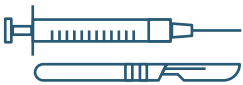
QUICK GUIDE

Emergency Pain Management for Injured Children

2024



This manual is designed for all people caring for children and can be used in conjunction with the Paediatric Blast Injury Field Manual.

Quick Guide:
Emergency Pain Management for Injured Children

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Introduction

Pain is experienced by children of every age, culture, demographic and physical or mental state. It is a complex and subjective experience influenced by physical, psychological, cognitive, cultural and situational factors. Pain is what the patient says it is.

Pain management is an essential and basic humanitarian standard in the care of injured children and our aim as caregivers is to relieve pain as early and as completely as possible.

Unmanaged pain leads to short- and long-term adverse effects including delayed healing, along with increased risk of developing chronic pain syndromes, post-traumatic stress disorder and poor functional outcomes all of which can have a lifelong impact for the child.

A structured and comprehensive approach to pain management in children is described using 3 pillars of intervention. These are physical, psychological, and pharmacological and are built on the core principles of paediatric care. Together these structural elements support a holistic and effective approach to pain management for children.

> *In low resource and conflict settings the prioritisation and capacity to manage pain may be extremely challenging. This guide will give the caregiver a toolbox to select what may be available and achievable at the time. Do what you can.*

Figure 1: *Pillars and core principles of pain management for injured children*

PILLARS OF INTERVENTION

Physical:

- Immobilisation
- Comfort positioning
- Application of heat / cold
- Dressings

Psychological:

Cognitive and behavioural strategies to manage pain and anxiety:

- Distraction
- Relaxation techniques and imagery
- Positive reinforcement
- Emotional support and reassurance
- Play, for distraction or to encourage engagement with treatment
- Involve family, friends and caregivers
- Manage caregivers' distress

Pharmacological:

- Multi-modal analgesia
- Regional techniques

CORE PRINCIPLES

- Create a caring environment
- Provide a sense of security and comfort
- Engage with spiritual and cultural practices
- Respect the child and be honest
- Communication

CHAPTER 1

Pain management for injured children that anyone can do, anywhere

The following methods can be used as first-line treatment for managing pain in children. They are safe and effective. When access to hospital care is limited, the techniques described will reduce the distress and pain a child experiences.

These techniques focus on reducing pain perception and improving physical and emotional comfort. They can be used by families, caregivers, lay and first responders, as well as medical providers.

By using these techniques, the quality of pain relief experienced by the child is greatly increased and they should be used for all children in pain.

Key messages

- The core principles of paediatric care along with psychological and physical interventions should always be used. They are safe and effective.
- Oral medication like paracetamol and ibuprofen can and should be used by non-healthcare providers. They can be given as per manufacturer instructions.
- If you are not usually the caregiver for the child, support their usual caregiver to provide care when possible.
- Relate to children according to their age and development and involve them in decision making.
- **Respect and listen to the child. Be truthful and do not lie about pain.**
- **Ask for child and caregiver consent for interventions.**
- **Explain what you are doing.**
- **Never, where at all possible, separate the child from their usual caregiver.**

Core principles for providing care to children

1. Create a caring environment

- **Principle:** Stimulating environments will increase stress and pain perception. Sight of wounds, noise, light, and crowding will add to the child's distress.
- **Practice:** Cover wounds. Get down to the level of the child to communicate and keep a safe space for them. Allow the usual caregivers to support the child if possible and safe to do so.
- **Application:** All injured children in all settings.

2. Provide a sense of security & comfort

- **Principle:** Familiar items provide a sense of security and comfort.
- **Practice:** Allow a child to bring an item of personal value or comfort with them.
- **Application**: All injured children, in particular younger children and those being moved from a familiar to unfamiliar environment.

3. Engage with spiritual and cultural practices

- **Principle:** Children and caregivers may rely on cultural, spiritual, and religious beliefs in times of crisis.
- **Practice:** Prayer, meditation or rituals that align with the family's beliefs.
- **Application**: Important in all situations, particularly for families relying on spiritual strength in times of crisis.

4. Respect the child and be honest

- **Principle:** Children are more likely to trust and engage with care providers when their thoughts and emotions are heard and respected.
- **Practice:** Make the child the centre of interactions. Be honest about what they can expect to experience.
- **Application**: All injured children in all settings.

5. Communication

- **Principle:** Healthcare professionals should communicate using age- and developmental-appropriate language for children who are able to understand. Children should be central in healthcare discussions.
- **Practice:** Use appropriate language for the child's age and development. Sit or kneel down when talking to the child so you are not standing over them.
- **Application**: All injured children in all settings, who are conscious and able to participate in conversation.

Physical interventions for managing pain in children

Comfort positioning

- **Principle:** Physical comfort will reduce pain perception.
- **Practice:** Holding, swaddling, or cuddling young children, using pillows for support, or allowing the child to sit on a caregiver's lap. Allow infants to breast feed or use a comforter (dummy).
- **Application**: All injured children in all settings.

Immobilisation

- **Principle:** Moving an injured child will cause pain and possibly further injury.
- **Practice:** Move only when necessary and to a minimum. Be gentle. Immobilise injured limbs as best possible. Swaddle and secure infants. Explain to older children they need to try to stay still.
- **Application**: All injured children in all settings. Particularly important in limb injury and suspected major trauma.

Use of heat and cold

- **Principle:** Heat can relax muscles and reduce discomfort, while cold can numb pain and reduce swelling.
- **Examples:** Use warm (not hot) or cool (not freezing) compresses. A cloth can be soaked in warm or cold water.
- **Scenarios:** Cold compresses are useful for sprains, bruises, or swelling, while warm compresses help with muscle aches or stiffness.

Psychological interventions for managing pain in children

Emotional support and reassurance

- **Principle:** Emotional distress will exacerbate the perception of pain and make it challenging to accurately assess the child's pain.
- **Practice:** Provide verbal reassurance, maintain a calm demeanour, and show empathy. Be kind and communicate at an appropriate level for child's age and development. Allow caregivers to support the child.
- **Application**: All injured children

Distraction

- **Principle:** Diverts the child's attention away from pain.
- **Practice:** Storytelling, singing, playing with toys, or using a flashlight or colourful objects to capture the child's attention.
- **Application**: All injured children but useful in situations where the child is anxious or undergoing a procedure, for example wound management or dressing. Use when there are delays to transporting or accessing care.

Relaxation techniques

- **Principle:** Helps to calm the child and reduce anxiety.
- **Practice:** Deep breathing exercises, guided imagery (like imagining a favourite place or activity) or listening to soothing sounds or music.
- **Application**: Beneficial during prolonged periods of pain or when the child is unable to move due to injury.

Positive reinforcement

- **Principle:** Reinforcing the child's role and control in a painful and stressful situation will engage them with care and reduce anxiety, boosting the child's morale and confidence in you.
- **Practice:** Acknowledge the child's bravery and strength in dealing with their situation. Be positive, recognise how well the child is doing and praise their role and effort.
- **Application**: Effective in all painful or stressful situations.

Simple oral analgesia

Paracetamol and ibuprofen are very effective treatments for mild to moderate pain and should be used even when stronger pain relief is required as part of the overall pain strategy.

Younger children may find it difficult to swallow tablets. Syrups are easier to take and enable accurate, safer dosing. Older children may be able to take medications in tablet form if the correct dose is available.

Both paracetamol and ibuprofen can be prescribed by age or weight. Different strength preparations are available for both, and detailed dosing guidance is available in Annexe 5.

Key messages

- Offer simple oral analgesia to all children in pain.
- Paracetamol and ibuprofen are effective for mild and moderate pain management.
- Check the appropriate dose to be delivered.
- Check if medication has been given prior to you meeting the child, what dose and when.
- Do not exceed maximum frequency or dosing.

Immediate care for burns

Burns are extremely distressing however the immediate treatment that anyone can provide will reduce the severity of injury and will offer pain relief for children who have suffered burns.

1. Cool & cover

The immediate management of burns injuries is also the most important step in managing pain for burns victims.

- Cool the burn area with clean, cool water for 20 minutes.
- If clean water is not available, use any non-toxic fluid.
- Cover the burn with non-adherent clean dressings. Strips of plastic food wrap are perfect.
- Once cooled and covered keep the child still, wrapped up and warm.

Caution

- Do not submerge or use ice/excessively cold water as you may cause hypothermia. Watch for shivering which may indicate over cooling.
- Do not circumferentially wrap burns on the neck or limbs.

2. Give simple oral analgesia

3. Provide psychological care as previously described including:

- Distraction techniques
- Emotional support and reassurance
- Relaxation techniques
- Positive coping statements and reinforcement.

CHAPTER 2

Emergency pain management provided by healthcare workers

Pain management is an essential and basic part of emergency care for injured children. Treating pain and distress in children is also important for healthcare professionals to feel they have provided benefit and relieved suffering in difficult circumstances. Providers should use the PAIN approach illustrated below to maximise success.

