maximum dose is 4mg/kg. If used with vasoconstrictor, max 7mg/kg

- Complication:
  Systemic toxicity if analgesia enters circulation from site of administration

Lignocaine toxicity

CNS

- Minor: tongue and perioral numbness, paraesthesias, restlessness, tinnitus, muscle fasciculations and tremors
- Major: Seizures, global CNS depression, decrease conscious level, apnoea

Cardiovascular

- Early: Hypertension, tachycardia
- Late: Hypotension,

b. Oral sucrose

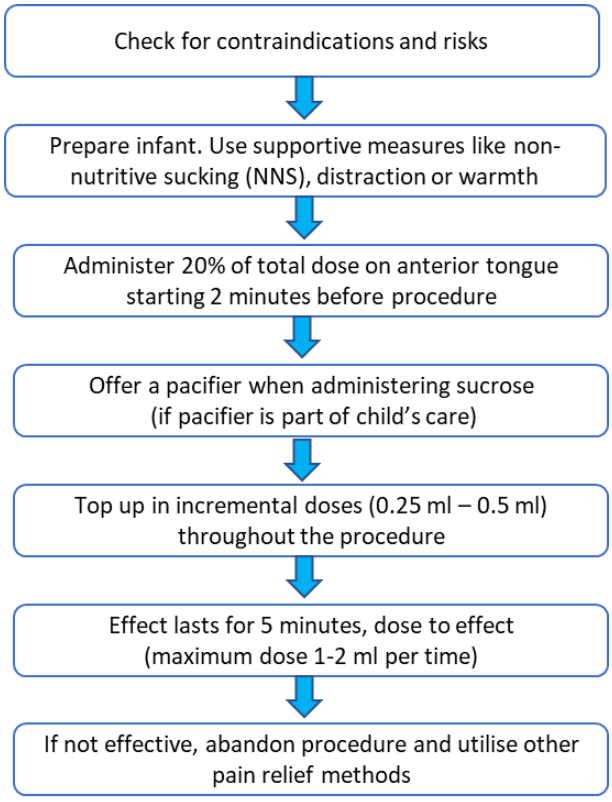
- Sucrose is a mild analgesic
- Works by producing endogenous opioids
- Effective to reduce pain and distress (calming, no sedative effect) from a single event during minor procedures

WHO	• Works well for infants < 12 months, sometimes up to 18 months • Most effective for premature and term babies in neonatal period
WHEN	1. Sole analgesic for minor procedures e.g., venepuncture, intravenous line, dressing, attach or remove ECG leads 2. Adjunct to strong analgesia & topical anaesthetic e.g., chest drain insertion, laser, ROP examination
CAUTION	• Useful for single attempt painful procedures • Not appropriate for continuing pain • Not effective if given via nasogastric tube directly to stomach
CONTRA-INDICATION	1. Known sucrose intolerance 2. Impaired gag reflex or swallowing difficulty 3. Fructose intolerance 4. Glucose-galactose malabsorption

Dose of sucrose in infants > 1 month

Sucrose concentration	**24%**
Starting dose	0.2-0.4 mls (20% of total dose)
Incremental dose	0.25- 0.5 mls
Max dose/event	1-2 mls
Max dose/day	5 mls > 3 months : up to 10 mls

How to administer sucrose in an infant 1-18 months



c. Inhaled nitrous oxide

- Nitrous oxide is a potent inhalational agent that has been shown to be tolerated and effective in reducing procedural anxiety by providing analgesia and light sedation[8].

d. Intravenous analgesics/anaesthetics

- Indicated for longer and more complex procedures such as bone marrow aspirations and lumbar punctures
- Most analgesia in this category can cause an impairment in conscious levels
- Examples of intravenous analgesia are ketamine and opioids
- See "Procedural sedation and analgesia"

e. Peripheral nerve block/ regional anaesthesia

- Nerve blocks are commonly used to manage pain during procedures especially those in the lower limbs
- Nerve block techniques include local infiltration of painful areas, peripheral nerve blocks, and central blocks (spinal, epidural and caudal blocks)
- Require the expertise of a trained personnel usually an anaesthetist

7.2.2 AFTER THE PROCEDURE

7.2.3.1. RE-EVALUATE THE PROCEDURE

- find out what went well, and what did not
- identify helpful strategies

7.2.3.2. REINFORCE COPING BEHAVIOUR

- praise the child for doing well in a specific aspect e.g., 'for staying still,' 'for not moving the hand,' 'for taking deep breaths'

7.2.3.3. PLAN FUTURE PROCEDURES

- discuss with child and parents on strategies to improve pain management for future procedures
- discuss with staff involved for inputs for further improvements

7.3. PROCEDURAL SEDATION AND ANALGESIA (PSA)

7.3.1. INTRODUCTION

- Procedural sedation is the delivery of sedating or dissociative medications to produce a state of depressed consciousness
- Analgesia is a loss of sensation to painful stimuli and is defined as having no effect on sensorium (most analgesics however tend to impair a patient's cognition as a side-effect)
- PSA provides both sedation and analgesia; and allows patients to maintain continuous and independent ventilation without a loss of protective reflexes
- PSA provides effective pain relief in procedures causing severe pain or in high anxiety levels
- Local anaesthetics can be a powerful adjuvant to PSA and when possible, should be implemented along with PSA
- Non pharmacologic interventions (including behavioural and cognitive approaches such as distraction, positive reinforcement, reinforcing coping skills, relaxation) should also be employed for all children receiving procedures

7.3.2. INDICATIONS

- Any painful or unpleasant procedure
    - E.g., wound dressing changes, lumbar puncture, chest tube, central lie placement, abscess incision and drainage, removal of sutures
- May be indicated in seemingly "minor" or relatively painless procedures as these can be quite traumatic for paediatric patients

7.3.3. GOALS OF PSA

- To guard patient's safety and welfare i.e. minimise risk of respiratory depression, hypoxia and hypotension
- To minimise physical discomfort and pain
- To control anxiety, minimise psychological trauma, and maximise potential for amnesia
- To modify behaviours and/or movement to allow safe completion of procedure
- To return patient to a state in which discharge from medical supervision is safe

7.3.4. CHOOSING THE DEPTH OF SEDATION

The choice of drugs to render a specific depth of sedation is determined by:

- Type of and complexity of procedure
- Anticipated degree of pain
- Allowable patient movement during the procedure (e.g., certain procedures cannot tolerate any movement at all will require deeper sedation)
- Characteristics of the child including age, medical history & ease of airway access
- Past experiences of the child with previous painful procedures
- Available vascular access

7.3.5. LEVELS OF SEDATION

- Sedation encompasses a wide range of levels of consciousness
- More important to recognise that sedation occurs along a continuum and even during the course of a single PSA, a patient will fluctuate in and out of different levels of consciousness.

Levels of sedation, response and vital functions

Levels of sedation	Verbal response	Tactile response	Pain response	Cognitive impairment	Airway protected	Respiration maintained	CVS maintained
Minimal sedation	+	+	+	±	+	+	+
Moderate sedation and analgesia (Conscious sedation)	+	±	+	+	+	+ (usually)	+
Deep sedation and analgesia	-	-	±	+	±	-	+
General anaesthesia	-	-	-	+ (LOC)	-	-	±

CVS: Cardiovascular, LOC: Loss of consciousness

7.3.6 PATIENT SELECTION

7.3.6.1. Select the appropriate patient with the utmost safety in mind

i. Evaluate the history considering key aspects

- Indication for PSA and any risk factors e.g obesity, sleep apnoea
- Past medical or surgical history eg. severe cardiorespiratory disease, raised intracranial hypertension, severe neurological impairment and/or bulbar dysfunction
- Recent or current illnesses eg. URTI or asthma exacerbation

- Allergies
- Drug history and current medications eg. prior use of narcotics or benzodiazepine

History		Comments
V	Volume	Vomiting, diarrhoea, fluid restriction, urine output *(Dehydration may potentiate hypotensive side-effects of some agents)*
A	Allergies	Opiates, Benzodiazepines, Barbiturates, local anaesthetics etc. *An allergy to one class of opiates does not generally confer cross-allergy to other classes of opiates. For eg morphine are natural opioid, fentanyl is synthetic*
M	Medications	CVS medications, CNS depressants. *May alter vital sings, volume status or resuscitative measures. Be careful with chronic benzodiazepine and opiate users-administration of reversal agents may induce withdrawal or seizures*
P	Past medical history	Asthma (histamine release with morphine), psychiatric disorders *(emergent reactions with ketamine)*, cardiac *disease (haemodynamic properties of certain sedatives)*, hepatic or renal impairment (*increased toxicity, decrease clearance),* porphyria (*etomidate)*
L	Last meal	For non-emergency cases, some guidelines recommend > 6 hours for solid food and formula milk, > 4 hours for breast milk and > 2 hours for clear liquid.

ii. Perform a focused examination

- for large (kissing) tonsils
- for anatomic airway abnormalities that may increase the potential for airway obstruction

7.3.6.1. Patient characteristics

- Patients who are in ASA classes 1 & 2 are frequently considered appropriate candidates for minimal, moderate, or deep sedation
- Any moderate or high-risk patients with severe systemic disease or significant co-morbidities (ASA III & IV) and children with special needs or those with potential anatomic airway problems should be referred to the anaesthetists
- Note that children with developmental disabilities have a 3-fold increased incidence of desaturation when compared to those without developmental disabilities
- There are also other conditions which may render PSA more risky and require to be used with caution. (see table below)

American Society of Anaesthesiologists (ASA) Physical Status Classification

Class	Description	Examples	Sedation suitability
I	A normal healthy patient	Unremarkable medical history	Excellent
II	A patient with mild systemic disease (no functional limitation)	Mild asthma, controlled seizure, anaemia, controlled diabetes	Generally good
III	A patient with severe systemic disease (definite functional limitation)	Moderate to severe asthma, poorly controlled seizure, pneumonia	Intermediate to poor, may consider benefits relative to risks
IV	A patient with severe systemic disease that is constant threat to life	Sepsis, advanced degree of pulmonary, cardiac, renal or hepatic insufficiency	Poor benefits, risks outweighs benefits
V	A moribund patient who is not expected to survive without an operation	Severe trauma	Extremely poor

Use PSA with caution in the following groups of patients

Condition	Reasons for caution
1. Major Illnesses	
• Asthma	Histamine release with morphine Risk of bronchospasm in poorly controlled asthma
• Cardiac disease	Effects of certain sedatives on the haemodynamic status
• Liver and Renal impairment	Increased toxicity or Decreased clearance of drugs
• Prematurity	Increased risk of apnoea Suggest delaying sedation to > 60 weeks post-conception
2. Prior drug use/abuse	
• Prior narcotics or benzodiazepines use	May develop tolerance to standard doses

7.3.7. EQUIPMENT REQUIRED

- The following types of equipment are required for PSA – use the acronym SOAPME
- Equipment for monitoring vital signs – heart rate, saturation, respiratory rate and blood pressure must be available
- Similarly, equipment for resuscitation must be available, checked and ready for use e.g. oxygen supply, suction, airway equipment and resuscitation trolley

Equipment required for Procedural Sedation and Analgesia

S	Suction – appropriate size catheters and functioning suction apparatus (e.g. Yankauer type suction)
O	Oxygen – adequate supply, functioning flow meters or other devices to allow its delivery
A	Airway – appropriate size airway equipment (endotracheal tubes, bag valve masks, laryngoscopes, stylets, laryngeal masks, oropharyngeal and nasopharyngeal airways)
P	Pharmacy – all basic drugs required for resuscitation including iv fluids (normal saline) and reversal agents(e.g. Flumazenil or naloxone) if indicated
M	Monitors : pulse oximeter, blood pressure montoring, stethoscope, and capnography and ECG if indicated
E	Special Equipment or drugs for a particular case (e.g. defibrillator)

7.3.8. HEALTH CARE PROVIDER REQUIREMENTS

- PSA should be performed only by trained and experienced personnel who
    - Have knowledge and competency in PSA including a clear understanding of the medications used and their side-effects
    - Have the ability to manage paediatric airway and resuscitate paediatric patients
    - Have the ability to recognise and manage any potential complications that may arise from PSA
- There should be a minimum of two personnel, and the one who is performing the procedure should not be administering the PSA
- In addition, a dedicated nursing staff to prepare patient, medications and equipment, as well as assist and monitor patient (record vital signs) during and after the procedure
- Institution support in the form of guidelines

7.3.9. DRUGS USED IN PROCEDURAL SEDATION AND ANALGESIA

- The choice of drugs to be used for PSA depends on the complexity of procedure, patient factors as well as expertise of the healthcare personnel
- Always select the lowest dose of drug with the highest therapeutic index for the procedure
- Examples of drug combinations for PSA (based on institutional guidelines) include
    - Morphine/midazolam e.g., procedural burn pain
    - Fentanyl/ midazolam e.g., short painful procedure
    - Ketamine/midazolam or fentanyl e.g., short painful procedure
    - Dexmedetomidine/midazolam e.g., painless procedure (e.g. MRI)
- Fentanyl and dexmedetomidine are permitted only with specialist supervision
- Local anaesthetics like EMLA or lignocaine infiltration are adjuvants to PSA and should be implemented along with PSA whenever possible
- Be mindful to use medications or a combination of medications that have BOTH analgesic and sedative effects for a painful procedure. For example, using midazolam alone for a painful procedure is not adequate as it does not have any analgesic properties

7.3.10. CRITERIA FOR DISCHARGE

- The time for greatest concern of adverse events for example respiratory depression is in the 5-10 minutes following the last administration of sedation AND after the painful stimuli for the procedure have been removed
- Monitoring of the patient must be continued until the patient has fully recovered. This includes monitoring of airway patency, adequacy of breathing, sedation level, pain scores/comfort and vital signs every 15 minutes
- Patient can be discharged when they meet criteria as below
- Provide an appropriate multimodal comfort plan if post procedural pain is anticipated

Criteria for discharge post PSA	
1.	Return to pre-procedure level of orientation and consciousness
2.	Tolerate drinking without emesis

Drugs commonly used for procedural sedation and analgesia in children

Drug	Pediatric Dose	Comments
Midazolam	IV: 0.05-0.1 mg/kg given 3 min before the procedure; not to exceed a total cumulative dose of 0.4 mg/kg or 6 mg (if used as sole agent) IM: 0.1-0.2 mg/kg IM 30-45 min before procedure PO: 0.25-0.5 mg/kg PO 30-45 min before procedure Intranasal: 0.2-0.6 mg/kg/dose inhaled intranasally 10 min before the procedure	Provides amnesia, mild anxiolysis and sedation but NO analgesia Co-administer with an analgesia agent (e.g. Ketamine or Fentanyl) for painful procedures Reduce dose by 30-50% when combined with an opioid analgesic (e.g. fentanyl) or chloral hydrate; younger children (i.e. < 5 y) may require higher doses up to 0.6 mg/kg/dose Common adverse events: Respiratory depression and apnoea (especially co-administration with opioids), paradoxical reactions including hyperactivity, aggressive behaviour, and inconsolable crying
Ketamine	IV: 0.5-1 mg/kg loading dose ; Then 0.25-0.5 mg/kg IV q10-15min; administer slowly, not to exceed 0.5 mg/kg/min IM: 2-5 mg/kg/dose IM	Provides excellent sedation and analgesia; elicits dissociative state Increases bronchial and salivary secretions; increases heart rate, blood pressure, and intracranial pressure Emergence hallucinations observed in older children (>15 years) and adults Pharmacologic effects NOT reversible
Fentanyl	IV: 0.5 - 1 mcg/kg/dose	Provides analgesia for painful procedures Increased risk of respiratory depression when combined with sedatives (reduce dose of sedative and fentanyl dose by 30-50% if used in combination) Chest wall rigidity associated with rapid IV push
Dexmedetomidine* (Precedex)	IV: 1mcg/kg and/or infusion 0.2-1mcg/kg/h IM: 1-4mcg/kg Intranasal: 1-2 mcg/kg	Good sedation without taking away respiratory drive, short acting Can cause severe bradycardia
Chloral hydrate	Neonates : 25-50 mg/kg/dose PO max once without repeat, administer 30 min before procedure Children : 50 mg/kg/dose (max 1000 mg) 30-45 min before procedure, may repeat afte 30 min with 25-50 mg/kg/dose; Max dose per procedure 100 mg/kg or 2000 mg/procedure (children)	Most effective in < 2 years or 15 kg ; Most successful if used for short painless procedures, no analgesic effect No longer recommended for PSA since much safer and more effective alternatives exist; Contraindicated with severe renal or liver impairment, no dose adjustment provided for non severe cases either. Unpredictable effect; paradoxical hyperactivity may occur; may cause nausea and vomiting; decrease dose if combined with opioid analgesic (eg, fentanyl); deaths and permanent neurologic injury from respiratory compromise have been reported, particularly in those with risk factors (eg, ASA class III, Leigh encephalopathy, tonsillar and adenoidal hypertrophy, obstructive sleep apnea); active metabolite has prolonged half-life

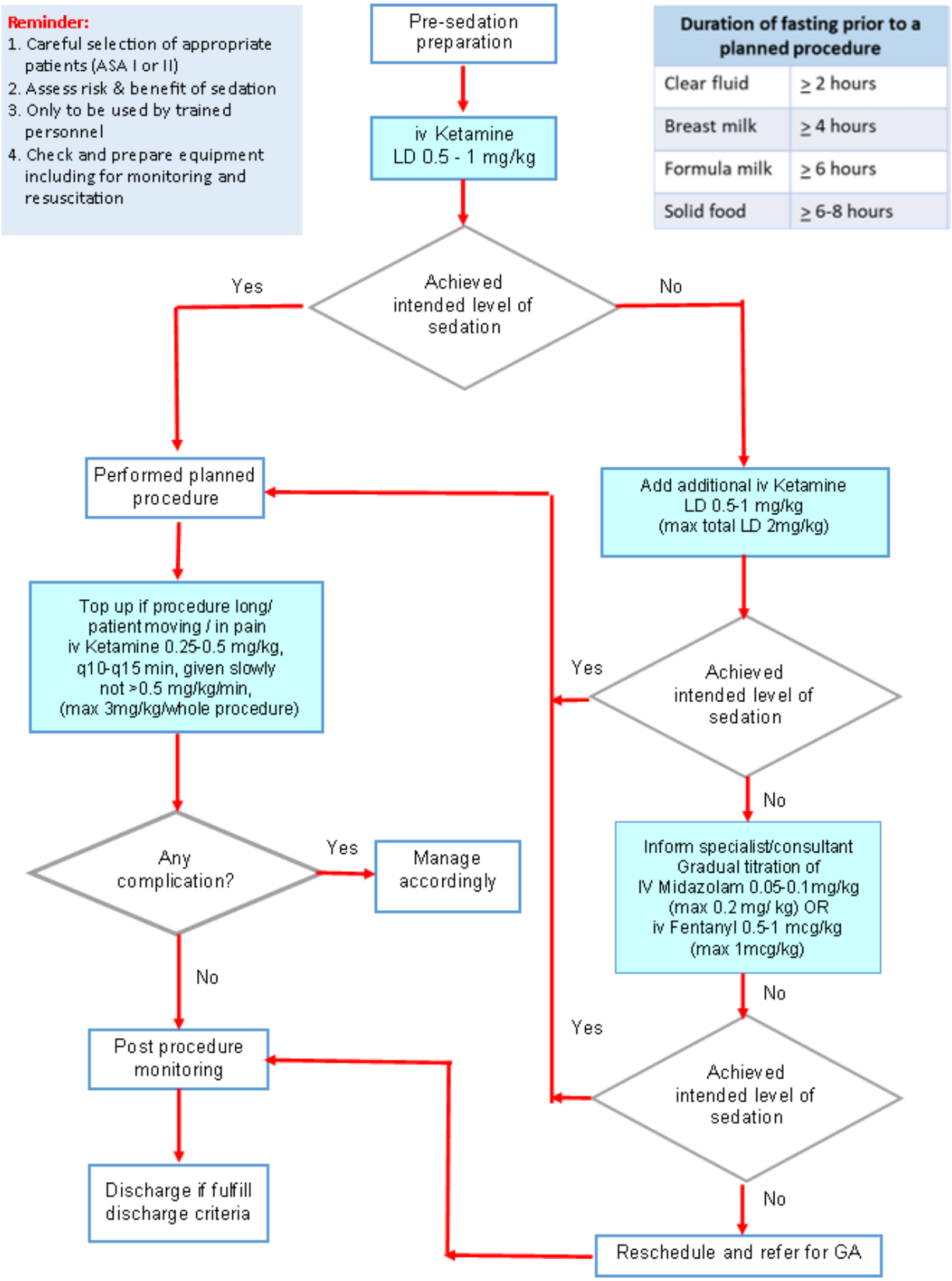
IV: intravenous, IM: intramuscular, PO: per oral, PR: per rectal; *Only for trained personnel or under supervision of intensivist or anaesthetists

Adapted from www.Medscape.com

PSA FOR PAINFUL PROCEDURES (< 30 MINUTES) IN CHILDREN > 3 months

Reminder:
1. Careful selection of appropriate patients (ASA I or II)
2. Assess risk & benefit of sedation
3. Only to be used by trained personnel
4. Check and prepare equipment including for monitoring and resuscitation

Duration of fasting prior to a planned procedure	
Clear fluid	≥ 2 hours
Breast milk	≥ 4 hours
Formula milk	≥ 6 hours
Solid food	≥ 6-8 hours

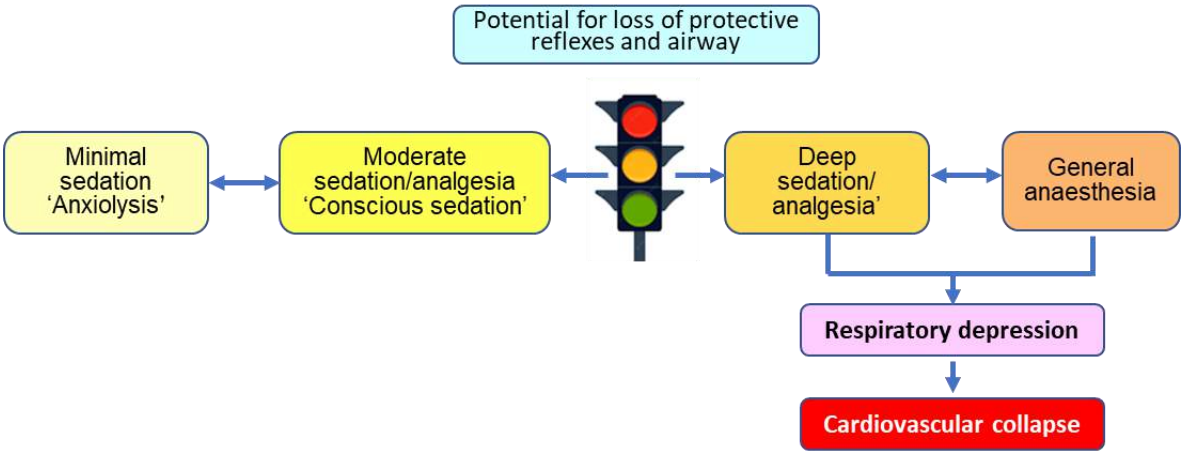


LD—Loading dose

** Routine use of iv Midazolam or iv Atropine with iv Ketamine no longer indicated*

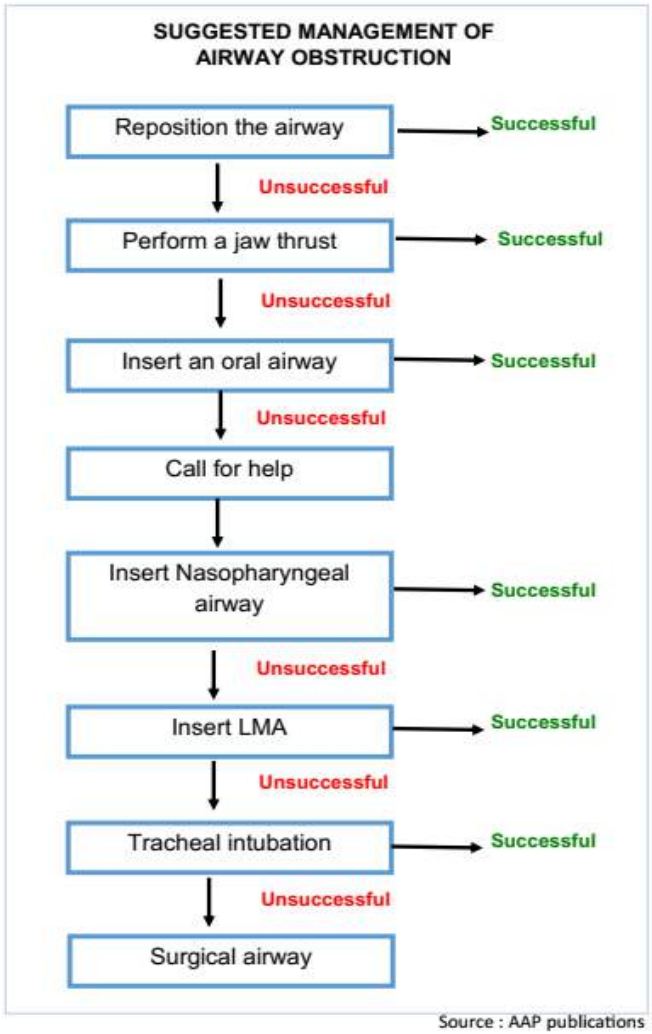
7.3.10. RESCUE THERAPY

- It is common for children to pass from intended level of sedation to a deeper, unintended level of sedation
- When children move from moderate sedation to deep sedation, there is a potential for loss of protective reflexes and they may no longer be able to maintain their airway
- The risk of respiratory depression and cardiovascular collapse increases
- Thus, practitioners must have the skills to be able to recognise when this occurs and rescue patient from a deeper level than that intended for the procedure
- The practitioner must also be able to manage any complications like respiratory depression or cardiovascular compromise

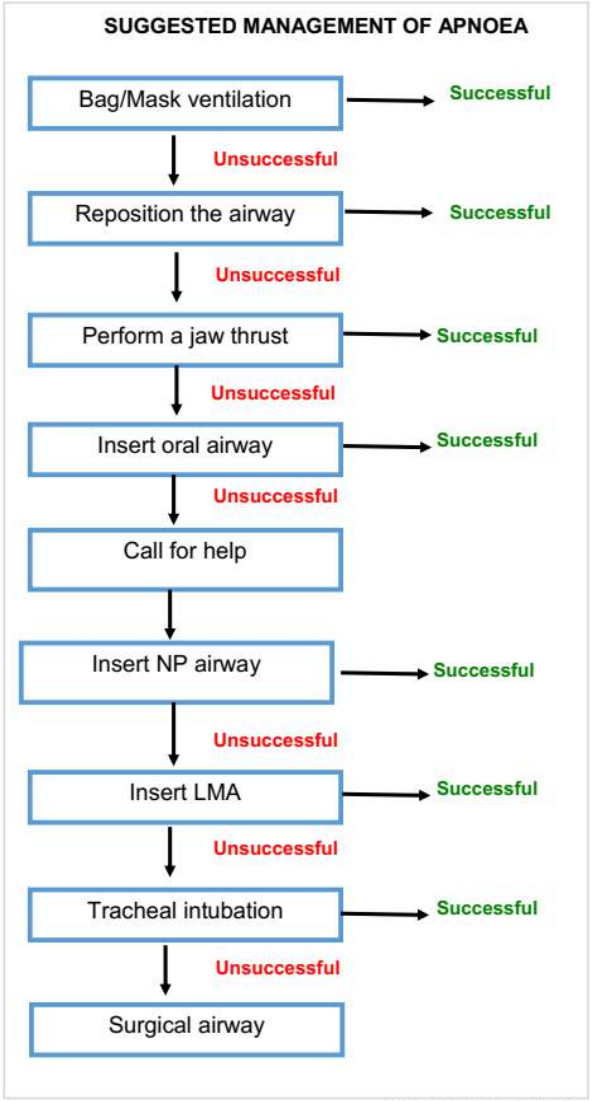


The continuum of sedation

RESCUE THERAPIES FOR AIRWAY OBSTRUCTION, APNOEA AND LARYNGOSPASM



Source : AAP publications



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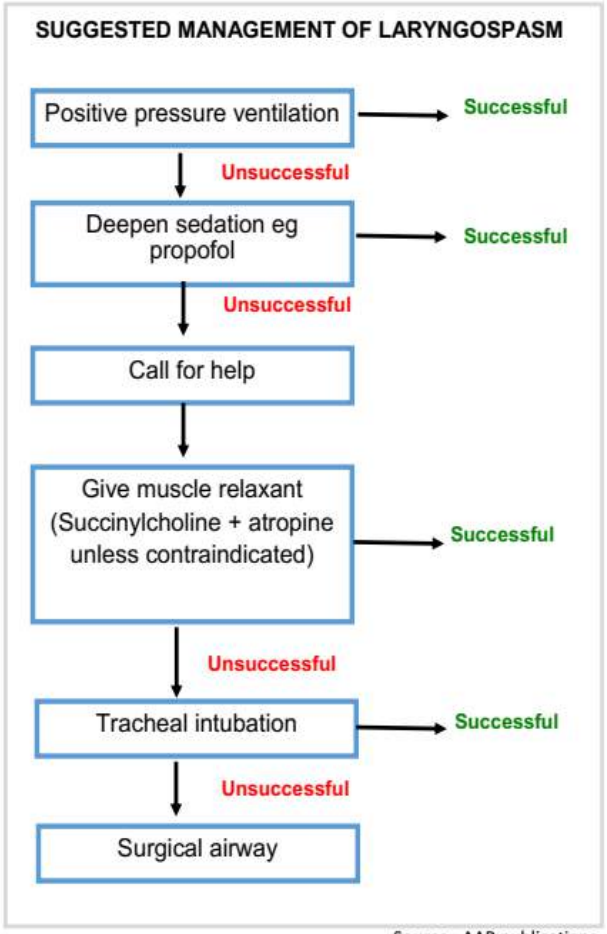


Source : AAP publications

References :

1. Taylor EM, Boyer K, Campbell FA. Pain in hospitalized children: a prospective cross-sectional survey of pain prevalence, intensity, assessment and management in a Canadian pediatric teaching hospital. Pain research & management. 2008;13(1):25-32.
2. Shomaker K, Dutton S, Mark M. Pain Prevalence and Treatment Patterns in a US Children's Hospital. Hospital pediatrics. 2015;5(7):363-70.
3. Birnie KA, Chambers CT, Fernandez CV, Forgeron PA, Latimer MA, McGrath PJ, et al. Hospitalized children continue to report undertreated and preventable pain. Pain research & management. 2014;19(4):198-204.
4. Taddio A, Chambers CT, Halperin SA, Ipp M, Lockett D, Rieder MJ, et al. Inadequate pain management during routine childhood immunizations: the nerve of it. Clinical therapeutics. 2009;31:S152-S67.
5. Khan M, Calic M, Tablon P, Racine NM, Pillai Riddell RR, Taddio A. Systematic Review: Predisposing, Precipitating, Perpetuating, and Present Factors Predicting Anticipatory Distress to Painful Medical Procedures in Children. Journal of Pediatric Psychology. 2015;41(2):159-81.
6. McMurtry CM, McGrath PJ, Chambers CT. Reassurance can hurt: Parental behavior and painful medical procedures. The Journal of Pediatrics. 2006;148(4):560-1.
7. Essential Medicines and Health Products Information Portal A World Health Organization resource.
8. Kanagasundaram SA, Lane LJ, Cavalletto BP, Keneally JP, Cooper MG. Efficacy and safety of nitrous oxide in alleviating pain and anxiety during painful procedures. Archives of Disease in Childhood. 2001;84: 4925
9. Meredith JR, O'Keefe KP, Galwankar S. Pediatric procedural sedation and analgesia. Journal of emergencies, trauma, and shock. 2008;1(2):88-96.
10. Charles J. Coté, Stephen Wilson .Guidelines for Monitoring and Management of Pediatric Patients Before, During, and After Sedation for Diagnostic and Therapeutic Procedures: Update 2016, AAP and AAPD, Pediatrics July 2016, 138 (1) e20161212; DOI: https://doi.org/10.1542/peds.2016-1212
11. https://pediatrics.aappublications.org/content/138/1/e20161212

Chapter 8: Management of Acute Pain in Children

8.1. INTRODUCTION

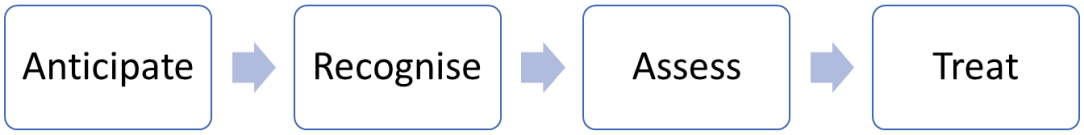
Children of all ages including newborns feel and react to pain. Acute pain is far more common than chronic pain in children. Acute pain is a normal and temporary response that alerts the body to an injury. Pain from injury or illness typically is transitory; and majority can be easily managed by the patient and caretakers.

Iatrogenic acute pain is also common and extends from the increasing number of needle stick procedures (immunizations, screening blood tests) that are performed as part of preventive medicine strategies, to acute severe pain related to surgery or other procedures done to address a serious medical problem. The procedures can be divided into two categories, painful diagnostic and therapeutic (procedural pain); and surgical procedures (postoperative pain).

Acute pain is associated with increased anxiety, avoidance, somatic symptoms and increased parent distress. Unrelieved and undertreated acute pain can also lead to long term adverse consequences such as post-traumatic stress disorder and pain hypersensitivity. There is mounting evidence that adequate pain relief after surgery reduces the period of recovery, lowers morbidity and improves outcome. Pain should not only be anticipated and prevented; but should also be safely and effectively controlled in all children regardless of age, maturity or severity of illness.

Type of Acute Pain	Nociceptive or inflammatory pain	Neuropathic
Pathophysiology	Caused by normal neural activity in response to tissue-damaging stimuli	Caused by lesion or disease affecting nervous system (peripheral or central)
Character	Sharp, throbbing, aching, often well-localised	Shooting, burning pain, tingling, numbness
Examples	• Procedural pain • Postoperative pain • Infection • Arthritis • Ischemia	• Spinal cord compression • Nerve injury

8.2. PRINCIPLES OF ACUTE PAIN MANAGEMENT IN CHILDREN



8.2.1. ANTICIPATE AND RECOGNISE

- When possible, pain should be anticipated and prevented e.g., using topical EMLA before insertion of iv lines
- Plan post-operative pain relief before any surgery; including preparing the child and family in advance with clear and simple information to reduce fear and anxiety and to correct misconceptions. Furthermore, some analgesic techniques require preoperative explanation for the technique to be optimally used eg. Patient controlled analgesia (PCA)
- When pain has occurred, it is important to recognise pain early and to treat it appropriately e.g., pain recognition should start at Triage in ED

8.2.2. ASSESS PAIN USING ABCDE APPROACH

- Pain should be assessed using the ABCDE approach as discussed in Chapter 3. Please refer to 3.1.1.

A	Ask the child and Assess Pain Score
B	Use Behavioural and Biological Measures
C	Find the Cause
D	Decide and Deliver treatment in a timely manner
E	Evaluate outcome

A proper pain assessment includes

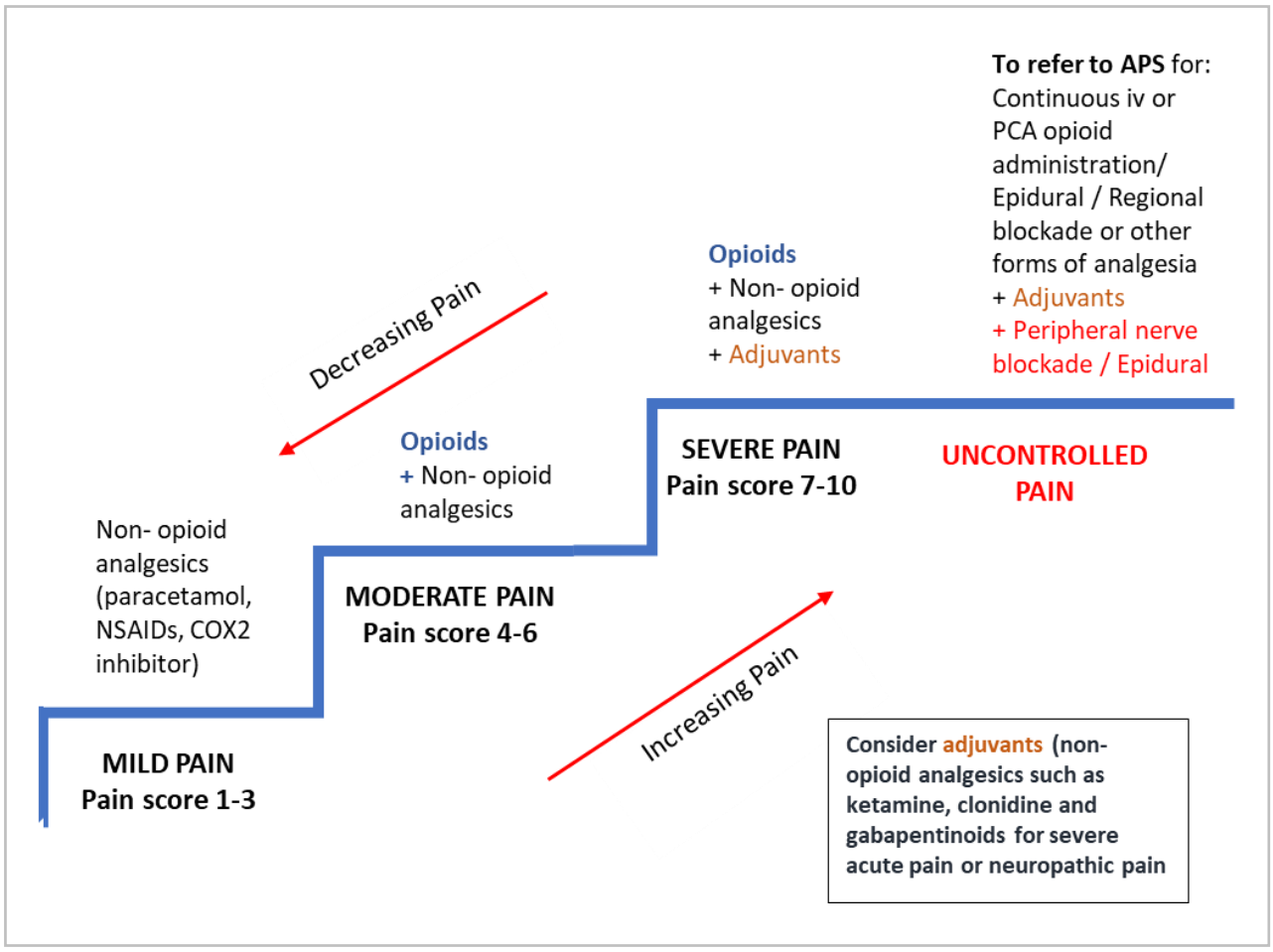
- Taking a good history exploring the pain quality, characteristics, location, onset, duration, aggravating and alleviating factors, and impact on function
- Performing a meticulous examination to search for possible causes of pain. Document pain intensity and site of pain.

- Assessing pain using an age and developmentally appropriate pain scale/tool that is suited to the child's condition
- Interpretation of the severity of pain

8.2.3. TREATMENT OF PAIN

- there should be clear documentation of pain assessments, analgesia used and patient's response
- treatment should be multimodal and involve the use of non-pharmacological techniques
- It is vital to involve the patient/carer to ensure satisfactory pain management

Analgesic ladder for acute pain



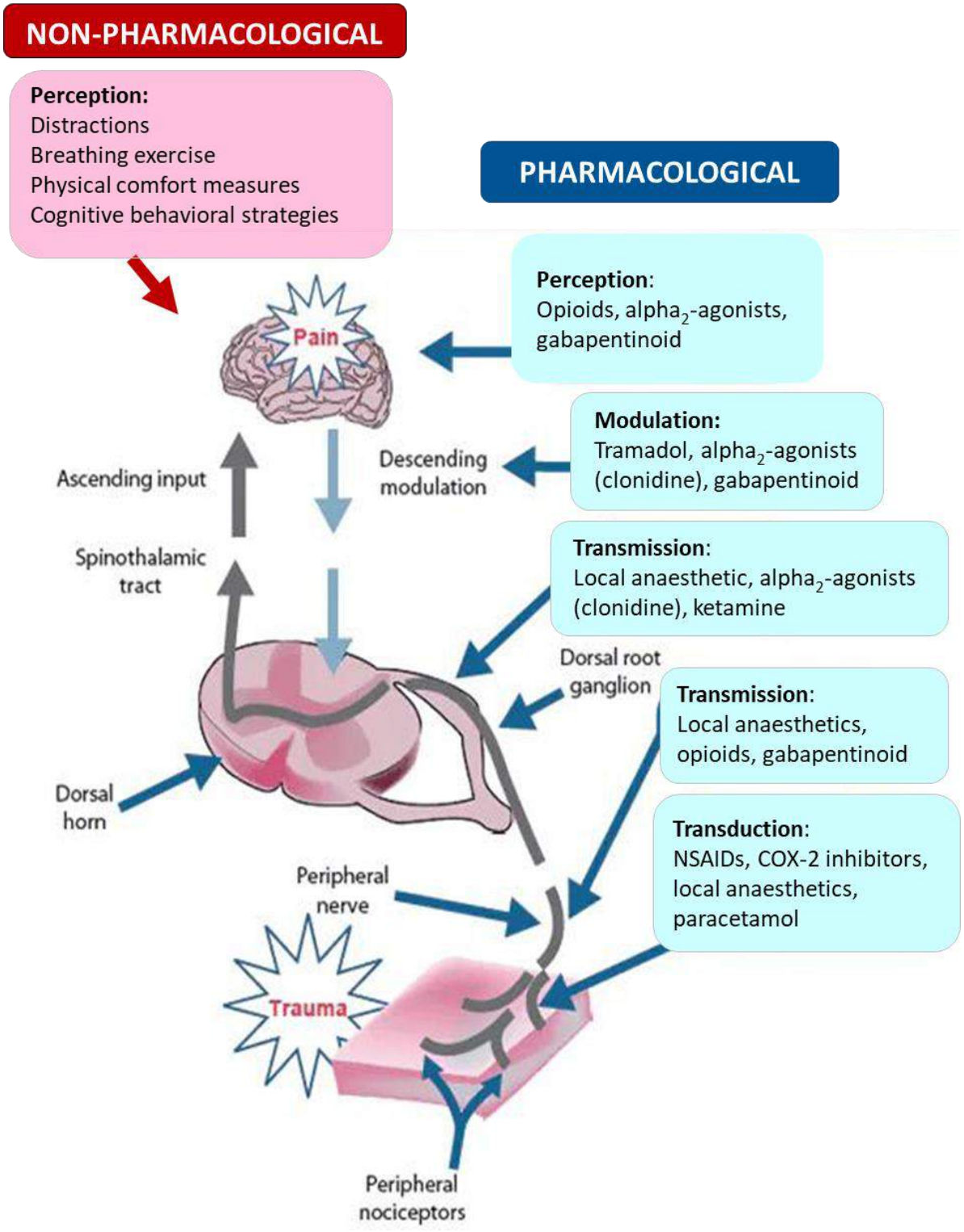
8.3. MANAGEMENT OF ACUTE PAIN

Treatment	Comments
Goal	◦ Pain is best prevented rather than treated. ◦ Regular pain assessment and rapid pain control ◦ Aim for pain score ≤ 3 if possible
Analgesia	◦ Use the analgesic ladder - Always start with optimal doses - Titrate further doses according to pain response - Administer regularly (around the clock and advise active involvement from parents)
Dose	◦ Medication dosing should be tailored to the individual patient ◦ Calculate based on mg/kg body weight (Caution in obese: use ideal body weight for opioids, or adjusted body weight for PCM and NSAIDs)
Route	◦ Use intravenous, oral, intranasal or rectal routes ◦ Choose the least invasive route whenever possible ◦ Oral administration is preferred for mild to moderate pain ◦ Intravenous route is indicated for immediate pain relief. ◦ Persistent moderate to severe pain would require continuous analgesia either as an intravenous infusion, patient-controlled analgesia (PCA), or continuous infusion local anaesthetic via epidural ◦ PCA can be used only if the patient can operate the pump on their own. ◦ Avoid intramuscular injections as the bioavailability is unpredictable. It also causes unnecessary fear, and the child will deny pain to avoid further injections
Types	◦ Multimodal ◦ Use a combination of multiple analgesics with different modes of action to achieve the best pain control ◦ Always include non-pharmacological interventions ◦ Pre-emptive analgesia ◦ Pain is best prevented rather than treated ◦ Children who have been treated before a painful procedure or allowed to wake up comfortably post-surgery require less analgesia
Monitoring	◦ Certain at-risk children including neonates and ex-premature infants may need to be monitored continuously when given opioids (refer to the section on opioids)
Follow-up	◦ Assess pain frequently in all patients ◦ To provide safe and efficient analgesia but adjust when required.

8.3.1. THE PAEDIATRIC ACUTE PAIN SERVICE (APS)

- The APS team is a specialised, multi-disciplinary inpatient team
- Its members may consist of anaesthetic consultant/ specialists, anaesthetic medical officer and nurses under the department of Anaesthesiology and Intensive Care
- It functions to assist with the management of severe pain by working in collaboration with the patient's primary care team, bedside nurse, family, and pharmacists to provide a patient-centered multi-modal pain plan
- It is usually consulted when either a patient's analgesic needs have grown beyond standard drug dosing that their primary service is comfortable prescribing, or there is anticipated need for APS involvement for postoperative patients
- APS management is routinely indicated for the following postoperative patients e.g. patients with an indwelling regional or neuraxial block catheter, patients who have received a single-shot peripheral nerve block, patients with a patient-controlled analgesia (PCA) technique, or patients receiving opioids or ketamine infusion

8.3.2. MECHANISMS AND SITES OF ACTION FOR ACUTE PAIN INTERVENTIONS



8.3.3 PHARMACOLOGICAL GUIDELINES FOR ANALGESICS IN ACUTE PAIN

Drug			Route	1 month-2 years	2-12 years	12- 18 years
				Dose and frequency		
Non- opioid analgesics		Paracetamol	Oral	**0 - 3 months:** 15mg/kg 6 – 8H (Max: 60mg/kg/day; if preterm 28-32 CGA, max 30mg/kg/day) **> 3months -12 years:** 15mg/kg 4-6H (Max: 75mg/kg/day or 4 grams/day)		500 mg - 1 gram 4-6H **(If non- obese ≥ 50 kg:** 1 gram 4-6H) (Max: 4 grams /day)
			Per rectal	**0- 3 months: LD** 30 mg/kg; **MD :** 20mg/kg 8 H (Max: 60mg/kg/day) **> 3 month – 12 years : LD** 40mg/kg ; **MD :** 15-20mg/kg 6H (Max: 75mg/kg/day)		
			IV	**Preterm neonate over 32/52 (CGA) :** 7.5mg/kg 8H (max 25mg/kg/day)**; Term neonate & until 10 kg:** 7.5 mg/kg 6-8H (Max: 30mg/kg/day) **> 10kg or child up to 50 kg:** 15mg/kg 4- 6H (Max: 60 mg/kg/day, not exceeding 2 grams/day if < 33 kg, or 3 grams/day for 33-50 kg)		**If non obese > 50 kg :** 1 gram 4 – 6H (Max: 4grams/day) ****Obese Children:** 15mg/kg Adjusted body weight (Max: 4grams/day)
	NSAIDS	Ibuprofen	Oral	**< 3 months:** not recommended **> 3 months:** 5mg/kg 6-8H (Max: 20mg/kg/day) **6 months – 12 years**: 5-10 mg/kg 6-8H (Max: 30-40mg/kg/day or 1.2 grams/day, whichever is less)		200 mg – 400 mg 4-6H (Max: 2.4 grams/day)
		Diclofenac	Oral	**< 6 months**: not recommended **> 6 months or >10 kg**: 0.3-1mg/kg 8H (Max: 3 mg/kg/day up to 150 mg/day, whichever is less for 2 days)		Oral 25 - 50mg 8H (Max: 3 doses/day)
			Per rectal	**> 1 year:** 1 mg/kg 8-12 H (Max: 3 mg/kg/day up to 150 mg/day, whichever is less)		50-100 mg (oral to be started 18 hours after initial 100mg suppository)
	Cox2 inhibitor	Celebrex	Oral	**< 2 years:** not recommended	**> 2 years:** weigh risks & benefits **10-25 kg:** 50mg 12H **> 25 kg:** 100mg 12H	
		Parecoxib	IV	**< 2 years:** not recommended	**> 2 years:** weigh risks & benefits A single dose of 0.5-1 mg/kg (max: 40 mg, administered by the anaesthetists in theatres. NSAIDs should only be administered 24 hours after a dose of parecoxib.)	
Opioid Analgesics		Fentanyl (Opioid agonist)	IV	**For specialist use /with supervision only.** Bolus: 1-2 mcg/kg/dose (Should only be given by the Anaesthetists / PICU Team/Paediatric Emergency Specialist/ Trained accredited personnel) **INFUSION in an independent line (in ICU or refer APS):** **Preparation:** Dilute 20mcg/kg of Fentanyl in 50mls normal saline. 1 ml of solution = 0.4mcg/kg of Fentanyl **Suggested rate :** 0.5 – 2mls/H (max 4ml/H) (0.2 – 0.8 mcg/kg/H)		
			PCA	(Restricted to APS team) **- Initial PCA dosing:** Concentration: 0.4mcg/ml ; Bolus dose: 0.4-0.8mcg/kg; Lockout interval: 5 to 7 minutes. Basal infusion (optional) : 0-0.8mcg/kg; 4 hour limit - 4 mcg/kg		
		Tramadol (opioid agonist, SNRI)	Oral/ IV	**> 1 year**: 0.5-1mg/kg 4-6H (with caution or refer APS) NB: For tonsillectomy max 1mg/kg /dose 6-8H (caution in OSA)		**> 12years**: 1mg/kg 4 - 6H (Max: 100mg/dose or 400mg/day)
		Oxycodone (Opioid agonist)	Oral	**> 1 month**: Immediate Release (IR Oxynorm) 0.1-0.2 mg/kg (max5mg) PRN or 4-6H (by APS/ Palliative team) **NB:** Immediate release (IR Oxynorm) for acute pain; Slow release (SR Oxycontin) for severe background pain (only available in tablet)		
		Morphine (Opioid agonist)	Oral	**> 1 month-1 year:** 0.1mg/kg 4-6H (for moderate – severe pain) (use with caution) **> 1 year:** 0.1-0.2 mg/kg 4-6H (for moderate pain) 0.2-0.4 mg/kg 4-6H (for severe pain)		**> 12yrs:** 0.1- 0.3 mg/kg 4 -6H (Max: 10-15mg/dose, up to 6x/ 24 Hs)
			SC	0.1-0.2 mg/kg **< 6 months:** (up to 4x/ 24 Hs) **> 6 months**: (up to 6x/ 24 Hs)	0.2 mg/kg (up to 6x/ 24 Hs)	**>12yrs:** 5 -10mg (up to 6x/ 24 Hs)