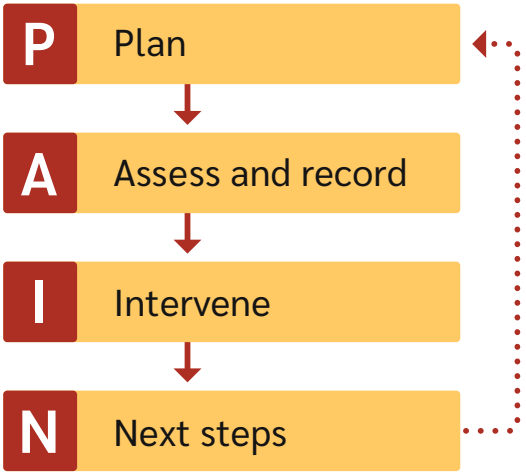


Figure 2:
The PAIN approach

Key messages

- The PAIN approach helps healthcare providers successfully treat the child's pain.
- Use an age and child appropriate pain assessment tool.
- Record pain scores and reassess.
- Excellent pain management can be achieved when the core principles of paediatric care and pillars of pain control are used.
- In limited resource settings, apply the interventions available to you.

The PAIN approach

Using the PAIN approach will structure the health care professional's management of the child in pain.

P Plan

Preparation is key for providing optimal pain relief for injured children prior to patient contact:

- Anticipate pain and effective management requirements
- Prepare the care environment
- Consider all core principles, physical, psychological and pharmacological techniques
- Consider effective routes of administration
- Calculate and prepare doses of initial analgesia
- Prepare physical and psychological interventions.

A Assess and record

This is an essential step for effective management of pain in all patients but especially in children. **Use an appropriate pain assessment tool and document the pain score in the patient records.** This enables reassessment and monitoring of pain management effectiveness.

I Intervene

Deliver pain management plan using core principles, physical, pharmacological, and psychological techniques that are available and possible.

N Next steps (next phase of care)

- **Reassess** – Assess response to pain management both objectively and subjectively
- **Record** – Record pain score
- **Anticipate** – Predict the care pathway for child and pain management requirements.

Go back to 'prepare' and continue the cycle.

Assessment and triage of pain severity

To treat pain safely, effectively and appropriately in children it needs to be assessed and scored. Without this there is a risk of under-treatment.

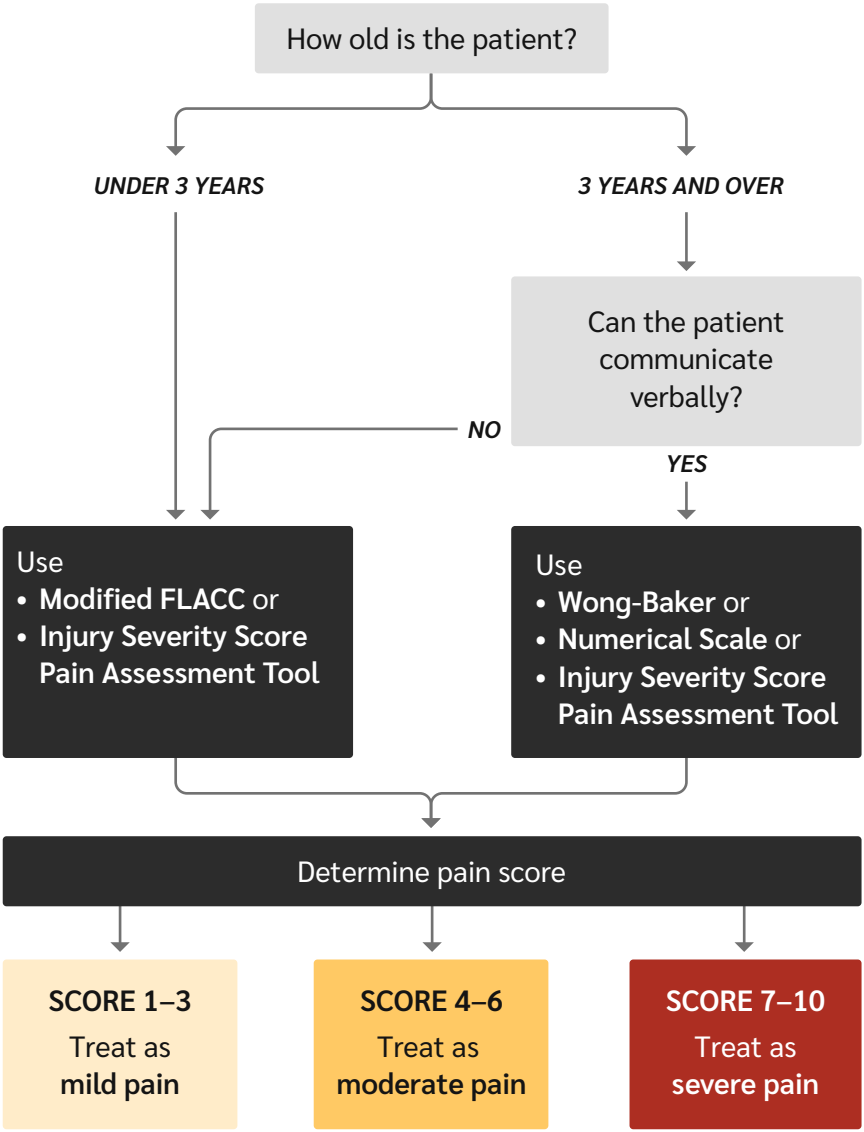
Both under-treatment and over-treatment of pain can result in adverse outcomes. Successful treatment is of obvious benefit to the child but also to caregivers and healthcare providers.

As a subjective experience pain should ideally be reported by the patient. When communication is not possible then a validated objective assessment tool could be used. However, healthcare providers should use their experience to anticipate pain in injured children. This manual uses the following assessment tools.

- Modified Face Legs Activity Cry and Consolability Pain Scale (FLACC) – Children 2 months to 18 years who are not able to communicate effectively.
- Numerical Rating Scale (NRS) – 0–10 scale that can also be used by caregivers.
- Wong-Baker Faces Scale – Children >3 years old who can communicate effectively.
- Paediatric Injury Severity Based Pain Assessment – This guides clinicians to treat pain effectively in patients with reduced consciousness by using injury severity and physiological measurements.

Pain assessment for children under 2 months is discussed in the neonatal section found in Chapter 5 of this manual.

Figure 3: *Choosing an assessment tool and determining pain score*



The Modified Face, Legs, Activity, Cry and Consolability (FLACC) Pain Scale

The FLACC Pain Scale is a measurement tool used to assess pain in children who are unable to communicate their pain verbally. FLACC stands for Face, Legs, Activity, Cry, and Consolability. Each category is scored on a scale of 0 to 2, which are then summed to provide an overall pain score ranging from 0 to 10. This modified version uses the original scoring criteria as indicators of mild, moderate, or severe pain to help guide emergency responders quickly and easily without the need to make additional calculations.

If a score of 2 is given for any of the sections then the patient is assumed to be in severe pain.

Modified FLACC pain scale

	0	1	2
Face	Neutral	Occasional frown / grimace. Withdrawn, disinterested	Constant girmace / frown. Chin quivering / Jaw clenching
Legs	Normal position, relaxed	Uneasy, restless, tense	Kicking or legs drawn up
Activity	Laying quietly, normal position, moves easily	Squirming, shifting back & forth	Arched, rigid or jerking movements
Cry	No cry	Moans, whimpers; occasional complaints	Crying steadily, screams or sobs: frequent complaints
Consol-ability	Content, relaxed	Reassured by occasional touching, hugging, or being talked to. Distractible	Difficult to console or comfort

This scale is useful for assessing pain in young children and those with communication difficulties, such as those with developmental delays or disabilities. It's widely used in clinical settings to ensure that even non-verbal children receive appropriate pain management.

Use the following process when making your assessment, this will vary depending on whether the patient is awake or asleep.

Awake patients:

- Observe for 1 minute and ideally 3
- Observe legs and body uncovered
- Reposition patient or observe activity
- Assess their body for tenseness and tone
- Initiate consoling interventions if needed

Asleep patients:

- Observe for at least 5 minutes
- Observe body and legs uncovered
- If possible, reposition the patient
- Touch the patient and assess for tenseness and tone

The Numerical Rating Scale (NRS)

Numerical rating scale (NRS): The child must be conscious and able to report their pain. Ask the child:

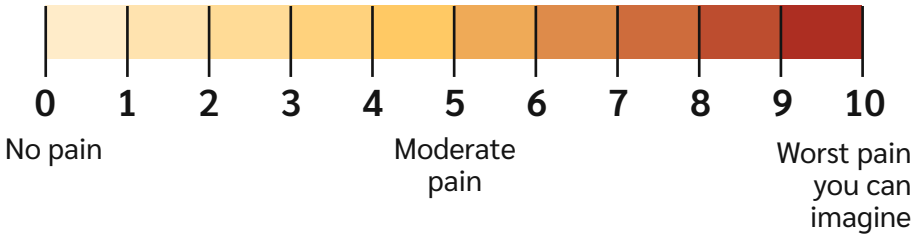
> *'How bad is your pain using the picture below'*

Mild pain is interpreted as 1–3, moderate pain is interpreted as 4-6, and severe pain is interpreted as 7–10 on the NRS.

If the child is not able to view the scale it can be delivered verbally.