Opioid Analgesics	**Morphine (Opioid μ-agonist)**	IV	**BOLUS:** Slow titration: **Refer iv morphine titration protocol** **1-12 months**: Max : 0.1 mg/kg (up to 4x /24 H) **> 1 year**: Max : 0.1 mg/kg (up to 6x/ 24 H)	**BOLUS:** Slow titration: **Refer iv morphine titration protocol** **> 12yrs:** 2.5 -10mg (up to 6x/ 24 H)
			INFUSION in an independent line (with caution or refer APS): **Preparation:** Dilute 0.5mg/kg of Morphine (max: 50mg) in 50mls normal saline. 1 ml of solution = 10mcg/kg of morphine **Suggested rate: Neonates:** 0.5 – 0.7mls/H (max: 1ml/H) (5 – 10 mcg/kg/H) **1 - 3 months:** 0.5 – 1mls/H (max: 2ml/H) (5 – 20 mcg/kg/H) **> 3 months:** 1 – 2mls/H (max: 4ml/H) (10 – 40 mcg/kg/H)	
		PCA	**Initial PCA dosing:** (Restricted to APS team) Concentration: 10-20mcg/ml ; Bolus dose: 10-20mcg/kg; Lockout interval: 5 to 7 minutes. Basal infusion (optional) : 0-20mcg/kg/H; 4-hour limit 300 mcg/kg	
Naloxone (pure opioid antagonist)		IV	0.01 mg/kg IV (Max: 0.4 mg) may repeat every 2 minutes.	
Adjuvants	**Ketamine (NMDA antagonist)**	Oral	Oral: 2-10mg/kg (sedation premedication)	
		IV	**BOLUS for analgesia:** 0.2-0.5 mg/kg ; **for sedation :** 1-1.5mg/kg (Use restricted to trained personnel only) **INFUSION in an independent line:** (Use restricted to trained personnel only) **Preparation:** Dilute 5mg/kg of Ketamine (max: 250mg) in 50mls normal saline. 1 ml of solution = 100mcg/kg of ketamine **Suggested rate:** 0.2 – 2mls/H (max: 4ml/hr) (20 – 400 mcg/kg/H)	
	Clonidine (alpha2-agonist)	Oral	**Analgesic adjunct:** 1-2 mcg/kg PRN or 8H **sedation premedication:** 2-4 mcg/kg NB: antihypertensive- do not give if hypotensive	
		IV	1-2 mcg/kg PRN or 8H **(with caution or refer APS)** NB: antihypertensive- do not give if hypotensive	
	Gabapentin (anticonvulsant)	Oral	Initial dose: 5mg/kg ON, increase if required to 5mg/kg 12H (Day 2), then 5mg/kg 8H (Day 3)	
Local Anaesthetic	**Lignocaine**	LA/RA	Max dose: 4-5mg/kg	
	Levobupivacaine / Bupivacaine	LA/ RA	Max dose: **Neonates - <6 months:** 1.5-2 mg/kg; **> 6months:** 2-2.5 mg/kg NB: Bupivacaine is particularly cardiotoxic	
		Epidural infusion	**Levobupivacaine 0.1% ± fentanyl infusion:** (restricted to APS team) **Preparation:** Dilute 10 mls of Levobupivacaine/ Bupivacaine 0.5% (i.e., 50mg) in 50mls normal saline + fentanyl (**<1months**: Nil; **1months – 1 year**: Fentanyl 1 mcg/ml ; **>1year**: Fentanyl 2 mcg/ml) **Suggested rate: Neonates:** Levobupivacaine 0.1% : 0.1 – 0.2ml/kg/H **1months – 1 year:** Levobupivacaine 0.1% + Fentanyl 1 mcg/ml: 0.2 – 0.4ml/kg/H **>1year:** Levobupivacaine 0.1% + Fentanyl 2 mcg/ml: 0.2 – 0.4ml/kg/H	
	Ropivacaine	LA/ RA	Max dose: **Neonates - <6 months:** 1.5-2 mg/kg; **> 6months:** 2-3 mg/kg	
		Epidural infusion	**Ropivacaine 0.1% ± fentanyl infusion:** (restricted to APS team) **Preparation:** Dilute 25mls of Ropivacaine 0.2% (i.e., 50mg) in 50mls normal saline *or* dilute 6.7ml of Ropivacaine 0.75% (i.e., 50mg) in 50mls NS + fentanyl (**<1months**: Nil; **1months – 1 year**: Fentanyl 1 mcg/ml ; **>1year**: Fentanyl 2 mcg/ml) **Suggested rate: Neonates:** Ropivacaine 0.1%: 0.1 – 0.2ml/kg/H **1months – 1 year:** Ropivacaine 0.1% + Fentanyl 1 mcg/ml: 0.2 – 0.4ml/kg/H **>1year:** Ropivacaine 0.1% + Fentanyl 2 mcg/ml **:** 0.2 – 0.4ml/kg/H	

IV : intravenous, SC : subcutaneous, PCA: patient-controlled analgesia, LA: Local infiltration, RA: Regional anaesthesia, H : Hour, Max : maximum, LD : Loading dose, MD: Maintenance dose, IBW : Ideal body weight, ON: on night

****For Obese Children, recommended adjustments for drug dosing:**

Opioids: Ideal Body weight (IBW); Paracetamol and NSAID: Adjusted Body Weight= IBW+ 0.4 x (Actual BW-IBW)

8.3.4 NON-PHARMACOLOGICAL INTERVENTION

- Most non-pharmacological techniques will not reduce the intensity of pain but will help the child and family to cope better and give a sense of being more in control.
- These techniques are designed to decrease anxiety but are not adequate as the sole means of pain relief for most painful procedures.
- They should not be used solely but in combination with appropriate pharmacological methods.
- The environment should be made as child friendly as possible and parental involvement should be encouraged where possible.
- Preparation of the parent and child, anticipation of and planning for each individual child's expected distress, and training of staff in coping with the child and parent are methods to reduce pain and distress.
- Management of acute pain in children should be individualised and tailored according to the child. Management may include giving the patient a chance to voice their concerns, validate their fears, and reassure them by reviewing their pain plan.
- Examples of non-pharmacological methods:
    - Distraction techniques to divert attention away from painful stimuli:
        - Playing with their favourite toys
        - Watching videos, video games, TV
        - Listening to music by headphones
        - Art therapy, aromatherapy
    - Positive incentive techniques:
        - Provide a small reward (*e.g.*, stickers or prizes) for attempts at mastery of their responses
    - Physical comfort measures:
        - For infants and younger children
        - Examples: holding, cuddling, rocking, swaddling, auditory and tactile stimulation, and suckling i.e., breast feeding and non-nutritive sucking and/or the use of sucrose or other sweet solutions (only for procedural acute pain) may reduce behavioural and physiological responses to acute pain
    - Breathing techniques:
        - Deep breathing (rhythmically with slow deep breathes)
        - Blowing (imaginary candles or take a deep breath and 'blow away the pain')
    - Physical strategies:
        - Examples: massage, application of heat and cold, warm baths, ice packs, vibratory stimulation
        - Physical and occupational therapy
    - Cognitive behavioural strategies:
        - hypnosis, guided superhero imagery, meditation, Reiki, storytelling

8.3.5 SUGGESTED APPROACHES TO ACUTE PAIN IN DIFFERENT CONDITIONS:

Setting	Condition/ Setting	Analgesia
Emergency department	Simple isolated fractures	• Combination Morphine (iv) & Paracetamol (oral or iv) • Inhaled Nitrous oxide (if available) • Intranasal Fentanyl (if available)
	Fracture reduction of simple isolated fractures	• Iv Ketamine • Iv Morphine & Paracetamol (oral or iv) • Iv Ketamine & Paracetamol (oral or iv)
	Acute abdomen	• Iv Paracetamol • Iv Fentanyl
Surgical ward	Acute post-operative pain	• Paracetamol (oral , suppository or iv) • Opioids (oral, iv or infusion) e.g Morphine or Fentanyl • Patient controlled anaesthesia (PCA) • Continuous local anaesthetic epidural infusion
Medical ward	Acute pain due to illness	• Depends on severity and type of illness and situation. Treatment to be individualized to the patient and condition • Paracetamol • NSAIDs • Opioids • Topical

References:

1. Pain Management Handbook, MOH/P/PAK/257.12 (HB)
2. The Assessment and Management of Acute Pain in Infants, Children, and Adolescents (AAP: Pediatrics Vol. 108 No. 3 September 2001
3. Sedation and Analgesia for Paediatric Fracture Reduction in the Emergency Department: A Systematic Review JAMA Paediatrics 2006
4. Postoperative Analgesia in Children: An Update M.E.J. Anesth 20 (3), 2009
5. Management of Postoperative Pain in Children; Paediatrics 2008
6. A practical guide to acute pain management in children. Journal of Anaesthesia (2020) 34:421–433

Chapter 9: Management of Pain in Critically Ill Children

9.1. INTRODUCTION

Critically ill children experience significantly more moderate to severe pain, and have higher pain scores than children in general ward[3]. Studies have shown that nearly half of the children in PICUs experience pain on a given day. They also experience about 6 times more painful procedures per day than children in general ward[4] e.g., turning, tracheal suction, wound care, line setting etc. In addition, inadequate pain management is the second most common cause leading to the adverse events in PICUs after intravenous complications[5].

Unfortunately, there are significant challenges in PICU pain assessment especially the diverse population (age, diagnosis, emotional and cognitive development and communicative ability), fluctuating condition of the children and also overlap between pain and non-pain related distress. This necessitates the knowledge of multiple methods of assessment together with a lot of patience.

Critically ill children and more so those who require respiratory support are unable to effectively communicate, and thus it is difficult to differentiate pain from other non-pain related source of distress. Figure 1[6] show the overlap in behavioural and some physiologic cues for the presence of pain and non-pain distress. All have similarities in the middle – agitation, inconsolable, sleep problems and irritability. Very importantly, pain also has considerable overlap with withdrawal, delirium and undersedation.

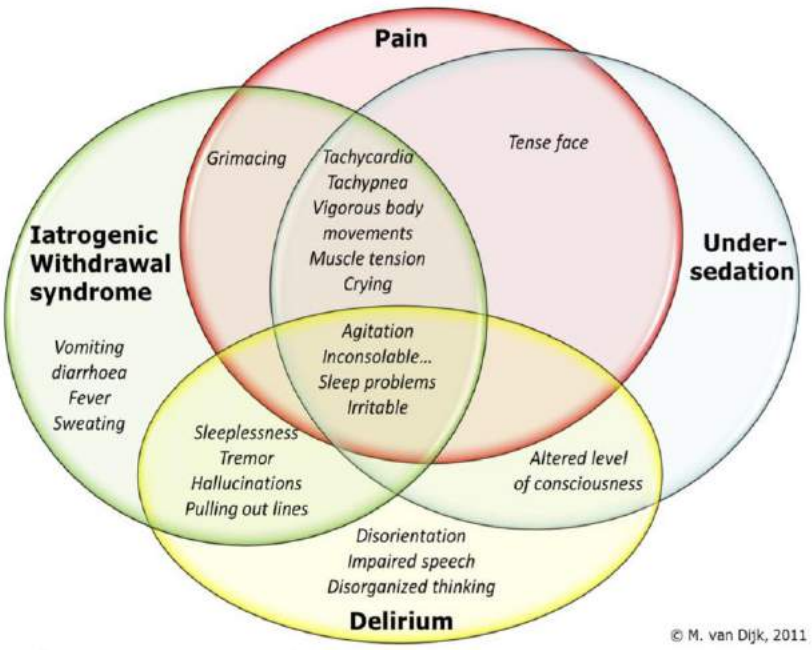
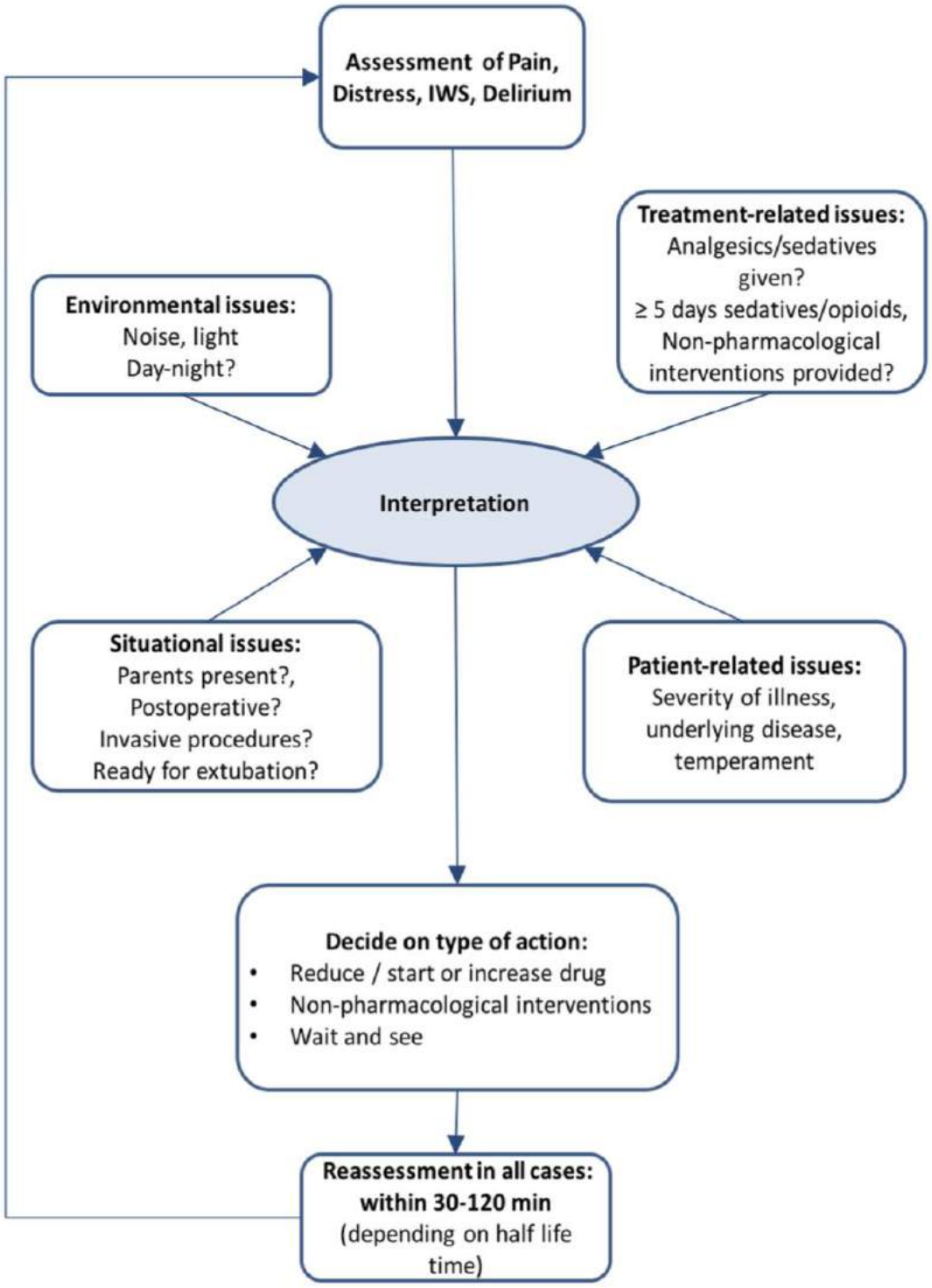


Fig. 1 Overlap of behavioural cues in pain, sedation, withdrawal syndrome and delirium

9.2. MANAGING PAIN IN CRITICALLY ILL CHILDREN

9.2.1. IDENTIFY APPROPRIATE SOURCES OF PAIN AND TAKE ACTION

- In a child with distress, consider non-pain related causes first. Environmental factors like noise, temperature, nappy care and change in position need to be addressed prior to considering pain management (Figure 2)[7]



9.2.2. PAIN ASSESSMENT TOOLS

- Use age-appropriate tools to assess acute and prolonged pain
- Self-report scales like revised FACES pain score (IASP) should be used first to assess pain whenever possible
- Sedation is different from pain control; a well sedate patient can still experience pain and vice versa. Over-sedation may also be associated with adverse events
- In patients who are mechanically ventilate and require sedation, a combination of Comfort B and FLACC can be used. This is an attempt to separate issues related to sedation and pain to allow more targeted therapeutic management. A very good example of this strategy has been used in the SANDWICH trial (Sedation and Weaning in Children) in which Comfort B is used to assess the effectiveness of sedation administered, maximising individual patient comfort while minimising potential for adverse events associated with sedation in the PICU. A separate pain score like FLACC, FACES etc. are used separately especially when Comfort B score is more than 17 to address the issues in related to pain in the process of weaning.

  SANDWICH | Sandwich (qub.ac.uk) (see below)
- Another important aspect in assessing pain in critically ill children is to enlist persons who knows the child well especially the parents/caretakers or bedside nurses. Another potential valuable tool is the Nurse interpreted Score for Sedation (NISS)

Nurse Interpreted Score for Sedation (NISS)		
1	2	3
Under sedated	Adequately sedated	Over sedated
Agitated, irritable, actively fights ventilation	Lightly asleep, awake and relaxed	No response to ET suction or other procedures

9.2.3. FREQUENCY OF PAIN ASSESSMENT

- Dependent on the goal of therapeutic treatment e.g. weaning of ventilation etc.
- Pain assessment should take place routinely, recommended at 1-2 hourly when a child is receiving analgesic infusion
- Once condition stable, the assessment can be done 6 hourly

9.2.4. DRUGS

- Commonly used drugs for pain control in critically ill children include morphine and fentanyl
- It is important to note that critically ill children may be on multiple medications and in addition suffer organ dysfunction, so it a requirement to check for drug-drug interactions, contraindications as well as dosage adjustments
- Managing pain during critical illness is a true balancing act. Pain and stress can increase intracranial pressure, heart rate, blood pressure, blood sugar, stress hormone and oxygen consumption. Pain events in critically ill children can be life threatening like secondary injury and increasing risk of losing artificial airway or intravenous access. On the other hand, oversedation with analgesics and sedatives can lead to negative outcomes, respiratory depression, iatrogenic withdrawal syndrome and hypotension

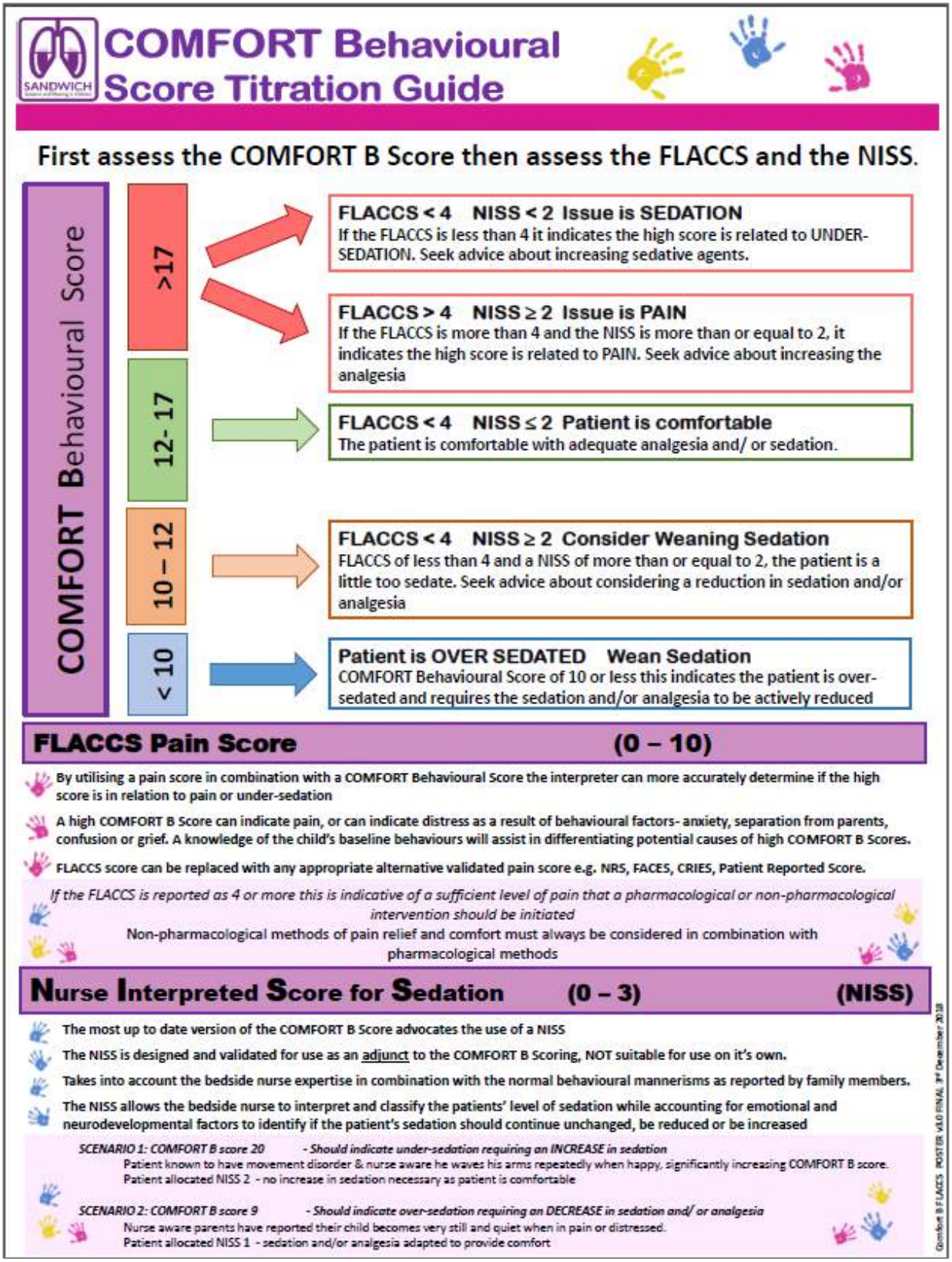
9.2.5. SPECIAL NOTE

- Vital sign changes usually reflect stress response: therefore, they are not specific or sensitive as an indicator of pain, especially if it is inconsistent across patient and timing of observation
- Physiologic indicators like pupillary dilation[8,9], diaphoresis and processed electroencephalography such as Bi-spectral Index (BIS)[10,11,12] are also not valid indicator for pain in critically ill children
- Current sedation and behavioural pain scores were created for patients who are able to display behaviors. There are no validated pain scales for patients who are heavily sedated or receiving neuromuscular blockade. Hence, active search and anticipate any painful procedure with trial of analgesic therapy should be used. Cautious use of physiologic indicators to prompt further assessment/treatment, but do not rely on them exclusively

References:

1. Julia Harris, Anne-Sylvie Ramelet, Monique van Dijk, Pavla Pokorna, Joke Wielenga, Lyvonne Tume, Dick Tibboel and Erwin Ista. Clinical recommendations for pain, sedation, withdrawal and delirium assessment in critically ill infants and children: an ESPNIC position statement for healthcare professionals. Intensive Care Med (2016) 42:972-986
2. Pain management in the paediatric intensive care unit (PICU). Renee CB Manwarren et al. Ann & Robert H Lurie Children Hospital of Chicago. 2019.
3. Groenewald, C. B., Rabbitts, J. A., Schroeder, D. R., & Harrison, T. E. (2012). Prevalence of moderate-severe pain in hospitalized children. Paediatr Anaesth, 22(7), 661-668. doi:10.1111/j.1460-9592.2012.03807.x
4. Stevens, B. J., Abbott, L. K., Yamada, J., Harrison, D., Stinson, J., Taddio, A., . . . CIHR Team in Children's Pain. (2011). Epidemiology and management of painful procedures in children in Canadian hospitals. Canadian Medical Association Journal 183(7), E403-410. doi:10.1503/cmaj.101341.
5. Best, K. MAgarwal, S., Classen, D., Larsen, G., Tofil, N. M., Hayes, L. W., Sullivan, J. E., . . . Sharek, P. (2010). Prevalence of adverse events in pediatric intensive care units in the United States. Pediatric Critical Care Medicine, 11(5), 568-578. doi:10.1097/PCC.0b013e3181d8e405.
6. van Dijk, M., de Boer, J. B., Koot, H. M., Duivenvoorden, H. J., Passchier, J., & Bouwmeester, N. (2001). The association between physiological and behavioral pain measures in 0-to 3-year-old infants after major surgery. journal of pain and symptom management, 22(1), 600-609.
7. van Dijk, M., & Tibboel, D. (2012). Update on pain assessment in sick neonates and infants. Pediatr Clin North Am, 59(5), 1167-1181. doi:10.1016/j.pcl.2012.07.012.
8. Gelinas, C., Chanques, G., & Puntillo, K. (2014). In pursuit of pain: recent advances and future directions in pain assessment in the ICU. Intensive Care Med, 40(7), 1009-1014. doi:10.1007/s00134-014-3299-3.
9. Luckett, T. R., & Hays, S. R. (2013). Analgesia, sedation, and neuromuscular blockade. In M. Hazinski (Ed.), Nursing care of the critically ill child (3rd ed.). St. Louis, MO: Elsevier.
10. Lamas, A., & Lopez-Herce, J. (2010). Monitoring sedation in the critically ill child. Anaesthesia, 65(5), 516-524. doi:10.1111/j.1365- 2044.2010.06263.x
11. Barr, J., Fraser, G. L., Puntillo, K., Ely, E. W., Gelinas, C., Dasta, J. F., . . . American College of Critical Care, M. (2013). Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the intensive care unit. Crit Care Med, 41(1), 263- 306. doi:10.1097/CCM.0b013e3182783b72.
12. Luckett, T. R., & Hays, S. R. (2013). Analgesia, sedation, and neuromuscular blockade. In M. Hazinski (Ed.), Nursing care of the critically ill child (3rd ed.). St. Louis, MO: Elsevier.

Assessing pain and sedation in critically ill children and its interpretation



Source: [SANDWICH | Sandwich (gub.ac.uk)]

Chapter 10: Management of Cancer Pain

10.1. INTRODUCTION

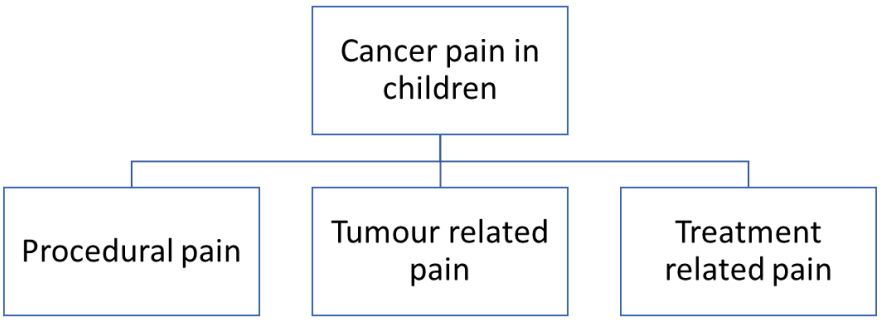
There are about 750 children (under 18 years) diagnosed with cancer annually in Malaysia and treated at ten paediatric oncology centers around the country[1]. These children are often co-managed with their referring general paediatricians during and post cancer treatment.

Cancer pain often presents even prior to diagnosis[2], hence all healthcare providers need to be competent to manage pain. Pain experienced by children with cancer can be tumour-related or from procedures related to investigations and treatment[3,4].

Despite available treatment for pain, children with cancer at both in-patient services and out-patient clinics are still experiencing pain[4,5,6]. In the last months of life, more than 80% of children with cancer experience pain and despite treatment, carers perceive they are still suffering from it[7,8]. Cancer pain is distressing and results in poor quality of life; and impacts the health and well-being of cancer survivors in their adulthood[9].

Cancer pain is multidimensional (physical, psychological, emotional and spiritual) and hence, management requires both pharmacological and non-pharmacological interventions. Cancer and its therapies can result in acute and chronic pain issues but for the purpose of this chapter, only principles of management of acute pain will be discussed.

10.2. TYPES OF PAIN IN CHILDREN WITH CANCER



10.2.1. PROCEDURAL PAIN

- Procedural pain can arise from:
  1. Diagnostic procedures
  2. Treatment related procedures

Tumour-related procedures

Diagnostic	Therapeutic
Venepuncture Lumbar puncture Bone marrow aspiration and biopsy Tissue biopsy	Central venous line insertion Pleural or peritoneal drainage External ventricular drainage Ventriculo-peritoneal shunt Surgeries (therapeutic or palliative) - Tumour resection, amputation, limb salvage Wound debridement or dressing

- **Principles of management**
  - Assess expected pain from the procedure
  - Provide early/preventive analgesia
  - Choose appropriate pharmacological and non-pharmacological therapies
  - Continue reassessment during and post procedure till pain resolves

10.2.2. TUMOUR RELATED PAIN

- **Tumour-related pain can present either**:
  - before or at diagnosis
  - persist during initial treatment
  - when tumour is resistant to treatment
  - at disease recurrence

- **Pathophysiological classification of types of pain:**
  - Tumour-related pain can result from tissue and/or nerve injury either from compression, invasion, obstruction by primary or metastatic tumour
  - It can be nociceptive or neuropathic or both

Nociceptive Pain	Neuropathic Pain

• Due to activation of nociceptors
• Nociceptors are found in skin, bone, joints, muscles and internal organs (uterus, bladder, intestine, lungs, liver, spleen)
• Nociceptors can respond to
  ○ Heat
  ○ Cold
  ○ Vibration
  ○ Stretch
  ○ Chemical substances from tissue injury or inflammation
	• Can be due to
	1. Damage to nerve cells (central or peripheral) from metabolic, trauma, infections, ischemia or immune-mediated pathological conditions
	2. Nerve compression
	3. Abnormal processing of pain signals by the brain and spinal cord

- **Principles of management**
  - Pain management aims to relieve pain both at rest and during activity, and with minimal side effects
  - Any pain experience is multimodal and all factors contributing to the pain experience (e.g. fear, anxiety, family distress, other aggravating symptoms) need to be addressed simultaneously
  - Consider both pharmacological and non-pharmacological treatment strategies
  - Include patient (when appropriate) and carers in discussion of management strategies
  - Identifying the cause of the pain is vital for appropriate cancer pain management
  - Continued reassessment and understanding of cause of changing pain patterns or new pain will help with appropriate treatment
  - Increasing opioids may be required rather than opioid rotation as cancer pain can escalate with progressive disease
  - Consider adjuvant analgesics (e.g. steroids to reduce tumour oedema)

Principles of managing tumour related pain

1. Relief pain at all times
2. Identify cause of pain
3. Use both pharmacological and non-pharmacological techniques
4. Involve the patient and family
5. Reassess and adjust therapy as needed

10.2.3. TREATMENT RELATED PAIN

- As treatment progresses, treatment related pain prevails over tumour-related pain
- Treatment related pain may occur in conjunction with other symptoms as a result of complications of treatment
- Treatment related pain may be procedure related or related to adverse effects of the various treatment protocols

Examples of treatment related pain:

- mucositis (post chemotherapy or radiotherapy)
- acute pancreatitis (side effect of chemotherapy e.g. asparaginase)
- neutropenic enterocolitis
- haemorrhagic cystitis (e.g. cyclophosphamide, ifosfamide, radiotherapy)
- intracranial haemorrhage (thrombocytopenia from bone marrow suppression)
- peripheral neuropathic pain (e.g. vincristine, cisplatin)
- post-operative pain
- phantom limb pain
- procedural pain (on treatment protocol)

- **Principles in management**
  - Important to identify and treat cause of treatment related complication (if possible) as well as associated pain
  - Renal and liver functions may be affected by treatment and doses of analgesia need to be adjusted accordingly
  - Treatment related pain may become chronic (phantom limb pain, chemotherapy related peripheral neuropathy)

10.3. MANAGEMENT OF PAIN IN SPECIFIC CONDITION IN CANCER

10.3.1. Mucositis

- Common oral complication of chemotherapy or radiotherapy
- Severity depends on treatment protocol
- Pain is commonly persistent till mucositis resolves
- Duration of mucositis is patient and protocol dependent
- Parenteral analgesia may be more appropriate as the oral route is often not convenient
- Severe mucositis may last for weeks

Management of pain from mucositis [12]

- Consider oral analgesia if able to tolerate orally
- For severe pain: IV bolus of opioid (morphine) for rapid control followed by intravenous infusion of opioid (morphine)
- Local anaesthetic (e.g. lignocaine gel) can complement systemic analgesia
- Mucosal surface protectants (hydroxypropyl cellulose gels or sucralfate solutions) can be considered
- Avoid aggravating pain: foods (temperature, consistency, spicy). Allow patients their choice of foods
- Continue oral hygiene
- Reassess pain frequently and optimise management

References:

1. Personal communication. Hany Ariffin. Malaysian Association of Paediatric Haematology and Oncology 2010-2012 Report
2. Miser AW, McCalla J, Dothage JA, Wesley M, Miser JS. Pain as a presenting symptom in children and young adults with newly diagnosed malignancy. Pain.1987;29(1):85-90.
3. Ljungman G, Gordh T, Sörensen S, Kreuger A. Pain in paediatric oncology: interviews with children, adolescents and their parents. Acta Paediatr.1999;88: 623-30
4. Collins JJ. Cancer pain management in children. European Journal of Pain.2001;5(Suppl A):37-41.
5. Miser AW, Dothage JA, Wesley RA, Miser JS.The prevalence of pain in a pediatric and young adult cancer population. Pain.1987;29(1):73-83.
6. Fortier MA, Wahi A, Bruce C, Maurer EL, Stevenson R. Pain management at home in children with cancer: a daily diary study. Pediatr Blood Cancer. 2014;61(6):1029-33
7. Wolfe J, Grier HE, Klar N, Levin SB, Ellenbogen JM, Salem-Schatz S, Emanuel EJ, Weeks JC. Symptoms and suffering at the end of life in children with cancer. N Engl J Med.2000;342(5):326-33.
8. Tamara Z. Vern-Gross, Catherine G. Lam, Zachary Graff, Sara Singhal, Deena R. Levine, Deborah Gibson, April Coan, Doralina L. Anghelescu, Ying Yuan, Justin N. Baker. Patterns of End-of-Life Care in Children with Advanced Solid Tumor Malignancies Enrolled on a Palliative Care Service. J Pain Symptom Manage. 2015; 50(3): 305–312
9. Lu Q, Krull KR, Leisenring W, Owen JE, Kawashima T, Tsao JC, Zebrack B, Mertens A, Armstrong GT, Stovall M, Robison LL, Zeltzer LK. Pain in long-term adult survivors of childhood cancers and their siblings: a report from the Childhood Cancer Survivor Study. Pain. 2011;152(11):2616-24
10. Mercandante S, Giarratano A. Pharmacological management of cancer pain in children. Crit Rev Oncol Hematol.2014;91(1):93-7.
11. WHO guidelines on the pharmacological treatment of persisting pain in children with medical illness. 2012
12. Miller MM, Donald DV, Hagemann TM. Review Article. Prevention and Treatment of Oral Mucositis in Children with Cancer. J Pediatr Phamacol Ther. 2012;17(4):340-350

CHAPTER 11: MANAGEMENT OF CHRONIC (NON CANCER) PAIN

11.1. INTRODUCTION

Chronic pain is often commonly seen in children with underlying chronic disease, including sickle cell disease, malignancy, rheumatologic disorders, inflammatory bowel disease and trauma. It is also seen in states where there may not be any known aetiology or precipitating factors like in diffuse idiopathic pain syndrome or complex regional pain syndromes[3].

11.1.1. DEFINITION

Chronic pain is defined as any pain that continues beyond the expected period of healing, or pain that continues beyond 3 months. Chronic pain can be either persistent or recurrent in nature.

11.1.2. PREVALENCE

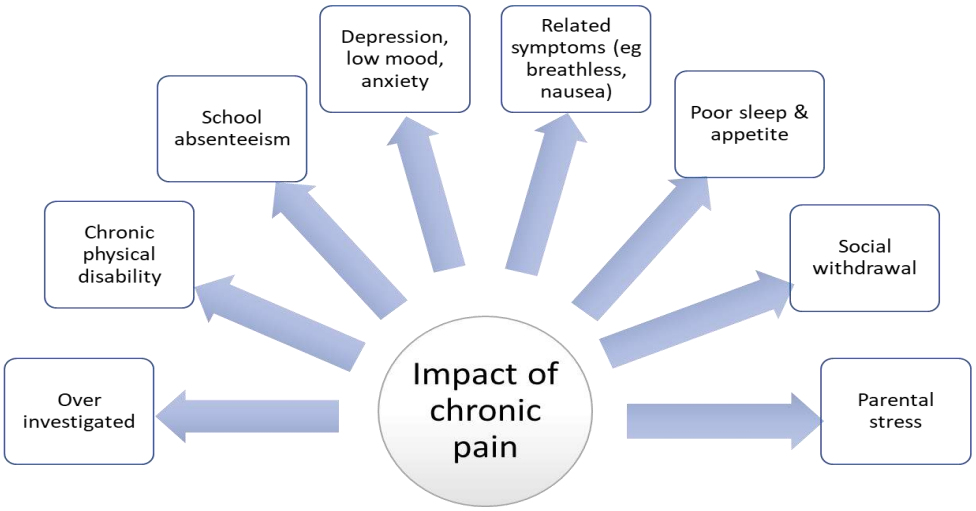
- prevalence varied according to different specific location of the pain[4]
- prevalence was higher among the girls[5] and increased with age for most locations of pain

Location of Pain	Prevalence	Age differences
Headache	8-82.9%	Older > younger
Abdominal Pain	3.8-53.4%	Younger > older
Back Pain	13.4-24%	Older > younger
Musculoskeletal pain/limb pain	3.9-40%	Older > younger
Multiple pain sites	3.6-48.8%	Unclear
Other / general pain	5-88%	Unclear

11.1.3. IMPACT OF CHRONIC PAIN IN CHILDREN

Failure to recognise and treat the underlying chronic pain may impact not only the child but his/her family members[5,6].

Chronic pain affects not only the child but also on his/her family members. For the child, it is not just suffering in pain but there may also be other pain associated symptoms like headache, breathlessness and nausea. Chronic pain can also affect the child in other domains, like poor sleep, mood (anxiety or depression), poor appetite and limited or incapacitated physical functioning. Many of these children are also absent from school and may be socially withdrawn. Children with chronic pain is often a source of stress to their parents.



11.2. PRINCIPLES OF MANAGEMENT OF CHILDREN WITH CHRONIC PAIN

- Use a multidisciplinary cognitive-bio-behavioural approach during assessment and treatment
- Focus not only on the reduction of pain but rather more importantly improvement in function[8]
- Patients would benefit from early referral to individuals with experiencing in management of chronic pain in children

11.2.1. ASSESSMENT

- Should be individualised
- Complete assessment by:
    - History, specifically for:
        i. Type of pain (nociceptive, neuropathic, nociplastic or a combination)
        ii. Psychosocial assessment of patient and family including emotional functioning, coping skills, impact on daily activities such as sleeping, eating, school, social and physical activities and the family and peer interactions
        iii. Patient's understanding and prior pain experiences

- Physical examination
  i. General appearance including 'la belle indifference'
  ii. All systems including neurological, posture and gait

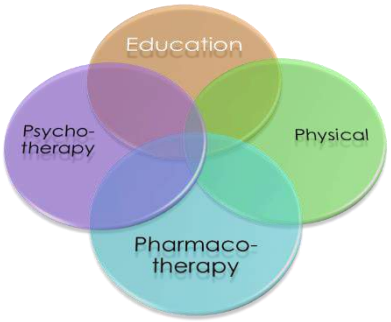
- Laboratory and radiological investigations
  i. Only useful if there is suspicion of a suspected disease[9]
  ii. Beware of over investigating but at the same time to not miss an underlying condition

- Pain assessment tools
  i. May be indicated to quantify and specify impact of pain to the patient and family
  ii. Examples are Varni-Thompson Paediatric Pain Questionnaire[10] and Visual analogue scale[11]

- Document in detail the pain assessment including the effectiveness of each intervention and the goals of treatment
- During assessments of chronic pain, always avoid focussing on the concerns of pain intensity, but rather focus on all domains of function and quality of life

11.2.2. MANAGEMENT STRATEGIES

- Management of a child with chronic pain should always involve multiple disciplines in an 'interdisciplinary approach'
- A Biopsychosocial model of treatment is more effective than any single mode of therapy[12]



'Interdisciplinary approach'

1. **Education and Empowerment**
   - Patient and equally parental involvement is essential
   - Always acknowledge the reality of pain and give credence
   - Provide an explanation of chronic pain and the rationale for what is counter intuitive
   - Stop searching for a cause
   - 'Demystify' associated symptoms
   - Provide structure for living: Sleep regimen, school attendance, food intake
   - Change in expectations – set realistic goals (don't look for a cure, look for ways to cope)

2. Physical

- Exercise is the key to rehabilitation
- Exercise can improve sense of well-being, improve physical functioning and reduce pain
- Exercise is especially important for those with musculoskeletal pain
- Examples include:
    - Physiotherapy: limb exercise, hydrotherapy, mirror box therapy, low impact aerobic exercise; all using a paced approach
    - Occupational therapy: TENS, heat/cold packs, ultrasound
    - Others: acupuncture, massage

3. Psychotherapy

- Cognitive behavioural therapy (CBT) is important to teach patients the link between behaviour, thoughts and feelings and how negative thoughts can lead to undesirable behavior
- Includes:
    - Self monitoring & self-management skills (e.g. relaxation training, mindfulness)
    - Problem solving and coping skills
    - Behavioural interventions - reinforcement healthy behaviour
    - Cognitive restructuring

4. Pharmacotherapy

- No well controlled therapeutic trials in children
- Only use in combination with other modalities of treatment
- Tricyclic antidepressants – improve sleep and reduce pain
- Analgesics:
    - most patients report no alleviation of pain, use judiciously if warranted
    - Paracetamol, NSAIDs, opioids*
    - Topical treatment e.g. lidocaine 5% patch
- Gabapentin / Pregabalin
- Treat comorbid anxiety and depressive disorders

*Chronic opioid therapy for chronic non-malignant pain in children is rarely indicated except for defined aetiologies with chronic pain (such as sickle cell disease, incurable degenerative joint disease). Consultation to a paediatric chronic pain specialist should be strongly indicated before starting the chronic opioid therapy[13].

References:

1. R.-D. Treede, W. Rief, A. Barke, Q. Aziz, M.I. Bennett, R. Benoliel, ... S.-J. Wang, A classification of chronic pain for ICD-11, Pain 156 (6) (2015) 1003–1007.
2. Fishman SM, Ballantyne JC, Rathmell JP. Bonica's management of pain.4th edn. Lippincott, Williams & Wilkins, 2009.
3. Chambliss CR, Heggen J, Copelan DN, Pettignano R. The assessment and management of chronic pain in children. Pediatric Drugs. 2002 Nov 1;4(11):737-46.
4. King S, Chambers CT, Huguet A, et al. The epidemiology of chronic painin children and adolescents revisited: a systematic review. Pain 2011;152: 2729e38.
5. Cupples PA. Chronic pain in children. Anaesthesia & Intensive Care Medicine. 2013 Dec 1;14(12):517-9.
6. Evans S, Djilas V, Seidman LC, Zeltzer LK, Tsao JC. Sleep quality, affect, pain, and disability in children with chronic pain: is affect a mediator or moderator?. The Journal of Pain. 2017 Sep 1;18(9):1087-95.
7. Palermo TM, Eccleston C, Lewandowski AS, Williams AC, Morley S. Randomized controlled trials of psychological therapies for management of chronic pain in children and adolescents: an updated meta-analytic review. PAIN®. 2010 Mar 1;148(3):387-97.
8. Liossi Christina, Howard Richard F. Pediatric Chronic Pain: Biopsychosocial Assessment and Formulation. Pediatrics 2016;138(5).
9. Palermo T, Eccleston C, Goldschneider K, Larkin McGinn K, Sethan N, Turner H. Assessment and management of children with chronic pain. Am Pain Society. 2012.
10. Varni JW, Thompson KL, Hanson V. The Varni/Thompson Pediatrie Pain Questionnaire. I. Chronic musculoskeletal pain in juvenile rheumatoid arthritis. Pain. 1987 Jan 1;28(1):27-38.
11. Carlsson AM. Assessment of chronic pain. I. Aspects of the reliability and validity of the visual analogue scale. Pain. 1983 May 1;16(1):87-101.
12. Gatchel RJ, Okifuji A. Evidence-based scientific data documenting the treatment and cost-effectiveness of comprehensive pain programs for chronic nonmalignant pain. The Journal of Pain. 2006 Nov 1;7(11):779-93.
13. Chou R, Fanciullo GJ, Fine PG, Adler JA, Ballantyne JC, Davies P, Donovan MI, Fishbain DA, Foley KM, Fudin J, Gilson AM. Clinical guidelines for the use of chronic opioid therapy in chronic noncancer pain. The Journal of Pain. 2009 Feb 1;10(2):113

Chapter 12: Management of Pain in the Neurologically Impaired Child

12.1. INTRODUCTION

Children and adolescents with neurological impairments have been proven to experience moderate to severe pain for prolonged durations albeit their non-verbal communicative states. In fact, those with the least abilities have been noted to have most pain[1,2]. A lack of verbal capacity does not and should not lead to assumptions of absence of pain; but instead, should be more sought after.

12.2. TYPES OF PAIN

- Pain in children and adolescents with severe neurological impairment (SNI) can be broadly classified into nociceptive pain and neuropathic pain. Neuropathic pain can be further divided into central or peripheral pain.

12.2.1. NOCICEPTIVE PAIN IN CHILDEN WITH SNI

Type of Pain	Aetiology	Examples
NOCICEPTIVE	Tissue injury or inflammation which resolves as injury heals	• Gastroesophageal reflux disease • Acute pancreatitis (Valproate and hypothermia) • Cholecystitis (Tube feeds) • Urinary tact infection • Nephrolithiasis (Topiramate, immobility, ketogenic diet) • Hip subluxation • Fractures • Dental pain • Drug withdrawal
Comments: • Children with neurological impairments also experience nociceptive pain from sources common to all paediatric population e.g. otitis media , hair tourniquets, tonsillitis, abrasions and lacerations • May occur in absence of identifiable pathology in which case, there is a role for empirical treatment to avoid invasive investigation		

12.2.2. NEUROPATHIC PAIN IN CHILDREN WITH SNI

Type of Pain	Aetiology	Examples
NEUROPATHIC	Pain signals attributable to injury, dysfunction or excitability in peripheral or central nervous system especially thalamus and cortico-spinal tracts	• Persistent post- operative procedure induced pain • Visceral hyperalgesia ie post feeding gut distension,constipation • Autonomic dysfunction
Comments: • Can be indistinguishable from seizure clinically • Difficult to prove or confirm via investigations which if done, are likely to be repetitive and invasive • Empirical treatment may have a role		

12.3. PAIN ASSESSMENT IN CHILDREN WITH SNI

- Pain assessment is extremely difficult in SNI children and adolescents [3,4]
- Conventional tools may not be so sensitive to pick up painful behaviours
- Several tools have been adapted for this purpose including the revised FLACC (rFLACC), allowing for individualised pain behaviours to be assessed and scored accordingly should such behaviour be observed or anticipated in a child with SNI.