> *'On a scale of 0–10, 0 being no pain at all and 10 being worst pain possible, how bad is your pain?'*

Figure 4: *Numerical rating scale*



The Wong-Baker FACES Scale

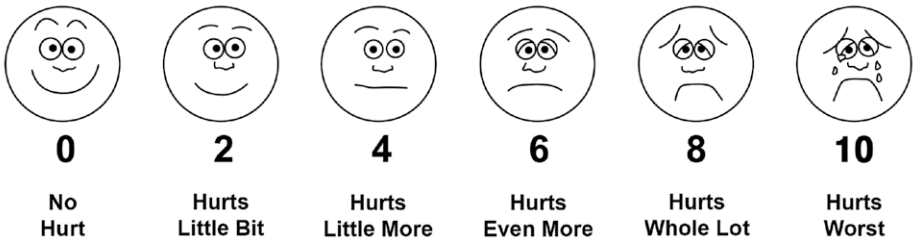
This tool was originally created with children, for children, to help them communicate about their pain. Now the scale is used around the world with people ages 3 and older (not limited to children), facilitating communication and improving assessment so pain management can be addressed.

How to Use

Explain to the child that Face 0 is very happy because he doesn't hurt at all. Face 1 hurts just a little bit. Face 2 hurts a little more. Face 3 hurts even more. Face 4 hurts a whole lot. Face 5 hurts as much as you can imagine, although you don't have to be crying to feel this bad. Ask the child to choose the face that best describes how he is feeling.

From Wong DL, Hockenberry-Eaton M, Wilson D, Winkelstein ML, Schwartz P: *Wong's Essentials of Pediatric Nursing*, 6/e, St. Louis, 2001, P. 1301. Copyrighted by Mosby, Inc.

Figure 5: *The Wong-Baker FACES® Pain Rating Scale*



Both the FACES and NRS scales can be used by a caregiver or observer to give a score on behalf of the child. However pain is frequently under reported this way.

Paediatric Injury Severity Based Pain Assessment

Pain has physiological effects which are important to manage even if the patient is unable to communicate their analgesic requirements. This may be due to being distressed and overwhelmed with events happening around them, or if they have a reduced level of consciousness following injury. This triage tool uses physiological signs and may serve as a useful guide for clinicians trying to determine analgesia requirements in these situations.

1. Initial assessment (primary survey)

- **Breathing:** Observe breathing status
  – normal, laboured, rapid, or absent.
- **Circulation:** Check for bleeding or signs of hypotension.
- **Consciousness:** Assess using AVPU scale
  – (Alert, responds to voice, responds to pain, unresponsive).

2. Severity indicators

Injury indicators:	Minor (ISS <9)	Moderate (ISS 9–15)	Major (ISS >15)
Breathing	Normal or slightly faster breathing	Laboured or rapid breathing	Absent or severely laboured breathing
Circulation	No significant bleeding	Minor to moderate bleeding	Major bleeding or signs of hypotension*
Consciousness	Conscious and alert	Altered mental status but not unresponsive	Unresponsive or significantly altered mental status
Injuries	Superficial or minor visible injuries	Visible injuries that are more than superficial	Multiple injuries in different body regions
Likely pain severity	**Mild**	**Moderate**	**Severe**

* Strong opioids may worsen hypotension, omitting opioids and administering Ketamine as a primary analgesic is appropriate in hypotensive patients.

3. Decision Rule

- If any major injury indicators are present, assume ISS >15 and anticipate severe pain.
- If any moderate injury indicators are present without major injury signs, assume ISS 9–15 and anticipate moderate pain.
- If only minor injury indicators are present, assume ISS <9 and anticipate mild pain.

Summary

- Pain is frequently under-recognised and under-treated.
- Use an age and patient appropriate tool to assess, score and record pain.
- Intervene and reassess.

Analgesia plans according to pain severity

Mild pain management *(for pain scores 1–3)*

Core Principles + essential physical & psychological interventions

– PLUS –

Oral Paracetamol 15 mg/kg (or as per age-based dosing guide)

REASSESS (30–60 mins)

MANAGED PAIN

PERSISTENT PAIN

ADD oral Ibuprofen 10 mg/kg for children over 6 months old

REASSESS (30 mins)

MANAGED PAIN

PERSISTENT PAIN

ADD AN OPIOID:

Oral morphine if oral route available

– OR –

IV morphine 0.1 mg/kg

– OR –

IV Fentanyl 1 mcg/kg

– OR –

Rapid-onset, short-acting intranasal analgesia (e.g. Fentanyl 1.5 mcg/kg)

(Continued on page 26)

Moderate pain management *(for pain scores 4–6)*

Core Principles + essential physical & psychological interventions

– PLUS –

Oral, Rectal or IV Paracetamol 15 mg/kg

– PLUS –

Oral ibuprofen 10 mg/kg for children over 6 months old and if oral route available

REASSESS (30–60 mins)

MANAGED PAIN

PERSISTENT PAIN

ADD AN OPIOID:

Oral morphine if oral route available

– OR –

IV morphine 0.1 mg/kg

– OR –

IV Fentanyl 1 mcg/kg

– OR –

Rapid-onset, short-acting intranasal analgesia (e.g. Fentanyl 1.5 mcg/kg)

(Continued on page 26)

(continued from Mild and Moderate pain management diagrams)

REASSESS
(30 mins)

MANAGED PAIN

PERSISTENT PAIN

REPEAT OPIOID

– PLUS –

IV Ketamine 0.2 mg/kg
if response to repeat opiate not adequate after 10 mins

REASSESS
(30 mins)

MANAGED PAIN

PERSISTENT PAIN

Consider further dose of Ketamine or anaesthesia with ongoing analgesia infusion as per dosing guideline

Be prepared to support breathing and reverse opioid adverse effects, especially in under one year olds (see page 51).

MANAGED PAIN

Continue provision of:

- Core Principles alongside essential physical and psychological interventions.
- Current analgesia regularly as per dosing guidance

Severe pain management *(for pain scores 7–10)*

Core Principles + essential physical & psychological interventions

– PLUS –

Oral, Rectal or IV Paracetamol 15 mg/kg

– PLUS –

Oral ibuprofen 10mg/kg for children over 6 months old and if oral route available

– PLUS –

Rapid-onset, short-acting intranasal analgesia (e.g. Fentanyl 1.5 mcg/kg)

OR

Intranasal Diamorphine as per dosing table

OR

IV morphine 0.1 mg/kg

OR

IV fentanyl 1 mcg/kg

Give Ketamine (IN or IV) as first line analgesia and omit opioid if patient is hypotensive

REASSESS (30–60 mins) → ***MANAGED PAIN***

PERSISTENT PAIN

REPEAT OPIOID

– PLUS –

IV Ketamine 0.2 mg/kg if response to repeat opiate not adequate after 10 mins

REASSESS (30–60 mins) → ***MANAGED PAIN***

PERSISTENT PAIN

Consider further dose of Ketamine or anaesthesia with ongoing analgesia infusion as per dosing guideline

MANAGED PAIN

Continue provision of:

- Core Principles alongside essential physical and psychological interventions.
- Current analgesia regularly as per dosing guidance

Be prepared to support breathing and reverse opioid adverse effects, especially in under one year olds (see page 51).

CHAPTER 3

Specific circumstances: Burns

- Burns are distressing for the child and caregiver.
- Optimal pain relief for children who have suffered burn injuries involves a combination of the 3 essential pillars of pain management.
- The interventions are tailored to the severity of the burn and the individual needs of the child.

Management plans can be formulated using the PAIN approach:

Plan

- Prepare the team, environment and drugs.
  Using the preparation card in Annexe 1 may be helpful.

Assess

- Assess and record pain using the tools included in Annexe 3.

Intervene

- Apply interventions from all 3 essential pillars of pain management interventions. Examples which are particularly helpful for burns injuries are described below.

Next steps for ongoing care

- Regularly reassess pain and adjust the management plan as needed.
- Provide simple oral analgesia when able.
- Frequent administration of opioid analgesics requires closer monitoring of respiratory function.
- **Remember the child may have life threatening injuries other than the burn.**

Physical interventions for burns injuries

1. Cool & cover principle

The immediate management of burns injuries is also the most important step in managing analgesia for burns victims. Immediate cooling of the burn area with clean, cool running water can provide pain relief and limit tissue damage. This should be done for at least 20 minutes to stop the burning process. If clean water is not available, any non-toxic fluid can be used. Avoid ice or excessively cold water as it can worsen the injury and cause hypothermia.

2. Protective dressings

Apply non-adherent, sterile dressings to protect the burn area and reduce pain caused by air exposure. Strips of plastic food wrap (cling film) is very effective for this, but never circumferentially wrap the neck or limbs.

3. Positioning and gentle handling

Position the child to minimise pain, being careful with movements and transport. Use soft, padded splints for severe burns to limit movement and pain.

Psychological interventions

These are extremely effective when managing burns injuries. Chapter 1 of this manual describes psychological interventions in more detail, including:

- Distraction techniques
- Emotional support and reassurance
- Relaxation techniques
- Positive coping statements and reinforcement.

Pharmacological interventions for pain relief of burns injuries:

1. Initial management:

- Administer initial analgesia, preferably intranasal or intravenous due to the ease of administration under these conditions. Intranasal fentanyl (1.5 mcg/kg) is a good option for rapid pain relief.
- Simple analgesia should always be given if available, although for burns >10% body surface area NSAIDs are generally avoided in the first 48 hours.
- For less severe burns, paracetamol or ibuprofen may be sufficient.