Pain Behaviours in children with severe neurological impairment

Category	Examples
Vocalisation	Crying, whimpering, moaning, gasping, sharp intake of breath
Facial expression	Grimacing, frowning, furrowed brow, squinting, eyes wide open, clenched teeth, teeth grinding, distressed look
Consolability	Inability to be consoled and made comfortable
Interaction	Withdrawn, seeking comfort
Sleep	Disturbed sleep, increased or decreased sleep
Movement	Increase from baseline in movement of arms and legs, restless and fidgety, startles easily, pulls away when touched, twists or turns
Tone	Stiffening of extremities, clenching of fists, back arching, resists movement
Physiologic	Tachycardia, sweating, shivering, change in color, pallor, breath holding, tears
Atypical features	Blunted facial expression, laughter, breath holding, self-injurious behaviours

12.4. APPROACH TO PAIN MANAGEMENT IN CHILDREN AND ADOLESCENTS WITH SNI [4,5]

12.4.1. HISTORY:

- Obtain a thorough history to determine type of pain and possible causes

12.4.2. PHYSICAL EXAMINATION:

- Perform a good physical examination with the aim to identify the source of pain

12.4.3. INVESTIGATIONS:

- Perform baseline non-invasive tests to confirm (or exclude) sources of pain if history and examination have not been adequate for a diagnosis.
- Invasive tests need to be weighed against empirical treatment on a case-to-case basis.

12.4.4. ASSESS PAIN USING THE REVISED FLACC SCALE

Revised FLACC scale

ASSESSMENTS	SCORES		
Individualised Behaviour	**0**	**1**	**2**
FACE **Individualised behaviour:**	No particular expression or smile	Occasional grimace or frown, withdrawn or disinterested; appears sad or worried	Consistent grimace or frown; frequent/constant quivering chin; clenched jaw; distressed-looking face; expression of fright or panic
LEGS **Individualised behaviour:**	Normal position or relaxed; usual tone & motion to limbs	Uneasy, restless, tense; occasional tremors	Kicking, or legs drawn up; marked increase in spasticity, constant tremors or jerking
ACTIVITY **Individualised behaviour:**	Lying quietly, normal position, moves easily, regular & rhythmic respirations	Squirming, shifting back/forth, tense or guarded movements, mildly agitated, shallow splinting respirations, intermittent sighs	Arched, rigid or jerking, severe agitation, head banging, shivering, breath holding, gasping or sharp intake of breaths, severe splinting
CRY **Individualised behaviour:**	No cry/verbalization	Moans or whimpers, occasional complaint, occasional verbal outburst or grunt	Crying steadily, screams or sobs, frequent complaints, repeated outbursts, constant grunting
CONSOLABILITY **Individualised behaviour:**	Content or relaxed	Reassured by occasional touching, hugging or being talked to, distractible	Difficult to console or comfort, pushing away caregiver, resisting care or comfort measures

**Individualised pain behaviours unique to each child with severe neurological impairment as identified by carers or staff can be inserted into the most appropriate category in the left column and its severity graded accordingly to encompass pain behaviours not covered by the existing table.*

12.4.5. TREATMENT:

- Include both non-pharmacologic methods and medications
- Nociceptive pain
    - Identifying the noxious stimuli and aim at treating the cause

- Neuropathic pain
    - Sometimes a potentially treatable noxious stimuli cannot be identified especially in chronic, recurrent or neuropathic pain.
    - In such instances, an adjuvant may need to be considered on case-by-case basis and there may be role for empirical treatment.
    - Adjuvants may be introduced with expert advice of pain specialists or paediatric neurologists [4,5,7]

Medications used for neuropathic pain in SNI children and adolescents

Medications	Usage	Side Effects
Gabapentin	Dystonia Neuropathic/Central pain Visceral hyperalgesia	Sedation,tremor, nystagmus
Midazolam	Spasticity Dystonia	Tolerance with prolonged use Respiratory secretions, sedation Sudden withdrawal can lead to rebound of symptoms
Clonidine	Dysautonomia Dystonia	Hypotension, bradycardia, sedation Sudden withdrawal can lead to rebound of symptoms
Baclofen	Spasticity/ Dystonia	Respiratory secretions, sedation , hypotonia
Benzhexol	Dystonia (especially when associated with excessive secretions)	Constipation, dry mouth, irritability blurring of vision Sudden withdrawal can lead to rebound of symptoms
IM Botulinum toxin	Spasticity causing pain or functional limitations	Pain at injection site, fever, weakness

References:

1. Breau LM, Camfield CS, McGrath PJ, Finley GA. The Incidence of Pain in Children with Severe Cognitive Impairments. Arch Pediatr Adolesc Med. 2003 Dec;157(12):1219-26.
2. Breau LM, Camfield CS, McGrath PJ, Finley GA. Risk factors for pain in children with severe cognitive impairments.Dev Med Child Neurol. 2004 Jun;46(6):364-71.
3. Hadden KL, von Baeyer CL. Pain in children with cerebral palsy: Common Triggers and Expressive behaviours. Pain. 2002 Sep;99(1-2):281-8.
4. Hauer J, Houtrow AJ. Pain Assessment and Treatment in Children with Significant Impairment of the Central Nervous System. Paediatrics. 2017:139(6):e20171002
5. LA Rasmussen,M-C Gregoire. Challenging neurological symptoms in pediatric palliative care : An approach to symptom evaluation and management in children with neurological impairment. Paediatr Child Health 2015;20(3): 159-165
6. Malviya S, Voepel-Lewis T, Burke C, Merkel S, Tait AR. The revised FLACC observational pain tool: Improved reliability and validity for pain assessment in children with cognitive impairment. Paediatr Anaesth. 2006 Mar;16(3):258-65.
7. Hauer JM, Wical BS, Charnas L. Gabapentin successfully manages chronic unexplained irritability in children with severe neurologic impairment.Pediatrics. 2007 Feb;119(2):e519-22.

Chapter 13: Management of Pain in Burns

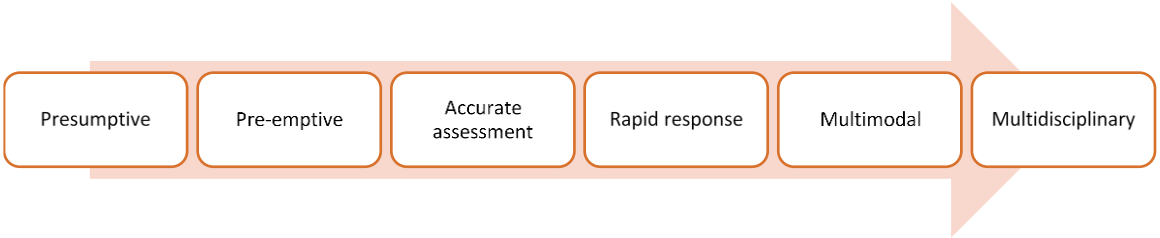
13.1. INTRODUCTION

Burns in children can be due to thermal, electrical or chemical injuries. The commonest is thermal burns and it is often due to scalds and contact with hot surfaces, and more rarely caused by flames or flash burns from ignition of volatile substances.

All children with burns suffer from pain regardless of the cause, size or depth of burn. Burns is often an extremely traumatic experience for any child. It not only affects the physiological well-being but leaves long term negative psychological impacts including stress, anxiety and post-traumatic stress disorder. It also alters the somatosensory and pain processing mechanisms leading to potential chronic pain.

13.2. PRINCIPLES OF PAIN MANAGEMENT IN BURNS

The following are the principles of pain management in paediatric burns:



13.2.1. PRESUMPTIVE

- All children with burns will have pain
- The degree of pain is not only dependent on the size or depth of pain but also modified by the psychological state of the child and emotional support from the family

13.2.2. PRE-EMPTIVE

- Focus on preventing pain when possible

13.2.3. ACCURATE ASSESSMENT

- Need to consider the distress (fear and anxiety) the child may be in when assessing pain
- Important to enlist parents/ care giver

13.2.4. RAPID RESPONSE

- Respond quickly to pain and frequent reassessment to tailor the treatment for optimal pain control

13.2.5. MULTIMODAL

- Use multimodal analgesia to block transmission of primary painful stimuli in order to limit pain sensation and risk for chronic pain

13.2.6. MULTIDISCIPLINARY

- Requires involvement of multiple health care providers and not only the surgeon
- Non-pharmacological interventions especially helpful for procedural pain

13.3. SOURCES OF PAIN IN PAEDIATRIC BURNS

Children with burns can suffer from various sources of pain and each of these may require different treatment

13.3.1. BACKGROUND PAIN

- Initial insult to the skin will damage or destroy nerve endings giving rise to pain
- Subsequently continued stimulation of nerve endings either from burn site or surrounding areas of stasis and hyperaemia will give rise to ongoing background pain

Burn depth	Appearance	Nerve endings	Sensation
Epidermal	Red	Intact	Painful
Superficial partial thickness	Pink with wet appearance. Brisk capillary refill	Intact	Painful
Deep partial thickness	Pale or fixed red staining. Poor capillary refill	Some nerves destroyed. Surrounding areas intact	Painful usually but can be painless or reduced
Full thickness	Leathery white or brown	All nerve endings destroyed. Surrounding areas damaged	No pain in burnt area, surrounding painful

- Often analgesia is given together with sedation in severe burns
- For simple burns, oral paracetamol is the drug of choice
- For severe pain, an opioid should be given and titrated according to response. (e.g. oral morphine 0.15 – 0.3 mg/kg/dose 4 hourly, or morphine infusion 10-40

mcg/kg/hour or PCA for those more than 5 years of age). Note that peak of onset for iv morphine bolus is 10-20 minutes whereas fentanyl has a rapid onset of action within 1-2 minutes.

- Midazolam may be given for sedation if required (would require monitoring for respiratory depression)
- NSAIDs are generally not used but can be used with caution because risk of bleeding, gastrointestinal complications as well as renal toxicity

13.3.2. NEUROPATHIC PAIN

- Neuropathic pain is an important element of pain in paediatric burns but largely still understudied
- It is due to nerve damage as well as abnormalities in regeneration of nerves and reprogramming of the central nervous system
- Drugs include anti-depressants and anti-convulsant
- Tricyclic antidepressants (eg amitriptyline) enhances opioid induced analgesia and improves sleep patterns
- Gabapentin/pregabalin useful to treat sympathetically maintained pain after burns and is useful for hyperalgesia

13.3.3. PROCEDURAL PAIN

- Procedural pain for e.g. dressing of burn wounds is often difficult to assess
- Procedural pain often requires more intense analgesia
- If the children are managed poorly, they will suffer from anticipatory anxiety for future procedures and this will lower the pain threshold
- Both pharmacological and non-pharmacological techniques should be employed
- Useful drugs include ketamine-midazolam or ketamine-propofol combination
- In some circumstances where ketamine is not used or where wounds are small and require simple dressing, opioids can be used before and after the procedure with some sedation. Inhaled nitrous oxide with paracetamol is also another option.

13.3.4. PERIOPERATIVE PAIN

- Usually, the mainstay of treatment is drugs used for background pain including paracetamol and opioid.
- Certain drugs may be used in the peri-operative period to reduce post -op pain like clonidine, gabapentin and dexmedetomidine
- Peripheral nerve blocks are also useful to reduce post-operative pain

Suggested approaches to paediatric burns in different phases [2]

Types of pain	Background pain	Procedural pain: Wound care and dressing changes	Peri-operative pain
Recommended	Sedation - Benzodiazepine - Dexmedetomidine for difficult to sedate patient	Morphine If require deep sedation: Ketamine + Midazolam Ketamine + Propofol	Epidural anaesthesia Regional anaesthesia
	Pain - Paracetamol - Opioids: morphine	Behavioural Adjuncts: - Multi-modal distraction - Virtual reality - Child life therapy	Acute management - Continue Paracetamol - continue opioids
Require further study	Pharmacological adjuncts: - Gabapentin - NSAIDs	Optimal integration of pharmacological and behavioural methods	Peri-operative adjuncts: - Clonidine - Gabapentin - Dexmedetomidine

References:

1. Management of pain in children with burns. Gandhi M[1], Thomson C, Lord D, Enoch S. Int J Pediatr. 2010;2010. pii: 825657. doi: 10.1155/2010/825657. Epub 2010 Sep 16.
2. Pain Management in Pediatric Burn Patients: Review of Recent Literature and Future Directions. Pardesi O[1], Fuzaylov G. J Burn Care Res. 2017 Nov/Dec;38(6):335-347. doi: 10.1097/BCR.0000000000000470.
3. Pain Management Handbook MOH/P/PAK/257.12 (HB)

Chapter 14: Management of Neonatal Pain

14.1. DEFINITION OF PAIN:

- Pain is "an unpleasant sensory and emotional experience associated with, or resembling that associated with actual, or potential tissue damage". [1]

14.2. PAIN IN NEONATES:

- Pain is always subjective especially in neonates, therefore the ability to approach, assess and manage pain is still controversial
- Pain assessment in neonate is not easy as they cannot indicate pain and thus depend on others to recognise, assess and manage their pain

14.3. MISCONCEPTIONS OF PAIN IN NEONATES:

- There are still many misconceptions/myths on why newborns cannot feel pain. These include:
    1. Absence of neurological substrate for pain perception due to lack of myelination of nerves.
       Fact: skin receptors and sensory nerves around the mouth appear around 7th week of gestation

    2. Incomplete periphery pain pathways to cortex or cerebral cortex immaturity especially in preterm infants
       Fact: The CNS immaturity affects the descending inhibitory pathways which modulate synapses in the dorsal horn of spinal cord and appear only at 32-week of gestation. Therefore, due to lack of inhibition, preterm neonates potentially suffer from more not less pain.

14.4. CONSEQUENCES OF INADEQUATELY TREATED PAIN

- There are concerns that inadequate treatment of pain during neonatal period may have
    1. Physiologic consequences: Uncontrolled sympathetic stress responses can also lead to significant deleterious effects on physiologic function and may affect the ultimate outcomes of neonates

    2. Neurodevelopmental consequences and increased susceptibility to chronic pain syndromes: The heightened sensitivity to subsequent painful stimuli may persist throughout childhood[7]

14.5. WHEN SHOULD PAIN BE ASSESSED IN A NEONATE?[3]

- Pain assessments should be done for pain caused both by disease and by procedures.

Non-Procedural Pain	Procedural Pain		
	Diagnostic	Therapeutic	Surgical
Disease related	Heel prick Venous puncture Arterial puncture Eye examination	Intubation Central line Insertion/removal of chest tube Insertion/ Removal of urinary catheter Ventricular Tap Mechanical ventilation Chest physiotherapy Orogastric tube insertion Tape removal Wound Dressing Laser Therapy Intramuscular / subcutaneous injection Lumbar puncture Intraosseous line insertion	Any surgical procedures Post-operative period

14.6. NEONATAL PAIN ASSESSMENT TOOL

- There are various tools which can be used to measure neonatal pain
- As neonates do not have the capacity to report pain, various behavioural and physiological measures are used a surrogate in these neonatal pain scales.

Neonatal/Infant Pain Scale (NIPS)[4] A score greater than 3 indicates pain		Score
Facial expression		
0 - Relaxed muscles	Restful face, neutral expression	
1 - Grimace	Tight facial muscles, furrowed brow, jaw, chin (negative facial expression – nose, mouth and brow)	
Cry		
0 - No cry	Quiet, not crying	
1 – Whimper	Mild moaning, intermittent.	
2 – Vigorous cry	Loud scream, rising, shrill continuous (note, silent cry may be scored if baby is intubated as evidenced by obvious mouth and facial movements).	
Breathing Patterns		
0 – Relaxed	Usual pattern for this infant	
1 – Change in breathing	In drawing, irregular, faster than usual, gagging and breath holding.	
Arms		
0 – Relaxed/Restrained	No muscular rigidity, occasional random movements of arms.	
1 – Flexed/Extended	Tense straight legs, rigid and/or rapid extension, flexion.	
Legs		
0 – Relaxed/Restrained	No muscular rigidity, occasional random movements of arms.	
1 – Flexed/Extended	Tense straight legs, rigid and/or rapid extension, flexion.	
State of Arousal		
0 - Sleeping/awake	Quiet, peaceful sleeping or alert random leg movement.	
1 - Fussy	Alert, restless and thrashing	

Interpretation:

1-2 : Mild pain
3-4 : Moderate pain
5-7 : Severe pain

14.7. STRATEGIES FOR MANAGEMENT OF PAIN IN NEONATES

14.7.1. DO NOT HARM

- Avoid or minimise painful procedure if possible[8]

14.7.2. NON-PHARMACOLOGICAL / NURSING COMFORT MEASURES (NCM) STRATEGIES

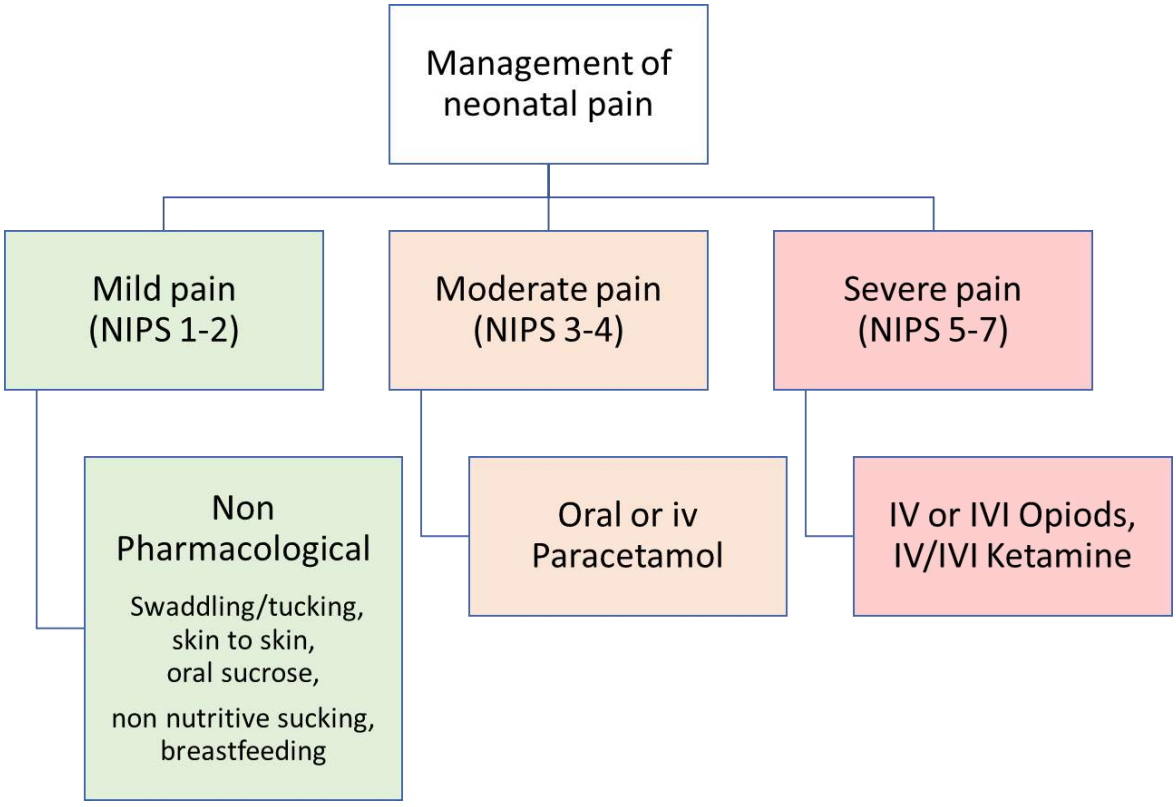
- Minimal handling / minimal procedures or grouping care to avoid frequent handling
- Breastfeeding – if baby's condition permits
- Positioning and containment– support limbs / trunk (nests can also be used)
- Swaddling with napkin / cloth / blanket, with arms and legs tucked in, to make them feel secure (caution: swaddling should not be too tight which can cause hip dislocation)
- Reduce environmental stimuli (reduce sound / dim lights when possible)
- Touch - Gentle touch on head, abdomen or back
- Allowing neonate to grasp a finger
- Skin to skin contact (Kangaroo Care) – nurse a neonate on the mother or father's skin, placed upright and covered by parent's shirt /gown
- Non-nutritive sucking
- Oral sucrose (Refer Table 1)

14.7.3. PHARMACOLOGICAL STRATEGIES

- ***Local topical analgesics***

  EMLA is a topical analgesic which can be used for term / GA ≥ 37wks corrected age infants of at least 14 days of age without predisposition to methemoglobinemia, G6PD deficiency or haemoglobinopathies. There is limited data available on EMLA use for GA <37weeks (Refer Table 2)
- ***Paracetamol*** (Refer Table 3)
- ***Opioid analgesics*** (Refer Table 4)
  - Morphine is commonly used opioid for the management of procedural pain.
  - Fentanyl - highly potent synthetic opioid, with more rapid onset and offset of action than morphine
- ***Ketamine***
  - Can be used for analgesia and sedation for painful procedures, particularly in burns units for dressing change and in emergency department for short procedures. However, higher risk of airway complications in under 3 months of age.