2. Ongoing pain management:

- Morphine is the gold standard for severe burn pain and can be administered intravenously. Dosing should be weight-based and titrated to effect.

3. Adjuncts and alternatives:

- Ketamine is very useful for its analgesic and dissociative properties, especially if opioid availability is limited. It can be given by intravenous, intranasal and intramuscular routes
- Intramuscular (IM) ketamine may be particularly useful to gain rapid control of severe pain in burns, especially when intravenous access is difficult, or the child is too distressed to comply with Intranasal (IN) administration of analgesia.

Dressing changes

Burn care requires frequent dressing changes which can be very painful. Prior to changing dressings anticipate the child's pain requirements and give analgesia in advance of the procedure. Simple oral analgesia should be given 20–30 minutes ahead. Opioids or ketamine IV or IN are effective a few minutes before the procedure and, if available, inhaled agents such as entonox or penthrox are excellent for patient delivered analgesia during the procedure.

Key points

Management of pain following a burns injury requires application of the core principles of paediatric care, with interventions from all 3 pillars of essential interventions including psychological interventions, physical analgesia methods, and pharmacological interventions for severe pain.

- Cool and cover the burn
- Distract
- Gain rapid control of pain.

Use alternative routes for administration of analgesia including the intranasal route as IV access maybe not be possible or take time.

- Reassess
- Always use simple oral analgesia when available
- **Remember the child may have life threatening injuries other than the burn.**

CHAPTER 4

Specific circumstances: Limb injury

- Optimal pain relief for children who have suffered limb injury involves a combination of all 3 pillars of pain management.
- The approach taken is very simple and important for achieving optimal outcomes.
- It can be tailored to the individual needs of the child.

Management plans can be formulated using the PAIN approach:

Plan

- Prepare the team, environment, equipment and drugs. Using the preparation card in Annexe 1 may be helpful.

Assess

- Assess and record pain using the tools included in Annexe 3.

Intervene

- Apply all 3 pillars of pain management. Examples which are particularly helpful for limb injuries are described below.

Next steps for ongoing care

- Regularly reassess pain and adjust the management plan as needed.
- Provide regular simple oral analgesia (Paracetamol and NSAIDs) when able.
- Monitor for signs of shock and neurovascular complications.
- Consider appropriate regional anaesthetic techniques (Annexe 7).

Physical interventions for limb injuries

1. Immobilisation

- Immobilise the injured limb using splints, bandages or plaster-of-Paris backslab casts to reduce pain caused by movement.
- Ensure that immobilisation does not compromise circulation or increase pain. Some examples of simple immobilisation techniques are included in Annexe 6 of this manual.

2. Ice and elevation

- Apply ice packs or cold compresses to the injury site to reduce swelling and pain. Avoid direct contact with the skin.
- Elevate the injured limb, if possible, to decrease swelling.

Pharmacological interventions for limb injuries

1. Initial pain management

- Administer initial analgesia, preferably intranasal or intravenous due to the ease of administration under these conditions. Intranasal fentanyl (1.5 mcg/kg) provides rapid pain relief.
- For less severe pain, paracetamol or ibuprofen may be sufficient and should be used whenever possible for all children with limb injuries.

2. Ongoing pain management

- Intravenous morphine is the ideal standard for severe pain. Dosing should be weight-based and titrated to effect. If morphine is not available consider other opioids or ketamine.

3. Adjuncts and alternatives

- Ketamine can be useful for its analgesic and dissociative properties, especially if opioid availability is limited.
- If resources are available, regional anaesthetic techniques provide excellent pain relief and may help facilitate fracture stabilisation and patient evacuation. Ideally these should be ultrasound guided but some safe and effective anatomical techniques are described in Annexe 7 for use if ultrasound is not available.

Key points

- Simple immobilisation techniques will significantly reduce pain.
- Always check for signs of impaired circulation (presence of distal pulses, pain, swelling, discolouration, cold extremities) after applying any immobilisation device and adjust as necessary.
- Avoid attempts to reduce fractured bones outside of a healthcare facility unless there is neurovascular compromise.
- Provide reassurance to the child, explaining what you are doing to help reduce anxiety.
- Provide available analgesia and sedation if you do need to reduce a fracture.
- Quick and effective immobilisation helps to facilitate safe transport to a medical facility.

CHAPTER 5

Specific circumstances: Neonates

- Neonates feel pain.
- Neurological pathways for perceiving pain are formed by 25 weeks gestation.
- The PAIN approach should still be applied to neonatal pain management, but with specific considerations for this group.
- Sucrose solution provides effective short term pain relief.

Assessment

Pain experienced during the neonatal period influences wound healing, neurological development, future painful experiences and behaviour.

Neonates cannot verbally express their pain, so observational tools for assessment are vital. Infants between 0–2 months are often assessed using detailed tools requiring physiological measurement. A more rapid assessment is possible using the modified FLACC tool. Facial expressions are the most specific and consistent pain response, especially:

- bulging brow
- deep naso-labial folds
- oval-shaped mouth
- screwed up eyes
- trembling tongue.

These should be considered markers of moderate to severe pain.

Interventions

The key to successfully managing pain relief in neonates is use of a multimodal approach as described in this manual. Interventions which should be provided for neonatal patients include:

- Swaddling the baby firmly and holding them closely, creating a warm and secure feeling.
- Suckling, breast or bottle feeding. Use of a pacifier.
- Comforting motions, stroking and rhythmic gentle patting.
- Soft soothing words/sounds.

Keeping neonates with their primary caregiver is especially important and should be facilitated whenever possible. Breast feeding has added analgesic and soothing benefits, while not requiring any additional resources and should be promoted where possible.

Sucrose

Sucrose solution 24–33% solution is effective as a sedative and analgesic for brief painful procedures e.g. cannulation, similar to breast or formula milk. The sweet taste releases endogenous opioids in the neonate's brain, offering analgesic effects for a few minutes. It can be dripped onto the neonate's tongue before and during the procedure or given via a pacifier dipped in the solution.

How to make 30% sucrose solution

- Weigh out 30 g of sucrose (household sugar)
- Add 70 g of safe drinking water
- Warm until dissolved but do not boil
- Cool prior to use.

Pharmacological interventions

Neonatal metabolism of drugs and the behaviour of drugs differs from that in older children. The key points to remember are:

- Neonatal patients require smaller doses of analgesics
- Neonates require less frequent dosing
- NSAIDS are not to be used in the neonatal period
- Opioids should be use with great caution
- Ketamine can be used for analgesia.

Recommended analgesia doses in neonates

Drug	Route	Dose	Dosing interval
Paracetamol	PO or PR	28–32 weeks PCA* 15 mg/kg	28–32 weeks PCA* 8–12 hourly (Max 35 mg/kg/day)
		32–53 weeks PCA* 15 mg/kg	32–53 weeks PCA* 8 hourly (Max 60 mg/kg/day)
Paracetamol 32-40 weeks PCA	IV	7.5 mg/kg	7.5mg 8 hourly, given over 15 minutes
Paracetamol >40 weeks PCA	IV	10 mg/kg	4–6 hourly (Max 30 mg/kg/day)
Morphine	IV	25–50 mcg/kg initially**	4–6 hourly as required
Oral Morphine	PO	50 mcg/kg	6 hourly
Fentanyl	IV	0.05–0.1 mcg/kg	2–4 hourly as required
Ketamine	IV	0.1–0.2 mg/kg	Every 30–60 minutes as required

* PCA = Post Conceptual Age

** Early exposure to morphine in first three months of life rapidly matures metabolism. With frequent use higher titrated doses may be required for equivalent effect.

Breastfeeding for pain and distress

Breastfeeding should be the first choice to alleviate procedural pain in newborns (< 28 days) undergoing procedures such as venepuncture and vaccination. There is significant evidence that breastfeeding provides pain relief for newborns. Other forms of non-pharmacological strategies to reduce pain relief in babies include swaddling, sucking on a pacifier and giving sucrose. Breastmilk given via syringe is not as breastfeeding itself. All breastfed infants should be given the possibility of feeding before, during and after a painful procedure, including those outside the newborn period, over 28 days of age.

Key points

- Neonates feel pain.
- Facial expression is the most specific and consistent pain response in neonates.
- Drug dosing differs in neonates.
- NSAIDs are contra-indicated in neonates.
- Local anaesthetic and regional techniques are safe and extremely effective for providing analgesia.
- Use sucrose solution for pain relief in painful procedures.
- Breastfeeding has analgesic and soothing benefits, should be promoted where possible. Its importance cannot be over-emphasised.
- Sucrose is an effective short term analgesic.

CHAPTER 6

Specific circumstances: Multiple patients

Incidents involving multiple patients can quickly overwhelm resources and the medical response. Such incidents require a pragmatic approach to treating patients – "Providing the most for the most". In these conditions, it is not always possible to provide the level of care you would provide for lower numbers of patients.

The following principles apply to incidents involving multiple patients and when resources are unable to meet the demand of the scene:

Safe approach

Your safety is the first priority, followed by that of your team and then patients. Unstable structures, secondary attacks and other threats must be mitigated before entering the scene.

Triage

Priority must be given to identifying those with life-threatening injuries and quickly reviewing all patients. There are several triage tools available to help achieve this.

Treatment of immediately life-threatening injuries

Quick, life-saving interventions must be performed as soon as threats to life are identified. These include:

- Control of catastrophic haemorrhage using tourniquets and other rapid haemostatic interventions
- Simple airway management and protection.