14.8. ALGORTHIM FOR MANAGEMENT OF PROCEDURAL PAIN IN NEONATES ACCORDING TO PAIN SEVERITY



Mild Pain	Moderate Pain	Severe Pain
Heel prick	Venous puncture	Intubation
Venous/ Arterial puncture	Arterial puncture	Central line insertion
Eye examination	Wound Dressing	Chest Tube Insertion
Central line insertion/removal	Intraosseous line	Mechanical ventilation
Chest Tube Removal		Wound Dressing
Urinary catheter		Laser Therapy
Ventricular Tap		Lumbar Puncture
Chest Physiotherapy		Incision & Drainage
Orogastric tube insertion		
Tape removal		
Wound Dressing		
Intramuscular / subcutaneous Injection		

14.9. DRUGS USED IN NEONATAL PAIN MANAGEMENT

Table 1: Sucrose 24% solution (refer glossary for details)	
Gestation Age (corrected)	Maximum volume [Maximum 4 doses in 24 hours]
27 – 31 weeks	0.5 ml
32 – 36 weeks	1.0 ml
37 weeks and over	2.0 ml
Storage	Room temperature
Administration Methods: Consent from parents (unlicensed product)	• Oral - By syringe, one drop at a time to anterior part of tongue, 2 minutes prior to procedure • Use with environmental and behavioural measures (e.g. positioning, swaddling and containment) • Ineffective given via orogastric tube • Analgesic effect improved if baby able to suck pacifier moistened with sucrose at the same time. If applied by a dip of the pacifier, each dip is estimated 0.2ml.
Contraindications	• Feed not established. • Fructose intolerance • < 27/32 weeks gestation • Infant mother on methadone (might be ineffective)
Cautions	• Choking and desaturation with oral administration • Safe for one off administration • Possible adverse neurobiological effects from repeated & frequent administration in preterm

Table 2: Topical anaesthesia		
	EMLA [5,11]	
Formulation	Eutectic mix lignocaine 2.5% and prilocaine 2.5%	
Onset of effective analgesia	60 minutes	
Duration can be left applied to skin	5 hours	
Duration of action after removal	1-2 hours	
Age limits	Under 1 year - not licensed, Not recommended < 14 days of life*	
Dose	**Age**	**Dose**
	0-1 months	1gm and 10cm^2 for 1 hour (limit to 1 application/day)
Caution	• G6PD deficiency • Anaemia • Methaemoglobinaemia	
Contra–indications	• Open wound • Mucous membranes • Atopic dermatitis	
* EMLA - usually safe to use in term/ GA≥ 37wks corrected age, infants who must be > 14 days of age without predisposition to methaemoglobinemia, G6PD deficiency or haemoglobinopathies **EMLA use for GA <37wks –Limited data available		

Table 3: Paracetamol [5,8,10,11]	
Formulation	• Oral suspension 120mg in 5ml or 250 mg in 5ml • Intravenous infusion 10mg/ml
Dose/Route/Age	
Oral /Age	**Dose**
28 -32 weeks corrected gestational age	Oral: 15mg/kg single dose then 10 -15mg/kg every 8-12 hours when necessary. [maximum dose 30mg/kg/24hours]
> 32 weeks corrected gestational age	15mg/kg single dose then 15mg/kg every 6-8 hours when necessary [maximum dose 60mg/kg/24hours]
Intravenous/Age	**Dose**
> 32 weeks gestation	IV: 7.5mg/kg every 8 hours [maximum 25mg/kg/24 hours]
Term neonate	7.5 mg/kg every 6-8 hours [Maximum dose 30 mg/kg/24 hours]
Contra indications	Caution in renal or liver impairment
Notes	Used for mild to moderate pain relief. This is an unlicensed use for patients in this age group and for this reason, on needs to inform parents/guardian and keep appropriate records according to the hospital's policy on the use of unlicensed medicines [8]

Table 4: Opioids [5,7,8,10,11]		
	Morphine	**Fentanyl**
Formulation	Intravenous, subcutaneous, oral	Intravenous
Intravenous	Dilute in 5%, 10% glucose or sodium chloride 0.9% for continuous infusion	Dilute in 5%, 10% glucose or sodium chloride 0.9% for continuous infusion
Preterm < 37 weeks gestation:	1. Slow bolus loading dose: 25-50mcg/kg (over 15-30min) 2. Continuous infusion dose: 5 mcg/kg/hour	1. Slow bolus - Single intermittent dose 0.5–4 mcg/kg, repeat 2-4 hours if required (administer over 30 seconds) 2. IV infusion - Initially 1–5 mcg/kg, followed by IV infusion 1.5 mcg/kg/hour, adjusted according to response
Term 37-40 weeks gestation:	1. Slow bolus loading dose: 50-100mcg/kg (over 15-30min) 2. Continuous infusion dose: 10-20mcg/kg/hour 3. Maximum dose 40mcg/kg/hour (caution: potential respiratory depression/apnoea)	
Subcutaneous	Initially 100 mcg/kg every 6 hours, adjusted according to response	NA
Oral/Rectal	Oral dose usually 4 to 5 x IV dose	NA
Caution/ Disadvantage	• Respiratory depression • Arterial hypotension • Constipation, nausea • Urinary retention • CNS depression • Tolerance, dependence • Long term outcomes not studied • Prolonged ventilator use	• Respiratory depression • Short half life • Quick tolerance and dependence • Inadequately studied • Chest wall rigidity has occurred in 4% of neonates who received 2.2-6.5 mcg/kg[10]
Notes	Prior to intubation: 100mcg /kg slow bolus dose	Naloxone should be readily available to reverse adverse effect

References

1. www.iasp.org Neonatal pain policy
2. Neonatal Pain Assessment- Clinical guideline for nursing , The Royale children Hospital of Melbourne
3. Best practice clinical guideline , Assessment and management of neonatal pain ANZNN- uptake of evidence using networks project for newborn pain – Sept 2007
4. Clinical Guideline analgesia for Neonates NHS-November 2016
5. Procedural pain management in neonates, infants and children elaine.wilson-smith@sch.nhs.uk, vol.5 No.3 Sept 2011.
6. A Guide to Pain Assessment and Management in the Neonate. Norina Witt, Seth Coynor, Christopher Edwards, Hans Bradshaw, Online Springerlink.com: March 2016
7. Assessment and management of pain in newborns hospitalized in a Neonatal Intensive Care Unit: a cross-sectional study, Natália Pinheiro ,Braga Sposito, Lisabelle Mariano Rossato,Mariana Bueno, Amélia Fumiko Kimura,Taine Costa,Danila Maria Batista Guedes- Rev. Latino-Am. Enfermagem 2017;25:e2931
8. Analgesia for Neonates Clinical Guideline, NHS 2016
9. Association of Paediatric Anaesthetists of Great Britain and Ireland. Good practice in postoperative and procedural pain London, APA 2008.
10. Neofax 2018
11. British National Formulary for Children (BFNC) 2017–2018
12. Pain assessment scales in newborns: integrative review Gleicia Martins de Melo, Ana Luíza Paula de Aguiar Lélis*, Alline Falconieri de Moura, Maria Vera Lúcia Moreira Leitão Cardoso, and Viviane Martins da Silva - Elsevier Editora Ltda 2014.
13. Neonatal pain Suellen M. Walker, Pediatric Anesthesia 24 (2014) 39–48
14. Neonatal pain management, Tarun Bhalla, Ed Shepherd,and Joseph D. Tobias Saudi J Anaesth. 2014 Nov; 8
15. Prevention and Management of Pain in the Neonate: An Update American Academy of Pediatrics Committee on Fetus and Newborn, Section on Surgery, and Section on Anesthesiology and Pain Medicine Canadian Paediatrics Society Fetus and Newborn Committee, Pediatrics Vol. 118, No.5, Nov. 2006
16. Neonatal Pain Assessment Tool, PAT score developed by Hodgkinson et al, 1994. Updated June 2012, RCH, Melbourne

15. Glossary of Pain Medications

<table>
<tr><th>Drug</th><th>Route</th><th>Dose</th><th>Advice for use</th></tr>
<tr>
<td>Paracetamol</td>
<td>Oral
Suppositories
Intravenous</td>
<td>
Oral:
<table>
<tr><th colspan="4">Doses for Oral Paracetamol</th></tr>
<tr><td></td><td>Maintenance dose</td><td>Dosing Interval</td><td>Maximum Daily dose</td></tr>
<tr><td>Age group</td><td>(mg/kg)</td><td>(hour)</td><td>(mg/kg/d)</td></tr>
<tr><td>0-3 months</td><td>15</td><td>6-8</td><td>60</td></tr>
<tr><td>3 months - 12 years</td><td>15</td><td>4-6</td><td>75
(max 4 gram/day)</td></tr>
</table>
Rectal:
<table>
<tr><th colspan="4">Doses for Rectal Paracetamol</th></tr>
<tr><td></td><td>Loading dose</td><td>Maintenance dose</td><td>Dosing Interval</td></tr>
<tr><td>Age group</td><td>(mg/kg)</td><td>(mg/kg)</td><td>(h)</td></tr>
<tr><td>0-3 months</td><td>30</td><td>20</td><td>6-8</td></tr>
<tr><td>3 months - 12 years</td><td>40</td><td>20</td><td>6-8</td></tr>
</table>
Intravenous:
</td>
<td>
Dosage guidelines are based on adjusted body weight (ABW). ABW= ideal body weight +0.4 x(actual body weight – ideal body weight)

Contra-indications:
Known sensitivity to paracetamol
Severe liver disease

Risk factors for paracetamol hepatotoxicity include: fasting/ vomiting/ dehydration, systemic sepsis, pre-existing liver disease, chronic under-nutrition and prior paracetamol intake
Single ingestion of more than 10 times the recommended dose is potentially hepatotoxic as are exposures greater than 140 mg/kg/day for several days.

Suppositories should not be used in neutropenic patients or patients who are severely immunocompromised

IV paracetamol orders should be reviewed daily
All paracetamol prescriptions should be reviewed after 48 hours, and if required for long term use, consider reducing maximum daily dose to:
After 48 hours: 60 mg/kg/day
After 8 days: 45 mg/kg/day
After 14 days: 30 mg/kg/day
</td>
</tr>
</table>

Doses for Intravenous Paracetamol

Age group	Maintenance dose (mg/kg)	Dosing Interval (h)	Maximum Daily dose (mg/kg/d)
> 32 weeks CGA *(corrected gestational age))*	7.5	8	25
Term neonate	7.5	6-8	30
< 10 kg	7.5	6-8	30
> 10 kg to 50 kg	15	4-6	60 (<33kg: not > 2g/day 33-50kg : not > 3 g/day

Drug	Route	Dose	Advice for use
NSAIDs		**General Contraindications to NSAIDs:** • Gastro-intestinal ulceration, ulcerative colitis or Crohn's disease. • Liver dysfunction. • Clotting coagulation abnormality or presence or potential for active bleeding. • Severe asthma or acute rhinitis, especially if exacerbated by aspirin. • Renal disease, diuretic therapy or situations of decreased renal perfusion e.g. hypotension, hypovolemia, rhabdomyolysis, significant dehydration. • Some orthopaedic procedures, where bone healing may be compromised. Children with un-treated bone or joint sepsis i.e. osteomyelitis or septic arthritis.	
Ibuprofen	Oral	>3 months : 5 mg/kg q6-8 hourly (max 20mg/kg/day) 6 months-12 years : 5-10 mg/kg q 6-8 hourly (max 30-40 mg/kg/day or 1.2 grams/day, whichever is less)	**Restrictions:** Patients younger than 3 months, caution in those 3-6 months
Diclofenac Sodium (Voltaren)	Oral Suppositories	Oral : >6 months or > 10 kg : 0.3 - 1 mg/kg/dose q8 hourly [max 3 mg/kg/day or 150 mg/day, *whichever is less*] Rectal :	Patients younger than 6 months. Suppositories should not be used in neutropenic patients or patients who are severely immunocompromised

		3 mg/kg per day PRN divided q8-12 hourly [max 3 mg/kg/day or 150 mg/day, whichever is less] [Lowest suppository dosage = 12.5 mg/supp]	Verbal consent required for suppositories usage Particular attention must be paid to maintaining hydration and minimizing exposure to other nephrotoxins during the peri-operative period.
Ketorolac	intramuscular or intravenous *Note: Although only licensed for intra-muscular use. Ketorolac is typically administered IV*	Intramuscular/Intravenous = 0.5 mg/kg/dose Subsequent dose: 1mg/kg/dose q6 Hourly. Max per dose: 10 mg. Max daily: 90 mg/day Max duration: 2 days	**Precautions:** Patients receiving methotrexate, ACE-inhibitors, diuretics, nephrotoxic medications, probenecid, lithium, psychoactive medications e.g. fluoxetine.

Drug	Route	Dose	Advice for use
Selective Cox-2 Inhibitors			
Parecoxib	Intravenous	Intravenous = A single dose of 0.5-1 mg/kg [maximum of 40 mg] administered by the anaesthetists in theatres.	**Restriction:** Patients younger than 2 years. Patients with spinal cord injuries Not to be administered to patients already receiving Aspirin or other NSAIDS Not to be administered to patients with hypertension receiving treatment with ACE Inhibitors As the drug may be active for 24 hours, further NSAIDs should not be administered for 24 hours after a dose of parecoxib**.**
Celecoxib (Celebrex)	Oral Formulation: Capsule 50 mg, 100 mg	Usual usage for Juvenile Idiopathic Arthritis	**Monitoring:** 1.Creatinine at baseline, avoid using if severe renal disease 2. For long term use, required to monitor blood

<table>
<tr>
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<td></td>
<td>
<table>
<tr><th colspan="3">Doses for Oral Celecoxib</th></tr>
<tr><th>Age group</th><th>Dose (mg)</th><th>Dosing Interval (h)</th></tr>
<tr><td>>2 years & between 10-25 kg</td><td>50</td><td>12</td></tr>
<tr><td>>2 years & more than 25 kg</td><td>100</td><td>12</td></tr>
</table>
</td>
<td>pressure, FBC, Renal and liver profile
3. If has systemic onset JIA, to monitor coagulation profile</td>
</tr>
</table>

Drug	Route	Dose	Advise for use
OPIOIDS		Opioids can be divided into weak (Tramadol) and strong (Morphine, Fentanyl, Oxycodone) Tramadol is indicated for moderate pain whilst strong opioids for severe pain. Strong opioids at a lower dose can also be used for moderately severe pain. **Indications:** 1. Post-operative pain 2. Burns 3. Oncology 4. Other painful conditions e.g. acute pancreatitis, acute abdomen, digital ischaemia **Side effects:** Respiratory depression, miosis, nausea and vomiting. Pruritus may be the result of actions at the level of the spinal cord. Constipation is the result of action on the gut. **Contraindications:** 1. History of apnoea	

		2. Airway obstruction 3. Head injury, raised intracranial pressure 4.Severe intercurrent illness, i.e. Congenital Heart Disease and severe Asthma.	
Tramadol	Oral Intravenous Rectal (suppository)	Oral Intravenous Rectal } = 0.5 - 1 mg/kg/dose q4-6 hourly Initial slow titration of tramadol may minimise side effects such as nausea and vomiting.	It demonstrates a relatively high rate of nausea and vomiting but is tolerated fairly well by children. **Precautions:** If the child is on tricyclic antidepressants, selective serotonin reuptake inhibitors, major tranquilizers, fentanyl and pethidine. Also caution in children with difficult airway and obese children. **Contraindication:** children who have taken MAO inhibitors within the previous two weeks.

Drug	Route	Dose	Advise for use
Morphine	Oral Intravenous (IV)	Oral = 0.15 - 0.3 mg/kg/dose PRN q4 hourly [max 10-15 mg/dose] IV bolus = 0.05 - 0.2mg/kg/dose (*refer **iv morphine titration protocol** for acute pain*)	**Precaution:** 1. Morphine kinetics is age dependent Neonates and some ex-premature infants (up to 52 weeks post-conceptual age) may be

Age	Pain severity	Dose
1/12 – 1 year	Moderate-severe pain	0.1 mg/kg q4-6 hourly
> 1 year – 12 years	Moderate pain	0.1-0.2 mg/kg q4-6 hourly
	Severe pain	0.2-0.4 mg/kg q4-6 hourly
> 12 years	Moderate – severe pain	0.1-0.3 mg/kg q4-6 hourly (max 10-15 mg/dose)

Age group	Volume of distribution (L/kg)	Clearance (mL/kg/min)	Half life (hours)
Pre-term neonate	1.8-5.2	2.7-9.6	7.4-10.6
Term neonate	2.9-3.4	2.3-20	6.7-13.9
1-8 years	1.4-3.1	6.2-56.2	0.8-1.2
Adult	1.1-2.1	12-34	1.4-3

<table>
<tr>
<td></td>
<td></td>
<td>(Use ideal body weight for obese child and lower dose in infants)

IV Infusion = Prior to commencing morphine infusion, the child should be titrated to comfort with intravenous boluses of morphine. (refer iv morphine titration protocol)
<u>Preparation of solution for infusion:</u>
Dilute 0.5 mg/kg of Morphine in 50mls normal saline
1 ml of solution = 10 mcg/kg of morphine

<table>
<tr><th colspan="3">Suggested Morphine infusion</th></tr>
<tr><th>Age group</th><th>Infusion rate</th><th>Max infusion rate</th></tr>
<tr><td>Neonates</td><td>0.5-0.7 ml/hr</td><td>1 ml/hr</td></tr>
<tr><td>1-3 months</td><td>0.5-1 ml/hr</td><td>2 ml/hr</td></tr>
<tr><td>> 3 months</td><td>1-2 ml/hr</td><td>4 ml/hr</td></tr>
</table>

Bolus doses of 0.5ml – 1ml of the infusion can be given in 2 situations:
1. If pain relief is inadequate, then a prescribed bolus dose should be administered followed by increasing the infusion rate by 0.5 – 1 ml/hr. Never leave the patient unattended during the bolus administration.
2. To cover “incident pain” (e.g. pulling out drains, physiotherapy, dressing etc.) A bolus dose should be given 10 – 15 minutes prior to the anticipated painful procedure. It is extremely important to ensure that the original rate is resumed once the bolus has been administered. Never leave the patient unattended during the bolus administration.

Extended-release oral: dose every 12 hours
- Conversion of oral from iv dose required, PO: iv = 3:1
- Consult anaesthetist/pain/palliative specialist</td>
<td>sensitive to opioids. Require close monitoring in HDU/ICU
2. Renal impairment and liver impairment

For Morphine infusion, before bolus doses are given:

1. Always exclude alternative causes for ‘inadequate pain relief’ such as urinary retention and hunger.
2. The patient should be awake and coherent with appropriate respiratory rate for age.</td>
</tr>
</table>

<table>
<tr><th>Drug</th><th></th><th>Dose</th><th>Advise for use</th></tr>
<tr><td>Fentanyl</td><td>Intravenous</td><td>For specialist use /with supervision only.

Intravenous bolus: 1-2 mcg/kg/dose
(Should only be given by the Anaesthetists / PICU Team/Paediatric Emergency Specialist)

Infusion:
<u>Preparation of solution for infusion:</u>
Dilute 20mcg/kg of Fentanyl in 50mls normal saline
1 ml of solution = 0.4mcg/kg of fentanyl i.e. 1ml/hr. = 0.4mcg/kg/hr.

Suggested Fentanyl infusion<table><tr><th>Age group</th><th>Infusion rate</th><th>Max infusion rate</th></tr><tr><td rowspan="2">> 1 year only</td><td>LD: 0.4 mcg/kg (1 ml)</td><td>-</td></tr><tr><td>1-2 ml/hr</td><td>4 ml/hr</td></tr></table></td><td>Precaution:
Fentanyl should only be used under close monitoring.
It should be used only in children more than 1 year of age.
1. Patient must be observed in the Acute Bay with pulse oximetry.
2. No other opioid is to be given except on the order of the anaesthetists.
3. Naloxone (Narcan) must be available at the bedside.
4. IV line for opioid infusion is to be used only for infusion of opioid unless anti-reflux valve is used.</td></tr>
<tr><td>Oxycodone</td><td>Oral

<u>Formulation:</u>
Immediate release (Oxynorm)

Slow release (Oxycontin)</td><td><u>Immediate release (Oxynorm)</u>
Oral = 0.1-0.2 mg/kg/dose q4-6hr [max dose 5-10 mg q4hr]
Or 0.15 -0.3 mg/kg/dose q6hr [max dose 7.5-15 mg q6hr]
- Use this dose when total daily requirement of Morphine from previous experience not available
- In opioid naive, maximum starting dose is 5mg/dose

<u>Slow release (Oxycontin)</u>
- Consult anaesthetists /pain /palliative specialists
- Given 12 hourly</td><td>Oxycodone is a synthetic opioid agonist in oral preparation with similar analgesic and side effect profile as morphine
Caution in renal and hepatic impairment, consider longer intervals 6 hourly or more in renal impairment
Do not use in < 1 month

Consider slow-release oxycodone once the daily opioid requirement is stable especially if
- require opioid for more than 2 weeks
- child is prone to constipation</td></tr>
</table>

<table>
<tr><th>Drug</th><th>Route</th><th>Dose</th><th>Advise for use</th></tr>
<tr>
<td>Ketamine</td>
<td>Oral
Intravenous
Intramuscular</td>
<td>Used effectively for sedation and analgesia for brief painful procedures and in combination with midazolam and fentanyl.
<u>Doses for analgesia:</u>
Oral = 0.25 - 1 mg/kg (chronic pain)
2 -10 mg/kg (premedication for procedures)
Intramuscular = 1- 2 mg/kg (5mg/kg for sedation)
Intravenous = 0.2-0.5 mg/kg

<u>Preparation of solution for continuous ketamine infusion</u>:
Add 5 mg/kg of Ketamine and make up to 50 mis with normal saline
1 ml of solution = 0.1 mg/kg of ketamine

• A loading dose is usually not required.
• Bolus doses are not routinely given and must not be given in the ward.
• Ketamine infusion must be run in an independent line.

Suggested Ketamine Infusion for analgesia

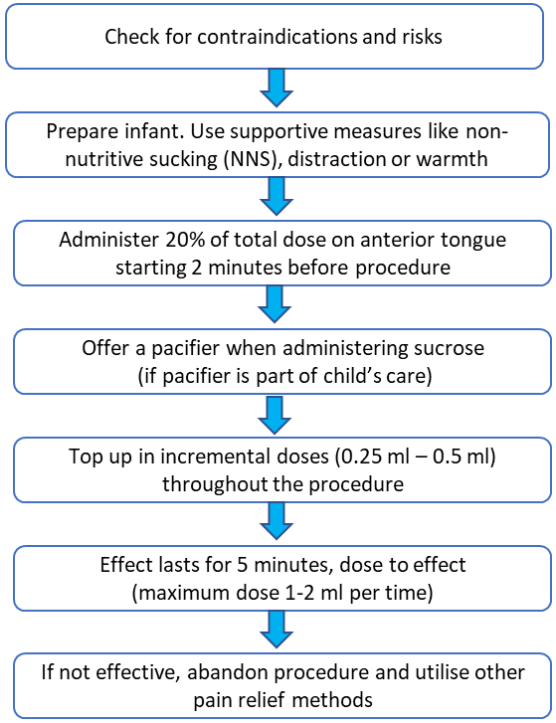
<table>
<tr><th colspan="3">Suggested Ketamine infusion</th></tr>
<tr><th>Dose</th><th>Infusion rate</th><th>Max infusion rate</th></tr>
<tr><td>0.02-0.4 mg/kg/hr (20-400 mcg/kg/hr)</td><td>0.2-2 ml/hr (20-200 mcg/kg/hr)</td><td>4 ml/hr- (400 mcg/kg/hr)</td></tr>
</table>
</td>
<td>Precaution:
Increases secretions

If use as sole anaesthetic agent, it can cause hallucinations and emergence phenomenon

At low doses (subanaesthetic doses: < 1mg/kg per dose IV or 1-2mg/kg per dose IM), it is analgesic and amnesic

At higher doses it produces a state of dissociative anaesthesia.</td>
</tr>
</table>

<table>
<tr><th>Drug</th><th>Route</th><th>Dose</th><th>Advise for use</th></tr>
<tr><td></td><td></td><td>Non-Pharmacological</td><td></td></tr>
<tr><td>Sucrose 24%
or
Glucose 25%</td><td>Oral</td><td><u>Dosage</u>
• Start administration 1-2 minutes before a painful stimulus
• May be repeated during a painful procedure if necessary up to maximum dose per event
• It can be given using a pacifier or directly dripped (one drop at a time) on to the tongue using a syringe
• The number of applications is decided according to the child’s response.