Analgesia for multiple casualties

The ideal characteristics of an analgesic for multiple casualties are:

- Rapidly effective pain relief
- Quick to prepare or pre-prepared
- Quick to administer or patient administered
- Safe and without a requirement to monitor.

The following agents meet those characteristics and are recommended for multiple casualty:

- Intranasal opioids (fentanyl and diamorphine)
- Intranasal ketamine
- Oral transmucosal fentanyl ‘lollipops’ (patient controlled)
- Inhaled methoxyflurane ‘Penthrox’ (patient controlled).

CHAPTER 7

General information and formulary of common analgesic drugs

This section offers an overview of the various routes of analgesic administration—each with its own set of advantages, considerations, and practical applications in different clinical scenarios. There is also specific information describing commonly used analgesic agents, including general dosing guidance and key points to be aware of when prescribing or administering these medications.

The dosing tables can be used to calculate the safe doses for children under the age of 12 based on their estimated bodyweight. These tables are also available in Annexe 5 of this manual.

When prescribing and/or administering analgesia to children, it is important to estimate the child's weight as accurately as possible to avoid under- or over-dosing them. The risk of under-dosing is ineffective pain relief and complicating on-going care, however over-dosing may risk toxicity, adverse effects and complications. If you are unsure, it is better to give a smaller dose and top-up after an appropriate period of time - as indicated in the following information.

> **Weight (in kg) = (Age + 4) × 2**
>
> *This will give you a weight for safe and effective prescribing in the majority of children.*

Routes of administration

Topical and transdermal

Topical analgesics provide a valuable route for pain management, offering the benefits of minimal invasiveness, ease of application, and reduced systemic side effects. It is important to remember that systemic absorption of topical medications will occur, this is why information about these routes have been combined in this chapter. This approach can be particularly advantageous for managing localised pain or as an adjunct to other routes of administration, while generally being acceptable to most children.

Pharmacologically, options like lidocaine patches or creams and non-steroidal anti-inflammatory (NSAID) gels are effective at numbing and reducing pain intensity in localised areas. Capsaicin creams may be beneficial for neuropathic pain, while fentanyl patches are useful for delivering analgesia over extended periods of time (up to 72 hours) once acute pain has been treated.

Non-pharmacological options such as heat and cold packs offer analgesic benefits.

Topical and transdermal analgesics can play an important role in pain management strategies, especially when combined with other interventions described in this manual or if alternative routes of administration are impractical or unavailable. With all topical methods be cautious of injury to or reaction of the skin.

Oral (PO)

Oral analgesia offers an accessible route of managing pain in injured children, particularly in settings where intravenous access may be impractical or delayed. This route is well-tolerated, convenient, and effective for mild to moderate pain, enabling the use of a wide range of analgesics that include paracetamol, ibuprofen, and oral morphine solutions.

Simple analgesics like paracetamol and ibuprofen are notable for their safety profile, ease of access, and the ability to be used in combination for enhanced analgesic effect without significant side effects.

Oral morphine solution while less commonly used, provides an excellent option for moderate to severe pain. Oral morphine is also a safer and more effective alternative to codeine. Codeine is variably metabolised and is contraindicated in children under 12 or those 12–18 years with a history of sleep apnoea or recent airway procedure. Oral tramadol can be used in children if oral morphine is not available.

Clinicians should recognise some problems associated with oral administration, such as variable absorption rates, the potential for gastrointestinal side effects, and the risk of over- or under-dosing due to errors in weight-based calculations or excessive frequency of administration. The onset of action is slower compared to systemic routes, which may not be ideal for acute severe pain.

Rectal (PR)

Rectal administration of analgesia is an alternative for pain management in injured children when oral or intravenous routes are not feasible. This administration route is particularly beneficial in cases of nausea, vomiting, or when the child is unconscious or will not take oral medication. The most commonly used analgesic used via this route is paracetamol which is widely available and has a relatively safe profile for managing mild to moderate pain. Diclofenac and occasionally ibuprofen are also available as a PR preparation. Rectal administration allows for usually consistent absorption, excellent bioavailability and provides a long duration of action.

The limitations and challenges associated with rectal administration, include discomfort and potential distress associated with administration and the cultural or personal sensitivities that may affect acceptance of this method. It is important to obtain consent and explain the process of rectal drug administration to the child and caregiver.

Intranasal (IN)

Intranasal (IN) administration is an easy, safe and rapid way to deliver highly effective analgesia. The IN route should be considered for the primary route for analgesia where IV access may be difficult and or slow to obtain.

Ketamine, fentanyl and diamorphine are all well absorbed through the nasal mucosa and offer rapid, effective relief of severe pain with an excellent safety profile. Cardiorespiratory monitoring is preferred but not absolutely required. IN administration is very useful in multiple casualty situations.

Intranasal medications need to be in a low volume, and volumes above 0.4 ml should be divided between nostrils. Volumes larger than this tend to pass over the nasopharynx and are swallowed. They should be administered using a mucosal atomisation device (MAD) if available, and a 1 ml syringe. Alternatively, the plastic portion of an IV cannula can be cut short and placed on the end of a syringe to achieve a similar atomisation effect. If neither are available the drug can be dripped onto the floor of the nostrils.

Figure 6: *Alternative atomisation device using a 1 ml syringe and standard IV cannula which has been cut short.*

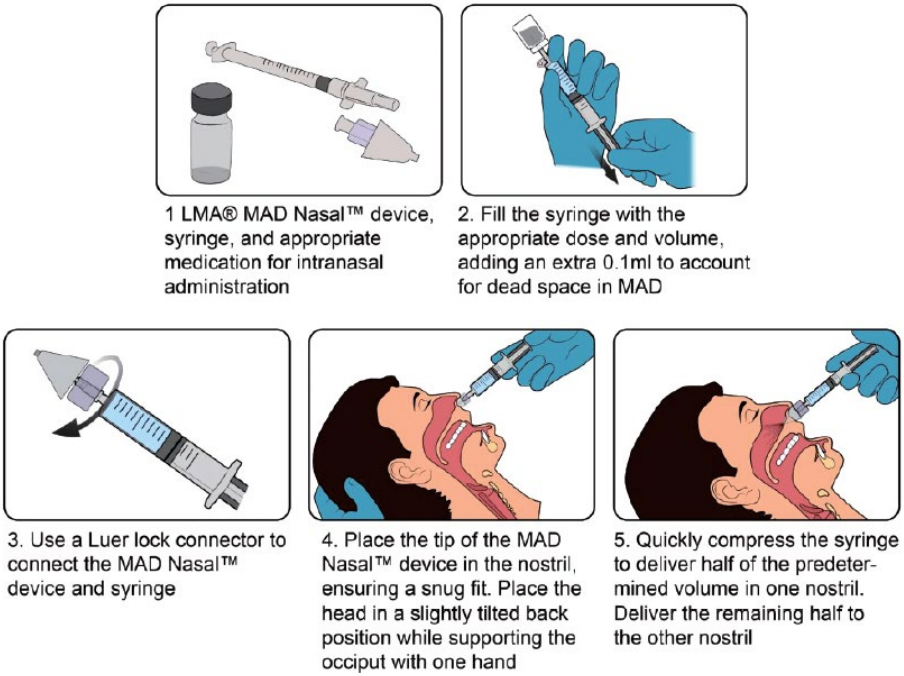


Figure 7: *Technique for intranasal medication administration using the MAD Nasal device.*

Credit: Ojo, et al. (2023). Improving the Emergency Department Management of Sickle Cell Vaso-Occlusive Pain Crisis: The Role and Options of Sublingual and Intranasally Administered Analgesia. *Journal of Clinical Medicine Research*. Provided under Creative Commons licence (CC BY-NC 4.0).

Key points

- Draw up the correct dose, preferably in a luer lock syringe.
- Add an additional 0.1 ml to prime the mucosal atomization device if using.
- Once primed, check the volume in the syringe matches the desired dose.
- Position the child at a 45-degree angle and tilt their head back.
- Hold the syringe in a horizontal position and expel the contents with firm application of pressure.
- DO NOT ask patient to sniff contents.

Inhaled analgesia

Inhaled analgesia offers a rapid, non-invasive route for pain management in injured children, ideal for acute pain relief due to its fast onset and ease of administration. Nitrous oxide mixed with oxygen in a 50:50 ratio (entonox), is a prominent example, widely used for its analgesic and anxiolytic properties. Another example is methoxyflurane (Penthrox), a portable option for pre-hospital settings, providing effective pain relief for short durations.

Inhaled analgesia allows for self-administration under supervision, giving children some control over their pain management which can be particularly comforting. While inhalational analgesia is generally well-tolerated and effective, clinicians must be mindful of its limitations and risks. These include potential respiratory depression. An important contraindication of entonox is in cases with trapped air within the body (e.g. pneumothorax, blast injuries).

The equipment required for inhalational analgesia may not always be available in all settings, particularly in low-resource environments or during transport.

Figure 8: *Penthrox inhalation device*

Buccal (oral transmucosal)

Oral transmucosal analgesia provides a rapid, safe, effective and non-invasive route for severe pain management in injured children, taking advantage of the rich vascular supply of the oral mucosa for rapid drug absorption and onset of action. This method is useful for children who are unable or unwilling to swallow tablets or liquids, offering a viable alternative for pain relief without the need for intravenous access. It is appropriate for situations where multiple unmonitored patients need rapid control of pain and limited resources are available. Oral transmucosal fentanyl lozenges are available with applicators resembling lollipops. These have been used to provide potent analgesia in acute pain scenarios and are especially useful in mass casualty scenarios where time is constrained.

The advantages of oral transmucosal administration include ease of use, fast onset, and avoidance of first-pass metabolism, leading to efficient pain control. However, clinicians must be aware of the potential for variable absorption, which can affect drug efficacy. The risk of mucosal irritation or damage and the possibility of inadvertently swallowing the medication, thus altering its intended pharmacokinetic profile, are also considerations.

More information on fentanyl lozenges can be found in Annexe 5 of this manual.

Intravenous (IV)

Intravenous (IV) analgesia is the ideal standard for managing moderate to severe pain in injured children, offering rapid onset, precise dosing, and the capability for continuous pain control.

Commonly used IV analgesics include opioids like morphine and fentanyl, non-opioid analgesics such as paracetamol, and adjuncts like ketamine, which can provide both analgesia and sedation.

The major benefits of IV administration include its rapid onset, the ability to titrate doses to the desired effect, and suitability for a wide range of clinical settings, including pre-hospital settings and emergency rooms. However, this route also presents several challenges, including the need for venous access, which can be

difficult in paediatric patients, especially in those who are dehydrated or in shock. As with other routes of administration there is a risk of medication errors, and the requirement for careful monitoring for adverse reactions, particularly with opioids. Clinicians must be skilled in assessing and managing these risks, ensuring appropriate dosing and monitoring for efficacy and side effects.

IV analgesia requires a diligent approach, involving not just the administration of drugs but also consideration of the child's overall clinical condition, monitoring needs, and the potential need for adjustments based on the child's response to treatment. Proper training, adherence to protocols, and a vigilant, patient-centred approach are essential to use IV analgesia safely and effectively in paediatric care.

Intraosseus (IO)

Any analgesic given IV can be given at the same dose via the intraosseus (IO) route. Children who are seriously injured may have access established for resuscitation which also enables the administration of titrated analgesia.

It would be unusual to establish IO access for just administering analgesia. However, if a child is in severe pain and no other effective route of administration is possible, IO should be considered.

Intramuscular (IM)

The intramuscular route is easy and reliably delivers analgesic drugs to a patient but should only be considered when intranasal, intravascular or intraosseous routes are not possible in the management of moderate to severe pain. Drugs that can be given IM are morphine and ketamine. It can be painful, distressing, slow and in the injured child absorption can be very variable leading to delayed therapeutic effect or adverse effects. Neither is it easy to titrate to effect. An exception to this is in the very distressed and non-compliant patient where ketamine IM will provide rapid potent pain relief and control of the patient and situation.

Weight calculated doses should be given as a single injection to allow an alternative route of administration to be obtained.

Paracetamol

Paracetamol is an extremely effective analgesic agent and has been shown to reduce the requirement for strong opioids and other analgesic agents. This makes it a key component for providing effective pain relief for children. Paracetamol can be administered via intravenous, oral and rectal routes.

General dosing guideline: Paracetamol

- Standard dose:

Route	Weight	Dose	Frequency	Max per 24 hours
IV	<10kg	10 mg/kg/dose	4–6 hourly	3 doses
IV	>10kg	15 mg/kg/dose	4–6 hourly	4 doses
PO/PR		15 mg/kg/dose	4–6 hourly	4 doses

- Peak effect: 30–90 minutes
- Duration of effect: 4–6 hours

The onset of paracetamol is not as rapid as other analgesics; therefore titration is rarely effective. A calculated dose using the patient's bodyweight should therefore be administered.

IV Paracetamol is typically presented as a 10 mg/ml solution, but this may vary between manufacturers. It is important to check the concentration being used. Use of an accurate measuring device such as a syringe is recommended as smaller doses maybe easier to administer via syringe. For larger doses it is easier to remove the excess from the bottle and then administer the remainder directly from the bottle through an IV giving set.

Paracetamol dosing table (IV/Oral/Rectal)

Age	Weight	Dose
1 month	4kg	60mg PO/PR 40mg IV
3 months	6kg	90mg PO/PR 60mg IV
6 months	8kg	120mg PO/PR 80mg IV
1 year	10 kg	150 mg
2 years	12 kg	180 mg
3 years	14 kg	210 mg
4 years	16 kg	240 mg
5 years	18 kg	270 mg
6 years	20 kg	300 mg
7 years	22 kg	330 mg
8 years	24 kg	360 mg
9 years	26 kg	390 mg
10 years	28 kg	420 mg
12 years	32 kg	480 mg

Key points: IV Paracetamol

- Check concentration.
- Use accurate measurement devices.
- Do not exceed the maximum number of doses in 24 hours.
- Do not give intravenous paracetamol within 4 hours of an oral dose.
- Use with caution in children with known liver disease or malnutrition.
- Neonates and children under 10 kg have specific dosing.

Opioids

Opioids are effective analgesics, and maybe administered via different routes and can often easily be titrated to effect. It is important that opioids are not administered via multiple routes within a small timeframe as this can lead to adverse effects. Ideally a single opioid should be chosen. All opioids have the potential to cause cardiorespiratory and central nervous system depression. Patients receiving opioids should ideally be monitored or observed after administration. Ideal monitoring includes respiratory rate, oxygen saturations, heart rate, blood pressure and level of consciousness using the AVPU scale. If this is not possible, aim to observe respiratory rate and consciousness level using the AVPU scale. In multiple casualty settings it is acceptable to deliver a single dose of IN or transmucosal opioids unmonitored.

Common patient-reported side effects of opioid medications include nausea, vomiting and itching. Anti-emetics such as ondansetron (0.15 mg/kg) are effective for reducing nausea and vomiting due to opioid administration and are often routinely given to patients being transported or laying supine, to reduce the risk of vomiting and aspiration.

Opioid toxicity causes respiratory depression, hypotension and reduced consciousness. Be particularly cautious in under 1 year olds. These are reversed with naloxone, an opioid antagonist (see box). Naloxone can be given IV, IM and IN. Naloxone has a shorter half-life than opioids and may need to be repeated. Reversing adverse effects will also reverse analgesia, pain relief may need to be reassessed.

In mild compromise the calculated dose can be divided into 2–4 boluses to achieve effect without total blockade of analgesia.

In opioid toxicity with cardiorespiratory or CNS compromise:

- Provide cardiorespiratory support
- Give naloxone 10 mcg/kg (maximum 400 mcg)
- Repeat as required until normal respiratory rate and consciousness restored
- Observe for deterioration.

Intranasal Fentanyl

Intranasal fentanyl is a fast acting, safe and effective analgesic which is easy to administer. The usual concentration is 50 mcg/ml therefore it is most desirable for use in patients weighing less than 50 kg to avoid excessive administration volumes.

A dose of 1.5 mcg/kg is equivalent to an intravenous fentanyl dose of 1 mcg/kg.

General dosing guideline: Intranasal Fentanyl

- Standard dose: 1.5 mcg/kg/dose
- Peak effect: 5 mins
- Duration of effect: 30–60 minutes
- Can repeat dose after 20 minutes if no IV access established.

Intranasal fentanyl has an excellent safety profile and patients should not routinely need full monitoring after administration.

See Routes of administration (page 44) for more information about administering intranasal medications.

Key points: Intranasal Fentanyl

- Check concentration: ensure you are using the correct concentration and modify the volume accordingly.
- Correct measurement: use an accurate measuring device, a 1 ml syringe is ideal.
- Dose volumes >0.4 ml should be divided so half the dose is administered into each nostril.
- Allow for the deadspace volume of the Mucosal Atomisation Device (MAD) by adding 0.1 ml to the volumes in the dosing table.

IN dosing for Fentanyl 50 mcg/mL concentration

Age	Weight	Dose	Volume
3 months	5 kg	7.5 mcg	0.15 ml
6 months	7 kg	10 mcg	0.2 ml
1 year	10 kg	15 mcg	0.3 ml
2 years	12 kg	18 mcg	0.36 ml
3 years	14 kg	21 mcg	0.42 ml
4 years	16 kg	24 mcg	0.48 ml
5 years	18 kg	27 mcg	0.54 ml
6 years	20 kg	30 mcg	0.6 ml
7 years	22 kg	33 mcg	0.66 ml
8 years	24 kg	36 mcg	0.72 ml
9 years	26 kg	39 mcg	0.78 ml
10 years	28 kg	42 mcg	0.84 ml
12 years	32 kg	48 mcg	0.96 ml
12 + years	34–39 kg	50 mcg	1.0 ml
	40–44 kg	60 mcg	1.2 ml
	45–49 kg	70 mcg	1.4 ml
	> 50 kg	75 mcg	1.5 ml

Intravenous Fentanyl

Intravenous fentanyl is a fast acting and effective analgesic if intravenous access has been obtained. It can easily be titrated to effect while observing recommended maximum doses.

Patients receiving intravenous fentanyl should be monitored for at least 20 minutes after administration.