Oral Sucrose 24 % administration
<table><tr><th>Age group</th><th><32 weeks & NBM</th><th>>32 weeks - term</th><th>Infants 0-1 month</th><th>Infants 1-18 months</th></tr><tr><td>Suggested incremental doses</td><td>0.05-0.2 ml</td><td>0.05-0.1 ml</td><td>0.05 – 0.1 ml</td><td>0.25-0.5 ml</td></tr><tr><td>Single event max dose</td><td>0.2 ml</td><td>0.2-0.5 ml</td><td>0.2 -1 ml</td><td>1-2 ml</td></tr><tr><td>24 hours max dose</td><td>0.5 ml</td><td>1 ml</td><td>2 ml</td><td>5 ml
> 3 months : 10 mls</td></tr></table></td><td>It reduces physiological and behavioural indicators of stress and pain in neonates and infants up to 18 months.
Administration:
  </td></tr>
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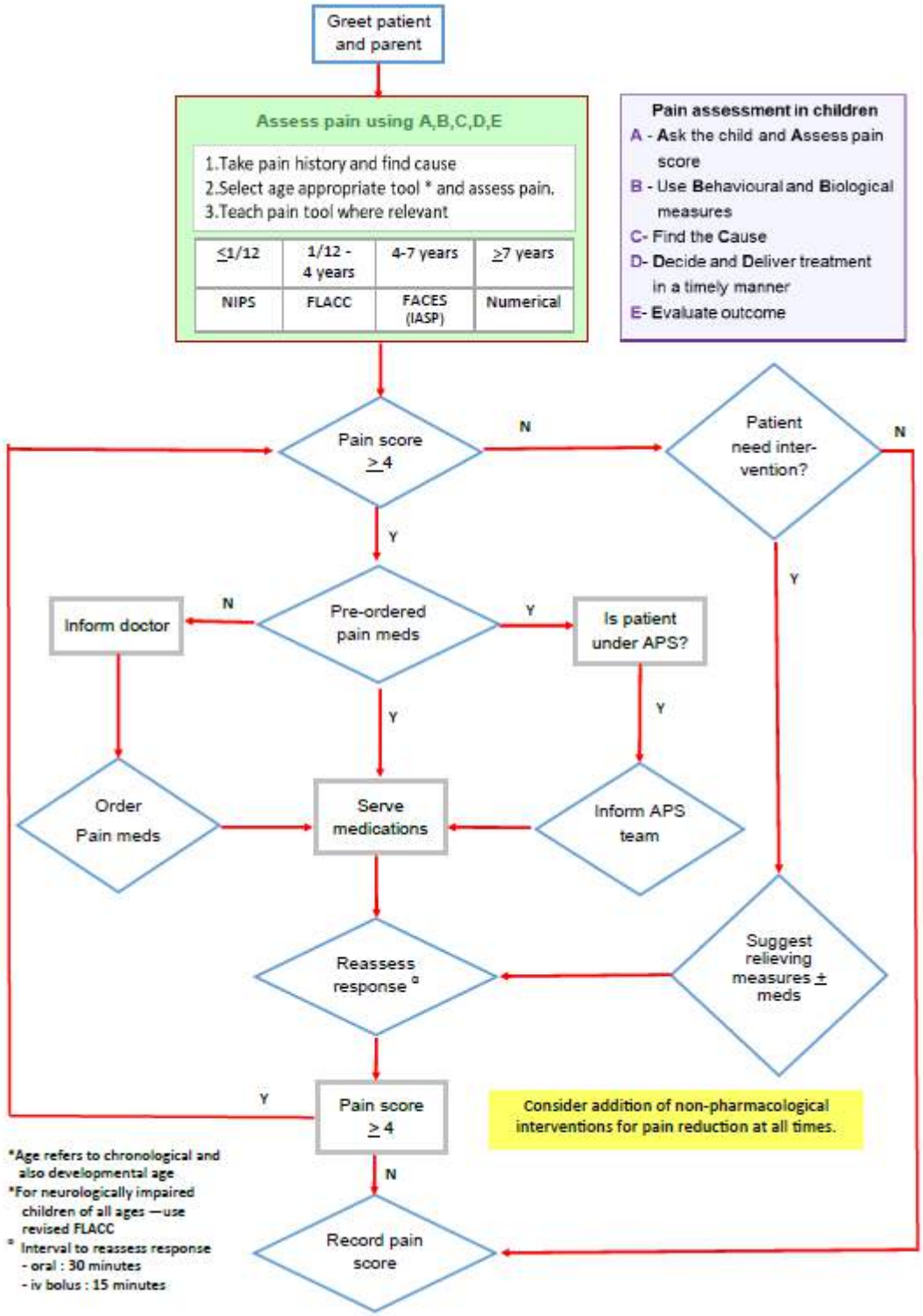
Appendix 1

PAEDIATRIC PAIN MANAGEMENT FLOWCHART



Appendix 2

ANALGESIC LADDER FOR ACUTE PAIN MANAGEMENT

MILD		MODERATE		SEVERE		UNCONTROLLED
Score 1-3		Score 4-6		Score 7-10		
Regular No medication or PCM	PRN PCM &/ or NSAIDs/ COX 2 Inhibitor	Regular Tramadol or Morphine ± PCM ± NSAIDs/ COX2 inhibitor	PRN Additional Tramadol or Morphine	Regular Morphine or IR Oxycodone ± PCM ± NSAIDs/ COX 2 inhibitor	PRN Additional Morphine or IR Oxycodone	To refer to APS for: PCA or Epidural or other forms of analgesia

RECOMMENDED DRUG DOSAGES FOR ACUTE PAIN MANAGEMENT IN CHILDREN

(Review all regular use of analgesics no later than 72 hours after initiation)

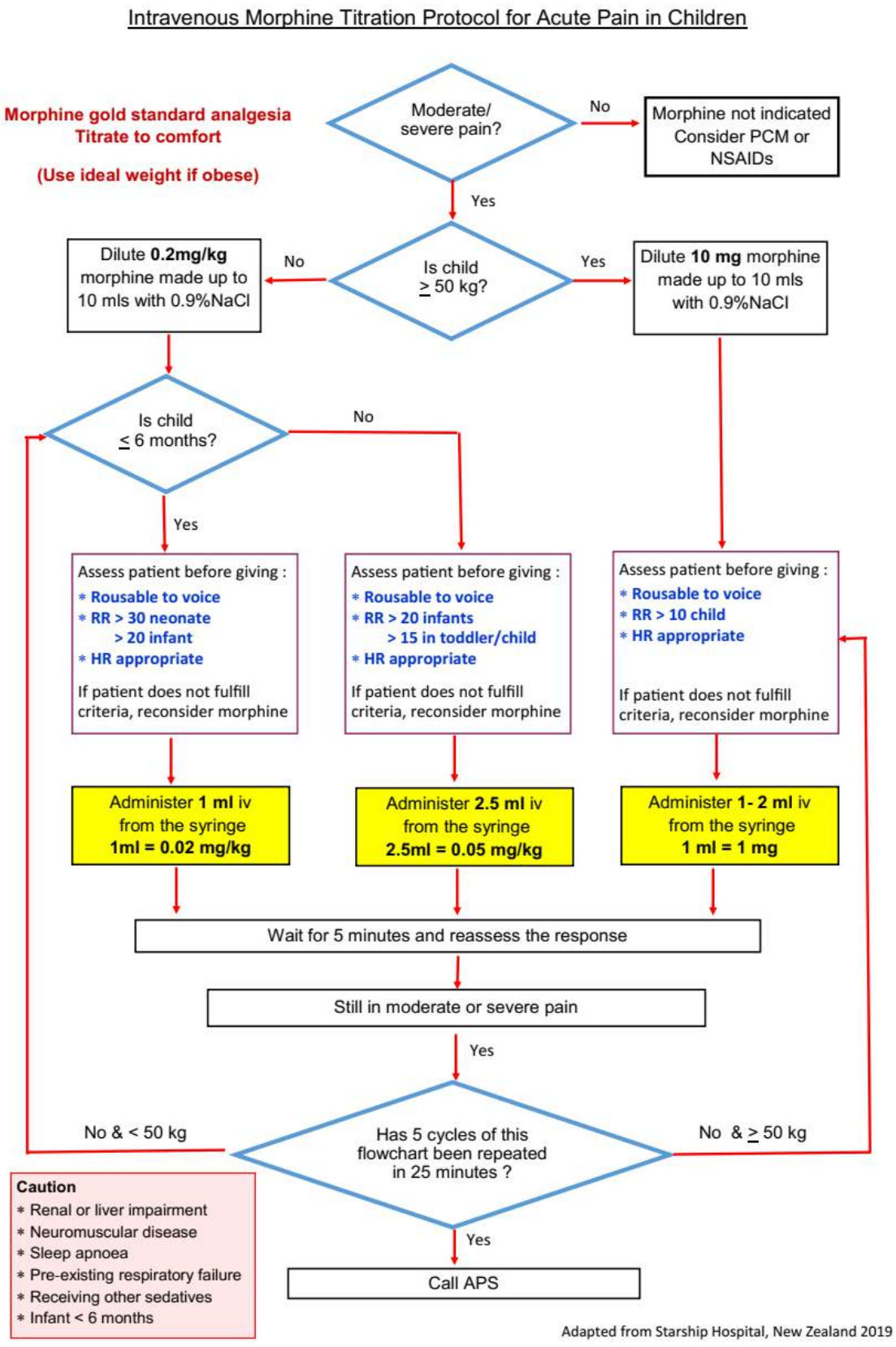
Drug	Route	1 month-2 years	2-12 years	12- 18 years	> 18 years
		Dose and frequency			
Paracetamol	Oral	**0 - 3 months:** 15mg/kg 6 – 8 H (Max: 60mg/kg/day; if preterm 28-32 CGA, max 30mg/kg/day) **> 3months -12 years:** 15mg/kg 4-6 H (Max: 75mg/kg/day or 4 grams/day)		500 mg - 1 gram 4-6 H **(If non- obese ≥ 50 kg:** 1 gram 4-6 H) (Max: 4 grams / day)	500 mg – 1gram 4-6 H (Max: 4 grams/day)
	Per rectal	**0- 3 months: LD** 30 mg/kg; **MD :** 20mg/kg 8 H (Max: 60mg/kg/day) **> 3 month – 12 years : LD** 40mg/kg ; **MD :** 15-20mg/kg 6 H (Max: 75mg/kg/day)			
	IV	**Preterm neonate over 32/52 (CGA) :** 7.5mg/kg 8 H (Max 25mg/kg/day); **Term neonate & until 10 kg:** 7.5 mg/kg 6-8 H (Max: 30mg/kg/day) **> 10kg or child up to 50 kg:** 15mg/kg 4- 6H (Max: 60 mg/kg/day, not exceeding 2 grams if < 33 kg, or 3 grams for 33-50 kg.)		**If non obese > 50 kg :** 1 gram 4 – 6 H (Max: 4grams/day) ****Obese Children:** 15mg/kg Adjusted body weight (Max: 4grams/day)	
Ibuprofen (NSAIDS)	Oral	**< 3 months:** not recommended **> 3 months:** 5mg/kg 6-8 H (Max: 20mg/kg/day) **6 months – 12 years**: 5-10 mg/kg 6-8 H (Max: 30-40mg/kg/day or 1.2 grams/24 hours, whichever less)		200 mg – 400 mg 4 - 6H (Max: 2.4 grams/day)	
Diclofenac (NSAIDS)	Oral	**< 6 months**: not recommended **> 6 months or >10 kg**: 0.3-1mg/kg 8 H (Max: 3 mg/kg/day up to 150 mg/day, whichever is less for 2 days)		Oral 25 - 50mg 8 H (Max: 3 doses/day)	
	Per rectal	**> 1 year:** 1 mg/kg 8-12 H (Max: 3 mg/kg/day up to 150 mg/day, whichever is less)		50-100 mg (oral to be started 18 hours after initial 100mg suppository)	
Mefenamic acid (NSAIDS)	Oral			**> 14 years:** 250mg 8 H	250-500mg 8 H
Celebrex (Cox2 inhibitor)	Oral	**< 2 years:** not recommended	**> 2 years:** weigh risks & benefits **10-25 kg:** 50mg 12 H **> 25 kg:** 100mg 12 H		Celecoxib: 200mg 12H / 400mg daily (Max for 1 week)
Tramadol	Oral / IV	**> 1 year**: 0.5-1mg/kg 4-6 H (with caution) NB: For tonsillectomy max 1mg/kg /dose 6-8H		**> 12years**: 1mg/kg 4 - 6H (Max: 100mg/dose or 400mg/day)	50mg -100mg 6-8 H (Max 400mg/day)
Oxycodone	Oral	**> 1 month**: Immediate Release (IR Oxynorm) 0.1-0.2 mg/kg (max5mg) PRN or 4-6H (by APS / Palliative team) **NB:** Immediate release (IR Oxynorm) for acute pain; Slow release (SR Oxycontin) for severe background pain			IR Oxynorm 5-10mg 6 H SR Oxycontin 10 -20 mg BD
Morphine (Opioid μ-agonist)	Oral	**> 1 month-1 year:** 0.1mg/kg 4-6 H (for moderate – severe pain) (with caution) **> 1 year:** 0.1-0.2 mg/kg 4-6 H (for moderate pain) 0.2-0.4 mg/kg 4-6 H (for severe pain)		**> 12yrs**: 0.1- 0.3 mg/kg 4 -6 H (Max: 10-15mg/dose, up to 6x/ 24 hours)	
	SC	0.1-0.2 mg/kg **< 6 months:** (up to 4x/ 24 hours) **> 6 months**: (up to 6x/ 24 hours)	0.2 mg/kg (up to 6x/ 24 hours)	**> 12yrs:** 5 -10mg (up to 6x/ 24 hours)	
	IV	Slow titration **: Refer iv morphine titration protocol** **1-12 months**: Max : 0.1 mg/kg (up to 4x /24 hours) **> 1 year**: Max : 0.1 mg/kg (up to 6x/ 24 hours)		Slow titration : **Refer iv morphine titration protocol** **> 12yrs:** 2.5 -10mg (up to 6x/ 24 hours)	
Naloxone(pure opioid antagonist)	IV	0.01 mg/kg IV (Max: 0.4 mg) may repeat every 2 minutes.			0.1 – 0.4 mg IV/IM/SC IV dose may repeat every 1-2 minutes
Ketamine	Oral/ IV	Oral: 2-10mg/kg; IV: 0.2-0.5 mg/kg (restricted use only for trained personnel) (To be used in combination with midazolam for procedural analgesia if Ketamine dose > 0.5 mg/kg)			

IV : intravenous, SC : subcutaneous, H : hourly, Max : maximum, LD : Loading dose, MD: Maintenance dose, IBW : Ideal body weight.

****For Obese Children, recommended adjustments for drug dosing:**

Opioid: Ideal Body weight (IBW); Paracetamol and NSAID: Adjusted Body Weight= IBW+ 0.4 x (Actual BW-IBW)

Appendix 3


Intravenous Morphine Titration Protocol for Acute Pain in Children
Morphine gold standard analgesia
Titrate to comfort
(Use ideal weight if obese)
Moderate/ severe pain?
No
Morphine not indicated Consider PCM or NSAIDs
Yes
Is child ≥ 50 kg?
No
Dilute 0.2mg/kg morphine made up to 10 mls with 0.9%NaCl
Yes
Dilute 10 mg morphine made up to 10 mls with 0.9%NaCl
Is child ≤ 6 months?
No
Yes
Assess patient before giving :
* Rousable to voice
* RR > 30 neonate
> 20 infant
* HR appropriate
If patient does not fulfill criteria, reconsider morphine
Assess patient before giving :
* Rousable to voice
* RR > 20 infants
> 15 in toddler/child
* HR appropriate
If patient does not fulfill criteria, reconsider morphine
Assess patient before giving :
* Rousable to voice
* RR > 10 child
* HR appropriate
If patient does not fulfill criteria, reconsider morphine
Administer 1 ml iv from the syringe
1ml = 0.02 mg/kg
Administer 2.5 ml iv from the syringe
2.5ml = 0.05 mg/kg
Administer 1- 2 ml iv from the syringe
1 ml = 1 mg
Wait for 5 minutes and reassess the response
Still in moderate or severe pain
Yes
Has 5 cycles of this flowchart been repeated in 25 minutes ?
No & < 50 kg
No & ≥ 50 kg
Yes
Call APS
Caution
* Renal or liver impairment
* Neuromuscular disease
* Sleep apnoea
* Pre-existing respiratory failure
* Receiving other sedatives
* Infant < 6 months
Adapted from Starship Hospital, New Zealand 2019

Appendix 4

MANAGING OPIOID SIDE EFFECTS

INTRODUCTION

- There are many opioid side effects ranging from mild and troublesome like pruritus to potentially life threatening like respiratory depression
- Patients can develop tolerance to some symptoms like pruritus which may disappear with time. However, tolerance does not develop for some symptoms like constipation
- Symptoms like nausea and pruritus are not signs of allergy but rather a side effect

STRATEGIES FOR MANAGING OPIOID INDUCED SIDE EFFECTS

Strategies	Comments
Dose reduction	• Drowsiness and delirium are dose dependent
Opioid rotation	• May be required not only to improve analgesia but also to reduce side effects • Changing oral morphine to transdermal fentanyl may reduced constipation
Altering route of administration	• Changing oral to subcutaneous morphine may reduce nausea/constipation or sedation
Symptomatic treatment of side effects	• Prophylactic management of constipation required at initiation of opiods • Other side effects may sometimes be managed with symptomatic treatment but always review concurrent medications first

MANAGEMENT OF SPECIFIC OPIOID SIDE EFFECTS

Refer Table 1

References:

1. Cravero JP et. The Society for Pediatric Anaesthesia recommendations for the use of opioids in children during the perioperative periods. DOI: 10.1111/pan.13639
2. Opioid Management – Sydney Children's Hospital guidelines . Guideline number 2018 – 222 v.1
3. Salwegle JM, Logemann C .Management of Common Opioid-Induced Adverse Effects., Am Fam Physician. 2006 Oct 15;74(8):1347-1354.
4. Rogers E, Metha S, Shegngelia R, Reid MC. Four Strategies for Managing Opioid-Induced Side Effects in Older Adults Clin Geriatr. 2013 Apr; 21(4): http://www.consultant360.com/articles/four-strategies-managing-opioid-induced-side-effects-older-adu

Table 1 Management of opioid side effects

Side effect	Notes	Treatment
Nausea and vomiting	• Due to opioid sensitivity and is not an allergy • Usually transient and does not require prophylactic treatment	• Reduce dose • Anti-emetics: Metoclopromide, Haloperidol, Dexamethasone, Granisetron • Consider opioid rotations • Low dose Naloxone 0.25-1 mcg/kg/hour if on iv opioid
Pruritus	• Due to histamine release and is not an allergy	• Calamine lotion • Non-sedating anti-histamine e.g. loratadine • If severe – consider low dose iv Naloxone infusion • If persistent – consider opioid rotation
Constipation	• Reduces gastrointestinal motility, secretions and blood flow to the GIT • Tolerance dose not occur, require long term treatment • Prophylaxis for constipation should be started when initiating opioids	• Non pharmacological : increase fibre intake, increase fluid intake, increase physical activity and establish toileting routine • Stool softener (e.g. lactulose) + Stimulant laxative (e.g. senna, bisacodyl) • Sometimes enema may be required
Urinary retention	• Confirm bladder full • For those on iv Opioid infusions, consider CBD insertion at commencement	• Confirm bladder full • Reassurance, warm compress • Consider bladder drainage if still unable to micturate
Drowsiness / Sedation	• Usually occurs at initiation or with increasing dosages • Dose dependent • Monitor sedation score and RR	• Stop opioid • Continue monitoring of sedation score and respiratory rate • Provide basic airway support • Oxygen • Naloxone if there is respiratory compromise
Respiratory depression	• Dose dependent • Monitor sedation score and RR	• Stop opioid • Support respiration with bag mask valve ventilation and oxygen • Iv Naloxone bolus, can be repeated
Hypotension	• Dose dependent	• Stop opioid • Resuscitate with iv fluids

Appendix 5

OPIOID CONVERSION

- Please be clear of the reason when changing from one opioid to another as opioid conversion/rotation will need to be done carefully and skillfully to prevent under dosing (causing ineffective analgesia) or excessive dosing (causing opioid toxicity or other adverse effects) with the new opioid.
- Opioid conversion ratios are merely an approximate guide and should not replace clinical judgement as many factors can affect the response to opioids:
    - wide inter-individual variation in opioid pharmacokinetics and pharmacodynamics; (influenced by age, ethnicity, renal or hepatic impairment)
    - other variables: dose and duration of opioid treatment, direction of switch in opioid, nutritional status and concurrent medications
- Recommend to routinely reduce the calculated equivalent dose of the new opioid by 25–50% to allow for incomplete cross tolerance. Breakthrough or p.r.n. doses can make up any deficit while re-titrating to a satisfactory dose of the new opioid.
- If in doubt, please consult a pain /palliative specialist

Table 1. Potency of opioids to oral morphine, duration of action and bioavailability

Analgesic	Relative potency to oral morphine	Duration of action (hours)	Oral bioavailability
Morphine (Oral)	1	3-4 hours	30%-35%
Oxycodone (Oral)	1.5 - 2	3-4 hours	60%-80%
Morphine (IV/SC)	2 - 3	3-4 hours	NA
Fentanyl (TD/IV)	100 - 150	72 hours (TD patch) 30-60mins (IV)	NA

Table 2. Recommended dose conversions from oral morphine

Conversion of opioids	Calculation	Example
Morphine (oral) -> Morphine (IV/SC)	divide by 2 - 3	Oral Morphine 30mg -> IV/SC Morphine 10mg -15mg
Morphine (oral) -> Oxycodone (oral)	divide by 1.5 - 2	Oral Morphine 30mg -> Oral Oxycodone 15mg - 20mg
Morphine (oral) -> Fentanyl (TD) mcg/hr*	divide by 2.4 - 3	Oral Morphine 36mg/24H - TD Fentanyl 12mcg/hr

IV: Intravenous, SC: Subcutaneous, TD: Transdermal

* Notes on converting to fentanyl transdermal patch

- do not use for acute pain
- do not use for intermittent or mild pain
- do not start fentanyl patch on opioid naive without first titrating analgesic needs
- do not use when analgesia needs are still increasing
- If converting from sustained-release opioid, apply patch concurrently with last oral dose.
- If converting from regular immediate-release opioid, convert to total oral morphine daily dose then calculate fentanyl TD patch strength. Continue 2-3 scheduled 4 hourly dosing after applying patch
- if converting from infusion of morphine/fentanyl, reduce infusion to 50% after 6 hours applying the patch and discontinue infusion after 12 hours of applying the patch. Breakthrough opioid continues to be available.

- For more long-term use, once the total daily opioid requirement is determined,
    - Convert to a sustained-release form given 2 times daily
    - Breakthrough pain is addressed by giving immediate acting opioid at one tenth or one sixth of 24-hour opioid requirement as often as hourly as necessary for oral doses
    - If consistently requires more than 3 breakthrough doses/24 hours, increase dose of sustained release opioid by an amount equivalent to 50-100% of breakthrough dose in 24 hours

EXAMPLES:

Converting Parental Morphine to Other Parenteral Opioids

Parenteral	Parenteral	Conversion ratio	Calculation
Morphine	Fentanyl	100:1	Morphine 10,000 mcg (10mg) = Fentanyl 100 mcg
Morphine	Tramadol	1: 10	Morphine 10 mg = Tramadol 100 mg

Converting oral Opioid to Parental Opioid of same drug

Oral	Parenteral	Conversion ratio	Calculation
Morphine	Morphine	3:1	Oral Morphine 30 mg = parenteral morphine 10 mg
Tramadol	Tramadol	1.2:1	Oral Tramadol 120 mg = Parenteral Tramadol 100 mg

Converting oral Morphine to other types of oral opioid

Oral	Oral	Conversion ratio	Calculation
Morphine	Oxycodone	1.5: 1	Oral Morphine 15 mg = oral Oxycodone 10 mg
Morphine	Tramadol	1:10	Oral Morphine 10 mg = Oral Tramadol 100 mg

For transdermal Fentanyl – for chronic cancer pain – please consult pain/palliative specialist

References:

1. Opiod Management Guideline – Sydney Children's Hospital. Guideline No 2018-112.v1
2. https://palliativedrugs.com
3. Pain management CHW – guideline. The children's hospital at Westmead. Guideline number 2006-8215 v 15
4. WHO Guidelines for the Pharmacological and Radiotherapeutic Management of Cancer Pain in Adults and Adolescents.Geneva: World Health Organization 2018. ISBN 978-92-4-155039-0.
5. Calculating morphine milligram equivalents. CDC Guidelines for Prescribing Opioids for Chronic Pain. https://www.cdc.gov
6. Opioid dose equivalence, Faculty of Pain Medicine, ANZCA. http://fpm.anzca.edu.au/documents/opioid-dose-equivalence.pdf
7. TreilletE, Laurent S, Hadjiat Y. J Pain Research 2018;11:2587-2601

Appendix 6

OPIOID CESSATION

- Opioids should be discontinued when there is no meaningful improvement in pain or the cause of pain has resolved.
- Patients who have been on long term opioid may need to be weaned off opioids to avoid withdrawal symptoms.
- Risk of iatrogenic withdrawal syndrome is increased in:

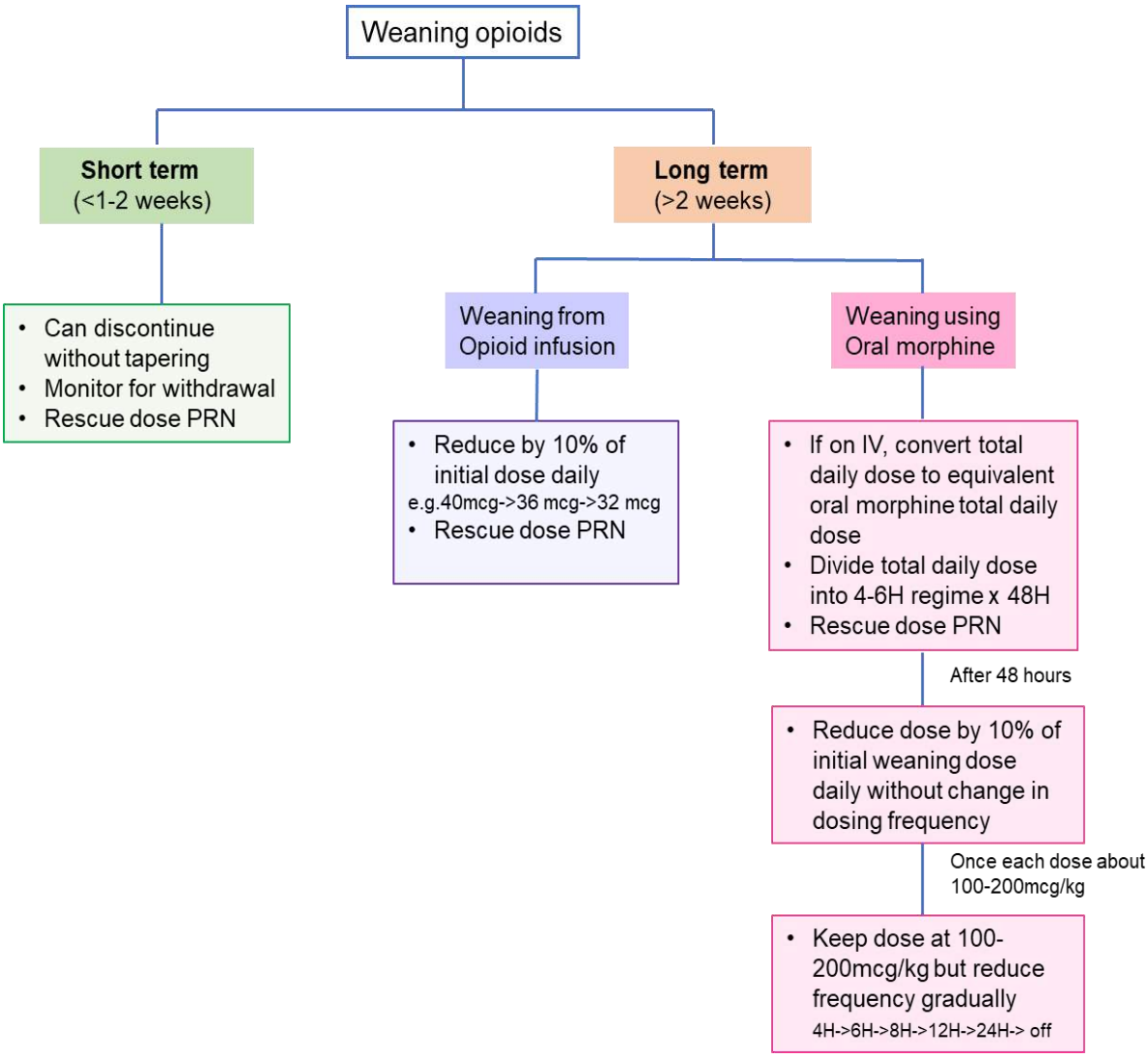
Increased risk for iatrogenic withdrawal syndrome [1]
Less than 6 months Higher cumulative opiod dose Longer duration of exposure Exposed to three or more sedative classes of medicines Pre-existing cognitive impairment

- Monitor these patients for signs and symptoms of withdrawal during weaning. The Withdrawal Assessment Tool-1 (WAT-1) is one of the validated tool for children six months to 17 years of age.[2]
- **Use clinical judgement when using weaning strategies, [3,4] and please consult a pain/palliative specialist if in doubt.**

Signs and symptoms of withdrawal:[1,3]

Frequency	Symptoms and signs
Common	• CNS: anxiety, agitation, insomnia, tremors, increased muscle tone
Other	• CNS: dilated pupils, frequent yawning, • Musculoskeletal: twitching, seizures, aches and pains • Respiratory: tachypnoea • GIT: abdominal cramps, pain, diarrhoea, nausea, vomiting, poor appetite • Autonomic: tachycardia, hypertension, mottled skin, sweating, hot/cold flushes • Others: nasal stuffiness, watery eyes, sneezing, hallucination

Method of weaning opioids:



References:

1. Best, K.M, Wypij, D, Asaro, L.A. etal. Crit. Care Med. 2017;45:e7–e15.
2. Children 2018, 5, 163; doi:10.3390
3. WHO Guidelines for the Pharmacological and Radiotherapeutic Management of Cancer Pain in Adults and Adolescents. Geneva: World Health Organization 2018. ISBN 978-92-4-155039-0.
4. Opioid Management Practice Guidelines. Sydney Children's Hospital. Guideline No: 2018-112 v1

Appendix 7

FLACC scale

Category	Score		
	0	1	2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant quivering chin, clenched jaw
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid or jerking
Cry	No cry(awake or asleep)	Moans or whimpers, occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasionally touching, hugging or being talked to, distractible	Difficult to console

How to use FLACC

In patients who are awake: observe for 1-5 minutes or longer. Observe the legs and body unvovered. Reposition patient or observe activity. Assess body for tenseness and tone. Initiate consoling interventions if needed.