General dosing guideline: Intravenous Fentanyl

- Standard dose: 1 mcg/kg/dose
- Peak effect: 5 minutes
- Duration of effect: 30–60 minutes

How to administer:

Body weight is more variable over the age of 12 years so titration of analgesia is a safe and effective way to achieve optimal results for the patient. Titration of intravenous fentanyl to effect can be achieved using the following method:

1. Estimate bodyweight and draw up correct dose
2. Administer half the standard dose
3. Administer another quarter of the standard dose every 5 minutes until the desired effect is achieved.

Titration of doses using this method is a safe way to administer intravenous fentanyl, especially when monitoring is not available or practical.

Key points: Intravenous Fentanyl

- Check concentration: ensure you are using the correct concentration and modify the volume accordingly.
- Correct measurement: use an accurate measuring device, a 1ml syringe is ideal.
- Titration of doses is a safe and effective way to achieve optimal analgesia – even when monitoring is not available.
- Ensure naloxone is available.

IV dosing for Fentanyl 50 mcg/mL concentration

Age	Weight	Dose	Volume
1 month	4 kg	4 mcg	0.08 ml
3 months	5 kg	5 mcg	0.1 ml
6 months	7 kg	7 mcg	0.14 ml
1 year	10 kg	10 mcg	0.2 ml
2 years	12 kg	12 mcg	0.24 ml
3 years	14 kg	14 mcg	0.28 ml
4 years	16 kg	16 mcg	0.32 ml
5 years	18 kg	18 mcg	0.36 ml
6 years	20 kg	20 mcg	0.4 ml
7 years	22 kg	22 mcg	0.44 ml
8 years	24 kg	24 mcg	0.48 ml
9 years	26 kg	26 mcg	0.52 ml
10 years	28 kg	28 mcg	0.56 ml
12 years	32 kg	32 mcg	0.64 ml

Intranasal Diamorphine

Intranasal diamorphine is another fast acting and effective analgesic which is easy to administer. As diamorphine is presented as a powder, the concentration can be adjusted for bodyweight so that the volume administered is always 0.2 ml. This makes it ideal for intranasal administration and means that splitting doses between nostrils in larger children is not required.

General dosing guideline: Intranasal Diamorphine

- Standard dose: 0.1 mg/kg/dose
- Peak effect: 5 mins
- Duration of effect: 20–60 minutes

Intranasal diamorphine has an excellent safety profile and patients should not routinely need full monitoring after administration. However, consideration should be given to the potential side effects of administering potent opioids, including respiratory depression and hypotension. Basic monitoring is advised for 1 hour after administration, if available and practicable.

Diamorphine is typically presented as a powder in ampoules containing 5 mg or 10 mg. It is important to check the amount in the ampoule being used. It is not recommended in children weighing less than 10 kg (or 1 year of age).

For practicality, the dose given in 0.2 ml of solution may vary slightly from exactly 0.1 mg/kg as measuring volumes of less than 0.05 ml is difficult in most circumstances even with a 1ml syringe. These doses are considered a safe variation.

An abbreviated table is available in Annexe 1 which is extensively used in the UK and has been validated for safety. It accompanies an analgesia preparation card.

Full dosing table for Intranasal Diamorphine (5 mg and 10 mg vials)

Age (years)	Weight (kg)	Volume of 0.9% Saline added to 5mg Diamorphine powder (ml)	Volume of 0.9% saline added to 10mg Diamorphine powder (ml)	Dose in 0.2ml of solution in (mg)
> 1	10	1	2	1
2	12	0.8	1.6	1.25
3	14	0.7	1.4	1.42
4	16	0.6	1.2	1.66
5	18	0.5	1	1.81
6	20	0.5	1	2
7	22	0.45	0.9	2.2
8	24	0.4	0.8	2.5
9	26	0.4	0.8	2.5
10	28	0.35	0.7	2.85
11	30	0.35	0.7	2.85
12	32	0.3	0.6	3.3
12 +	35	0.3	0.6	3.3
	40	0.25	0.5	4
	50	0.2	0.4	5
	60	-	0.3	6

Intravenous Morphine

Intravenous morphine is the gold standard analgesic if intravenous access has been obtained. It can be titrated to effect while observing recommended maximum doses.

General dosing guideline: Intravenous Morphine

- Standard dose: 0.1 mg/kg/dose
- Peak effect: 20 minutes
- Duration of effect: 60–120 minutes

Patients receiving intravenous morphine should be monitored for at least 40 minutes after administration.

How to administer

Body weight is more variable over the age of 12 years so titration of analgesia is a safe and effective way to achieve optimal results for the patient. Titration of intravenous morphine to effect can be achieved using the following method:

1. Dilute morphine to 1 mg/ml (if required)
2. Estimate bodyweight and draw up correct dose
3. Administer half the expected dose (IV)
   – expected dose is calculated as 0.1 mg/kg
4. Administer another quarter of the expected dose every 10–20 minutes until the desired effect is achieved.
5. If administering IM then give the expected dose with a single injection.

Titration of IV doses using this method is a safe way to administer morphine, especially when monitoring is not available or practical.

Dosing for Morphine 1 mg/mL concentration

Age	Weight (Age + 4) × 2	Dose	Volume
1 month	4 kg	0.4 mg	0.4 ml
3 months	5 kg	0.5 mg	0.5 ml
6 months	7 kg	0.75 mg	0.75 ml
1 year	10 kg	1 mg	1 ml
2 years	12 kg	1.2 mg	1.2 ml
3 years	14 kg	1.4 mg	1.4 ml
4 years	16 kg	1.6 mg	1.6 ml
5 years	18 kg	1.8 mg	1.8 ml
6 years	20 kg	2 mg	2 ml
7 years	22 kg	2.2 mg	2.2 ml
8 years	24 kg	2.4 mg	2.4 ml
9 years	26 kg	2.6 mg	2.6 ml
10 years	28 kg	2.8 mg	2.8 ml
12 years	32 kg	3.2 mg	3.2 ml

Ketamine

Ketamine is well suited for use in emergency environments due to its safety profile and multiple routes of administration. It is an effective dissociative analgesic. It comes in a wide range of concentrations. In higher doses it will result in sedation and anaesthesia. Haemodynamic stability and minimal respiratory depression after administration make it particularly valuable in emergency care settings. It is safe to give in head injury.

Dosing guideline: Ketamine

	Intravenous	Intramuscular	Intranasal
Standard dose	0.2 mg/kg/dose	2–4 mg/kg/dose	1.5–3 mg/kg/dose
Onset time	30 seconds –1 minute	3–4 minutes	5–10 minutes (variable – may be less than 5 minutes)
Peak effect	1–5 minutes	15–30 minutes	20–30 minutes
Duration of effect	15–30 minutes	30–60 minutes	30–60 minutes

How to administer

Titration of ketamine is a safe and effective way to achieve optimal results for the patient and can be achieved using the following method:

1. Estimate bodyweight
2. Administer half the calculated dose
3. Administer another quarter of the expected dose every 2–5 minutes (depending on the route being used) until the desired effect is achieved.
4. If administering IM then administer the expected dose with a single injection.

Titration of IV analgesia using this method is a safe way to administer ketamine when monitoring is not available or practical.

Ketamine adverse effects

Airway

Ketamine usually preserves airway reflexes but there is a risk of hypersecretions, hypersalivation and laryngospasm. Be prepared to provide airway management.

Cardiovascular

Ketamine is a haemodynamically stable agent and will increase heart rate and blood pressure. However in very shocked patients there is a risk of cardiovascular collapse.

Neurological

Some patients may experience emergence reactions, including vivid dreams or hallucinations. This can be effectively treated with small doses of benzodiazepines if necessary. A reassuring and calm approach will minimize adverse behavioural reactions.

Key points: Ketamine

- Ketamine is a versatile dissociative analgesic that can be administered via several routes.
- It is haemodynamically stable.
- Provides rapid onset pain relief.
- Is associated with emergence reactions.
- Can be used safely in head injury.
- **Ketamine comes in a wide range of concentrations. Check doses carefully and be sure of what concentration you are using.**

Annexe 1: Pain preparation card

Age		**Expected weight (kg)** = (Age + 4) × 2	
Physical interventions		**Pre-treatment pain score**	
Psychological interventions		**Post-treatment pain score**	