In patients who are asleep: Observe for 5 minutes or longer. Observe body and legs uncovered. If possible, reposition the patient. Touch the body and assess for tenseness and tone.

Appendix 8

Skala FLACC

Kategori	Pemarkahan		
	0	1	2
Wajah	Tiada ekspresi tertentu di wajah atau dalam keadaan tersenyum	Kadang-kadang muka berkerut, murung, tidak bermaya atau tidak bersemangat	Rahang terkancing, dagu bergetar (pada kadar kerap hingga berterusan)
Kaki	Kedudukan biasa ayau selesa	Keadaan tidak selesa, resah atau tegang	Menendang-nendang ataupun membengkokkan kaki
Activiti	Berbaring tenang, berkedudukan biasa, bergerak dengan selesa	Berguling, bergerak depan dan belakang, tegang	Meringkuk, kaku atau mengelupur
Tangisan	Tidak menangis (sama ada semasa tidur atau terjaga)	Merengek dan kadang-kadang mengeluh	Menangis berterusan, berteriak dan teresak-esak, sering mengeluh
Keboleh-pujukan	Tenang	Masih dapat dipujuk dengan sesekali sentuhan, pelukan atau kata-kata, masih boleh dialih perhatian	Sukar dipujuk

Cara penggunaan skala FLACC:

Bagi pesakit yang sedar : Pemerhatian hendaklah dilaksanakan selama 1 -5 minit atau selebihnya. Perhatikan kaki dan badan tanpa ditutup. Posisikan pesakit semula dan perhatikan sebarang pergerakan atau aktiviti gerakan badan. Nilaikan ketegangan badan dan cuba mengurangkan ketidakselesaan sekiranya perlu.

Bagi pesakit yang tidak sedar: Pemerhatian hendaklah dilaksanakan selama lebih daripada 5 minit. Perhatikan kaki dan badan tanpa ditutup. Posisikan pesakit semula sekiranya boleh . Nilaikan ketegangan badan dengan mengerakkan atau menyentuh bahagian badan tersebut.

Appendix 9

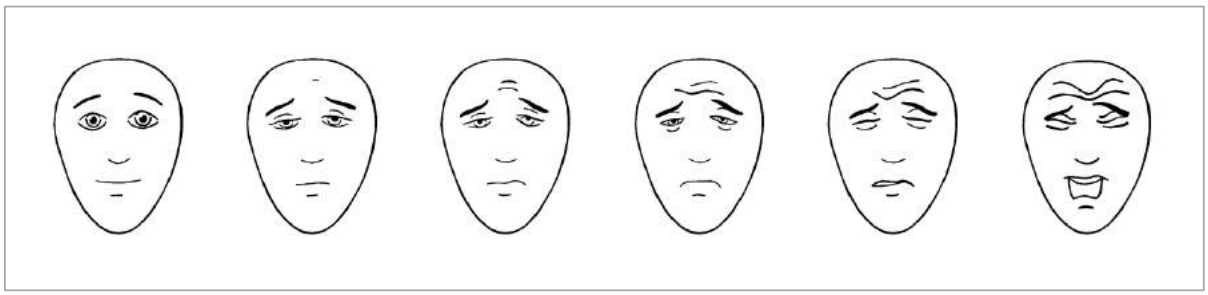
Revised FLACC scale

ASSESSMENTS	SCORES		
	0	1	2
FACE **Individualised behaviour :**	No particular expression or smile	Occasional grimace or frown, withdrawn or disinterested; appears sad or worried	Consistent grimace or frown; frequent/constant quivering chin; clenched jaw; distressed-looking face; expression of fright or panic
LEGS **Individualised behaviour :**	Normal position or relaxed; usual tone & motion to limbs	Uneasy, restless, tense; occasional tremors	Kicking, or legs drawn up; marked increase in spasticity, constant tremors or jerking
ACTIVITY **Individualised behaviour :**	Lying quietly, normal position, moves easily, regular & rhythmic respirations	Squirming, shifting back/forth, tense or guarded movements, mildly agitated, shallow splinting respirations, intermittent sighs	Arched, rigid or jerking, severe agitation, head banging, shivering, breath holding, gasping or sharp intake of breaths, severe splinting
CRY **Individualised behaviour :**	No cry/verbalization	Moans or whimpers, occasional complaint, occasional verbal outburst or grunt	Crying steadily, screams or sobs, frequent complaints, repeated outbursts, constant grunting
CONSOLABILITY **Individualised behaviour :**	Content or relaxed	Reassured by occasional touching, hugging or being talked to, distractible	Difficult to console or comfort, pushing away caregiver, resisting care or comfort measures

**Individualised pain behaviours unique to each child with severe neurological impairment as identified by carers or staff can be inserted into the most appropriate category in the left column and its severity graded accordingly to encompass pain behaviours not covered by the existing table.*

Appendix 10

FACES Pain Scale - Revised



Interpretation of the scale above:

0	2	4	6	8	10

Faces Pain Scale – Revised (FPS-R)

In the following instructions, say "hurt" or "pain" , whichever seems right for a particular child..

"These faces show how much something can hurt. This face (point to face on the far left) **shows no pain. The faces show more and more pain (**points to each from left to right**) up to this one (**point to the face on far right) **– It shows very much pain. Point to the face that shows how much you hurt (**right now**)"**

Score the chosen face 0,2,4,6,8, or 10, couting left to right, so "0" ="n pain" and "10" = "very much pain" . Do not use words like "happy" or "sad". This scale is intended to measure how children can feel inside, not how their face looks.

FPS-R - Australia/English - Version of 30 Jan 14 - Mapi.
ID7858 / FPS-R_AU2.0_eng-AU.doc

Faces Pain Scale – Revised (FPS-R)

In the following instructions, say "hurt" or "pain", whichever seems right for a particular child.

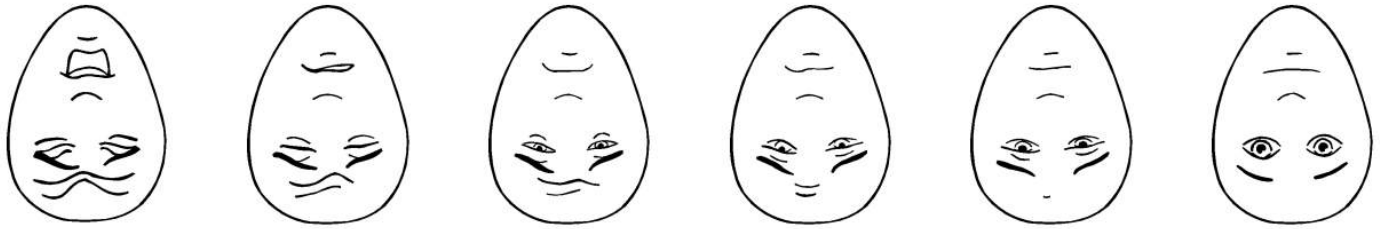
"These faces show how much something can hurt. This face *[point to face on far left]* **shows no pain. The faces show more and more pain** *[point to each from left to right]* **up to this one** *[point to face on far right]* **- it shows very much pain. Point to the face that shows how much you hurt** [right now]."

*Score the chosen face **0**, **2**, **4**, **6**, **8**, or **10**, counting left to right, so "0" = "no pain" and "10" = "very much pain". Do not use words like "happy" or "sad". This scale is intended to measure how children feel inside, not how their face looks.*

Sources. Hicks CL, von Baeyer CL, Spafford P, van Korlaar I, Goodenough B. The Faces Pain Scale – Revised: Toward a common metric in pediatric pain measurement. Pain 2001;93:173-183. Bieri D, Reeve R, Champion GD, Addicoat L, Ziegler J. The Faces Pain Scale for the self-assessment of the severity of pain experienced by children: Development, initial validation and preliminary investigation for ratio scale properties. Pain 1990;41:139-150.

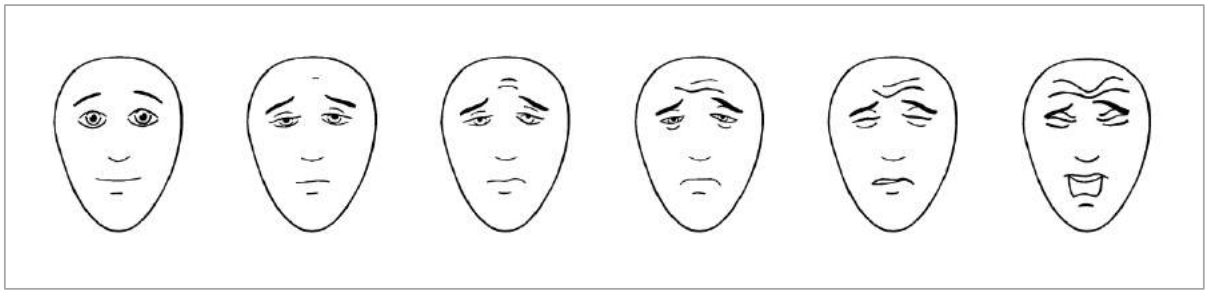
(fold along dotted line)

10 **8** **6** **4** **2** **0**



Appendix 11

Skala Kesakitan Muka – Disemak semula (FPS-R), IASP



Interpretasi skala muka di atas:

0	2	4	6	8	10

Skala Kesakitan Muka – Disemak Semula (FPS-R)

Dalam arahan-arahan berikut, gunakan perkataan "sakit".

"Muka-muka ini menunjukkan bagaimana sesuatu itu boleh menyakitkan. Muka ini *(tunjukkan pada muka yang paling kiri)* **menunjukkan tiada kesakitan. Muka-muka ini menunjukkan kesakitan yang makin lama makin banyak** (*tunjukkan pada setiap muka dari kiri ke kanan)* **sehingga ke muka ini** *(tunjukkan muka paling kanan)* **– ia menunjukkan kesakitan yang amat sangat. Tunjukkan pada muka yang menunjukkan betapa banyak kesakitan yang sedang anda alami (sekarang)".**

Berikan skor pada muka yang dipilih 0,2,4,6,8,atau 10, kira dari kiri ke kanan, jadi "0" = "tiada kesakitan" dan "10" =" kesakitan yang amat sangat". Jangan gunakan perkataan seperti "gembira" dan "sedih". Skala ini digunakan untuk mengukur bagaimana kanak-kanak merasa di dalam, bukan bagaimana wajah mereka kelihatan.

FPS-R - Malaysia/ Malay - Version of 10 Mar 14 - Mapi.
ID7858 / FPS-R_AU2.0_msa-MY.doc

Skala Kesakitan Muka – Disemak Semula (FPS-R)

Dalam arahan-arahan berikut, gunakan perkataan "sakit".

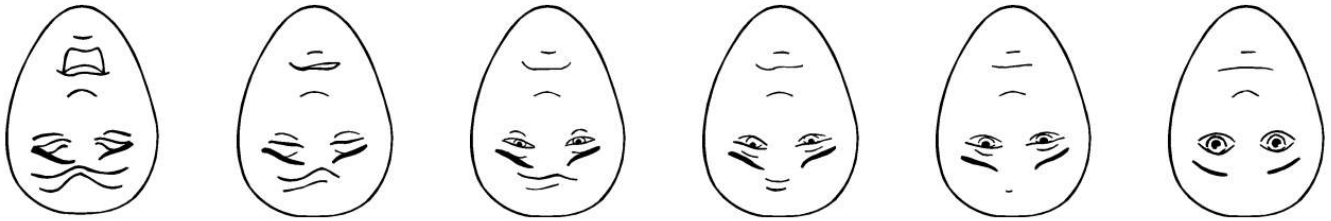
"Muka-muka ini menunjukkan bagaimana sesuatu itu boleh menyakitkan. Muka ini *[tunjukkan pada muka yang paling kiri]* **menunjukkan tiada kesakitan. Muka-muka ini menunjukkan kesakitan yang makin lama makin banyak** *[tunjukkan pada setiap muka dari kiri ke kanan]* **sehingga ke muka ini** *[tunjukkan muka paling kanan]* **- ia menunjukkan kesakitan yang amat sangat. Tunjukkan pada muka yang menunjukkan betapa banyak kesakitan yang sedang anda alami** [sekarang]."

*Berikan skor pada muka yang dipilih **0**, **2**, **4**, **6**, **8**, atau **10**, kira dari kiri ke kanan, jadi "0" = "tiada kesakitan" dan "10" = "kesakitan yang amat sangat". Jangan gunakan perkataan seperti "gembira" dan "sedih". Skala ini digunakan untuk mengukur bagaimana kanak-kanak merasa di dalam, bukan bagaimana wajah mereka kelihatan.*

Sumber-sumber. Hicks CL, von Baeyer CL, Spafford P, van Korlaar I, Goodenough B. The Faces Pain Scale – Revised: Toward a common metric in pediatric pain measurement. Pain 2001;93:173-183. Bieri D, Reeve R, Champion GD, Addicoat L, Ziegler J. The Faces Pain Scale for the self-assessment of the severity of pain experienced by children: Development, initial validation and preliminary investigation for ratio scale properties. Pain 1990;41:139-150.

(lipat mengikut titik garisan)

10 **8** **6** **4** **2** **0**



Appendix 12

Numerical scale

- Ask the child to report their pain severity based on numbers where ‘0’ is no pain and ‘10’ is the worst pain experienced.

Appendix 13

COMFORT BEHAVIOUR PAIN SCALE

Alertness	• Deeply asleep (eyes closed, no response to changes in the environment)	❑ 1
	• Lightly asleep (eyes mostly closed, occasional responses)	❑ 2
	• Drowsy (child closes his or her eyes frequently, less responsive to the environment)	❑ 3
	• Awake and alert (child responsive to the environment)	❑ 4
	• Awake and hyperalert (exaggerated responses to environmental stimuli)	❑ 5
Calmness–Agitation	• Calm (child appears serene and tranquil)	❑ 1
	• Slightly anxious (child shows slight anxiety)	❑ 2
	• Anxious (child appears agitated but remains in control)	❑ 3
	• Very anxious (child appears very agitated, just able to control)	❑ 4
	• Panicky (child appears severely distressed, with loss of control)	❑ 5
Respiratory response (score only in mechanically ventilated children)	• No spontaneous respiration	❑ 1
	• Spontaneous and ventilator respiration	❑ 2
	• Restlessness or resistance to ventilator	❑ 3
	• Active breathing against ventilator or regular coughing	❑ 4
	• Fighting against ventilator	❑ 5
Crying (score only in children breathing spontaneously)	• Quiet breathing, no crying sounds	❑ 1
	• Occasional sobbing or moaning	❑ 2
	• Whining (monotone)	❑ 3
	• Crying	❑ 4
	• Screaming or shrieking	❑ 5
Physical movement	• No movement	❑ 1
	• Occasional (3 or fewer) slight movements	❑ 2
	• Frequent (more than 3) slight movements	❑ 3
	• Vigorous movements limited to extremities	❑ 4
	• Vigorous movements including torso and head	❑ 5
Muscle tone	• Muscles totally relaxed, no muscle tone	❑ 1
	• Reduced muscle tone, less resistance than normal	❑ 2
	• Normal muscle tone	❑ 3
	• Increased muscle tone and flexion of fingers and toes	❑ 4
	• Extreme muscle rigidity and flexion of fingers and toes	❑ 5
Facial tension	• Facial muscles totally relaxed	❑ 1
	• Normal facial tone	❑ 2
	• Tension evident in some facial muscles (not sustained)	❑ 3
	• Tension evident throughout facial muscles (sustained)	❑ 4
	• Facial muscles contorted and grimacing	❑ 5
	Total Score	
VAS (Visual Analogue Scale) Put a mark on the line below to indicate how much pain you think the child has **at this very moment.** no pain ⟷ worst pain **VAS Score**		

Procedure to use Comfort-B:

Observe the child from a position with fill view of face and body for a full 2 minutes. Conclude observation by gentle touch on patient's arm or leg to determine muscle tension. Then document pain intensity on VAS provided on the ruler.

Appendix 14

Neonatal / Infant Pain Scale (NIPS)

Neonatal/Infant Pain Scale (NIPS)[4] A score greater than 3 indicates pain		Score
Facial expression		
0 - Relaxed muscles	Restful face, neutral expression	
1 - Grimace	Tight facial muscles, furrowed brow, jaw, chin (negative facial expression – nose, mouth and brow)	
Cry		
0 - No cry	Quiet, not crying	
1 – Whimper	Mild moaning, intermittent.	
2 – Vigorous cry	Loud scream, rising, shrill continuous (note, silent cry may be scored if baby is intubated as evidenced by obvious mouth and facial movements).	
Breathing Patterns		
0 – Relaxed	Usual pattern for this infant	
1 – Change in breathing	In drawing, irregular, faster than usual, gagging and breath holding.	
Arms		
0 – Relaxed/Restrained	No muscular rigidity, occasional random movements of arms.	
1 – Flexed/Extended	Tense straight legs, rigid and/or rapid extension, flexion.	
Legs		
0 – Relaxed/Restrained	No muscular rigidity, occasional random movements of arms.	
1 – Flexed/Extended	Tense straight legs, rigid and/or rapid extension, flexion.	
State of Arousal		
0 - Sleeping/awake	Quiet, peaceful sleeping or alert random leg movement.	
1 - Fussy	Alert, restless and thrashing	

Interpretation:

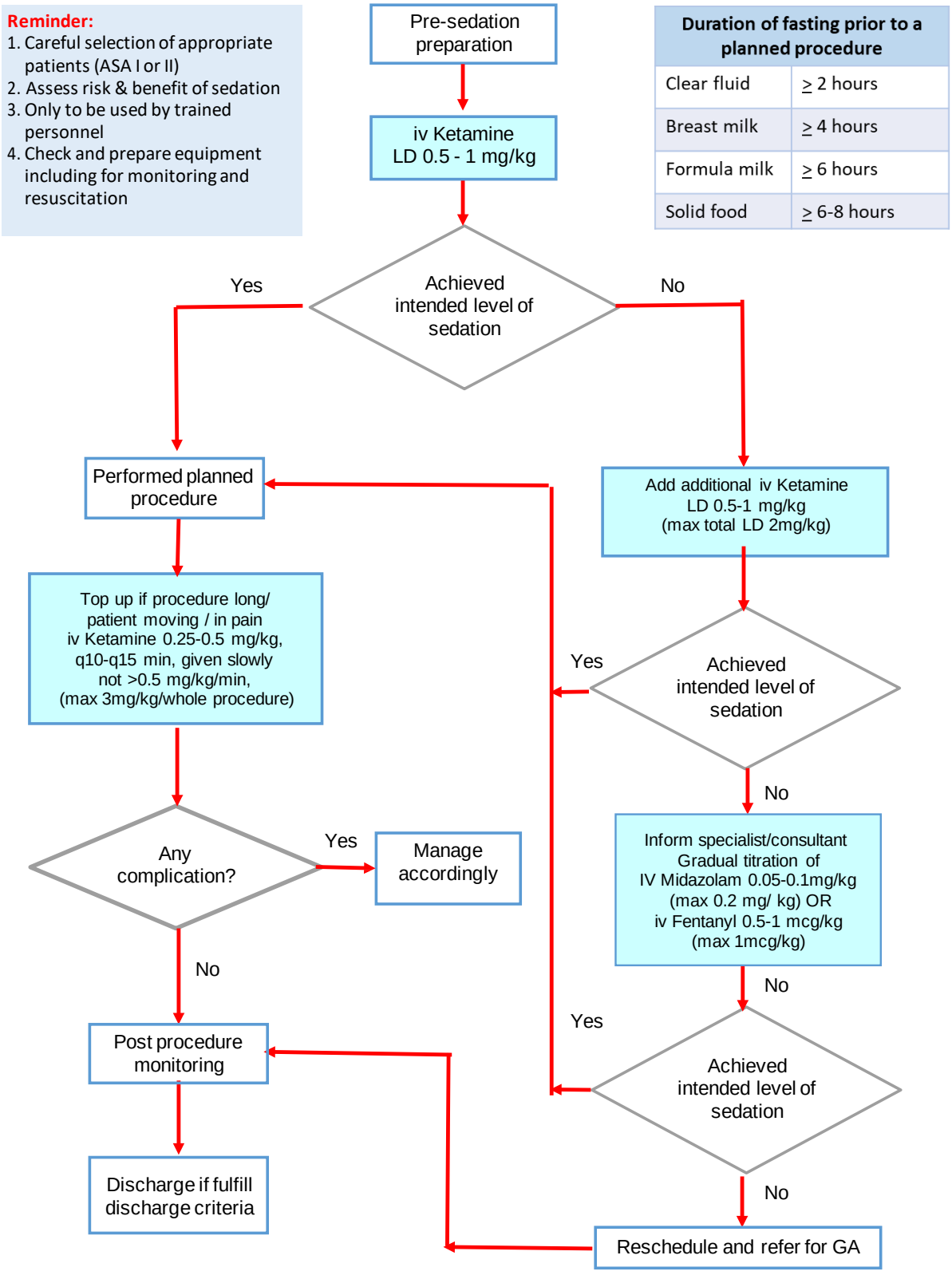
1-2 : Mild pain
3-4 : Moderate pain
5-7 : Severe pain

Appendix 15

PSA FOR PAINFUL PROCEDURES (< 30 MINUTES) IN CHILDREN > 3 months

Reminder:
1. Careful selection of appropriate patients (ASA I or II)
2. Assess risk & benefit of sedation
3. Only to be used by trained personnel
4. Check and prepare equipment including for monitoring and resuscitation

Duration of fasting prior to a planned procedure	
Clear fluid	≥ 2 hours
Breast milk	≥ 4 hours
Formula milk	≥ 6 hours
Solid food	≥ 6-8 hours



LD—Loading dose

** Routine use of iv Midazolam or iv Atropine with iv Ketamine no longer indicated*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Pelanggan Bebas Kesakitan