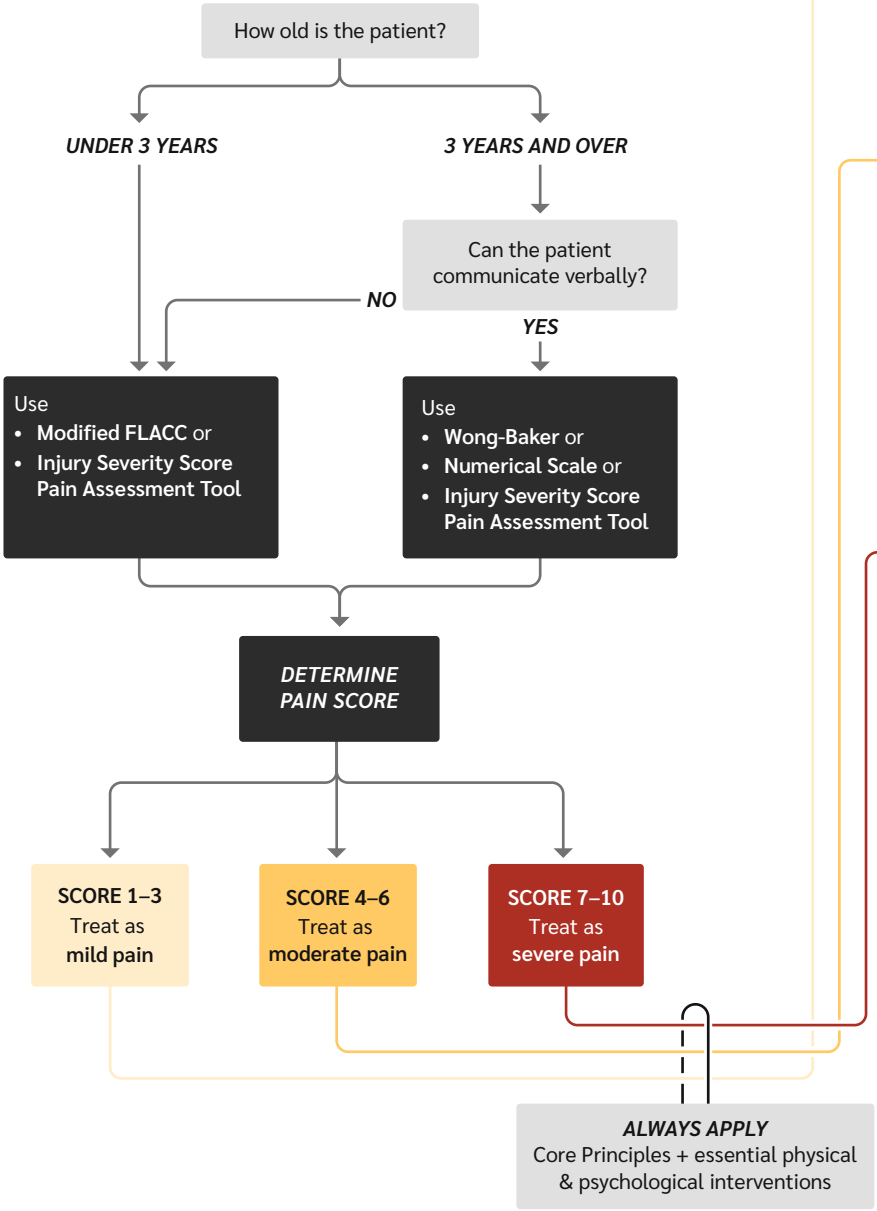
Medication	Recommended dose	Calculated dose
Paracetamol (PO/PR)	15 mg/kg	
Paracetamol (IV)	<10 kg: 10 mg/kg >10 kg: 15 mg/kg	
Ibuprofen	10 mg/kg	
Tramadol (PO or IV)	1 mg/kg (max 50 mg)	
Morphine (PO)	1 mth–1 yr: 0.1 mg/kg >1 year: 0.2 mg/kg	
Morphine (IV/IO/IM)	0.1 mg/kg	
Fentanyl (IV)	1 mcg/kg	
Fentanyl (IN)	1.5 mcg/kg	
Diamorphine (IN)	See dosing table on next page	
Diamorphine (IV)	0.1 mg/kg	
Naloxone (IV)	10 mcg/kg up to 400 mcg Repeat every 2 mins until desired effect achieved	
Ketamine (IN)	1.5–3 mg/kg	
Ketamine (IV)	0.2 mg/kg	
Ketamine (IM)	2–4 mg/kg	

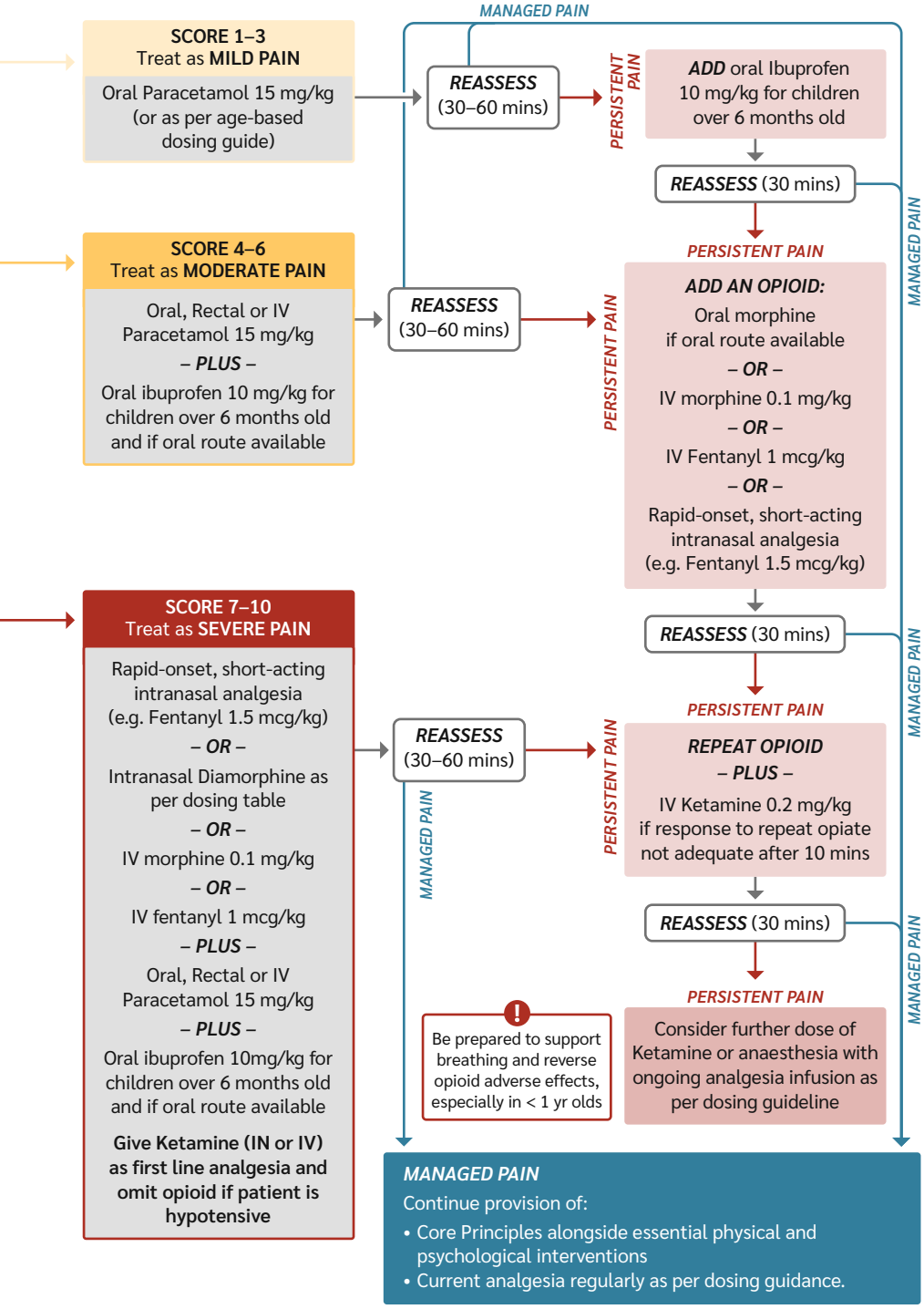
Intranasal Diamorphine quick dosing table

Weight (kg)	Volume of 0.9% NaCL added to 5 mg Diamorphine powder (ml)	Volume of 0.9% NaCL added to 10 mg Diamorphine powder (ml)
15	0.65	1.3
20	0.5	1
25	0.4	0.8
30	0.35	0.7
35	0.3	0.6
40	0.25	0.5
50	0.2	0.4
60	–	0.3

1. Estimate weight or weigh to nearest 5 kg
2. Add weight specific volume of 0.9% sodium chloride
3. Draw up 0.2 ml of the solution for correct dose to weight

Annexe 2: Master algorithm




MANAGED PAIN
SCORE 1–3
Treat as MILD PAIN
Oral Paracetamol 15 mg/kg
(or as per age-based
dosing guide)
REASSESS
(30–60 mins)
PERSISTENT PAIN
ADD oral Ibuprofen
10 mg/kg for children
over 6 months old
REASSESS (30 mins)
PERSISTENT PAIN
MANAGED PAIN
SCORE 4–6
Treat as MODERATE PAIN
Oral, Rectal or IV
Paracetamol 15 mg/kg
– PLUS –
Oral ibuprofen 10 mg/kg for
children over 6 months old
and if oral route available
REASSESS
(30–60 mins)
PERSISTENT PAIN
ADD AN OPIOID:
Oral morphine
if oral route available
– OR –
IV morphine 0.1 mg/kg
– OR –
IV Fentanyl 1 mcg/kg
– OR –
Rapid-onset, short-acting
intranasal analgesia
(e.g. Fentanyl 1.5 mcg/kg)
REASSESS (30 mins)
PERSISTENT PAIN
MANAGED PAIN
SCORE 7–10
Treat as SEVERE PAIN
Rapid-onset, short-acting
intranasal analgesia
(e.g. Fentanyl 1.5 mcg/kg)
– OR –
Intranasal Diamorphine as
per dosing table
– OR –
IV morphine 0.1 mg/kg
– OR –
IV fentanyl 1 mcg/kg
– PLUS –
Oral, Rectal or IV
Paracetamol 15 mg/kg
– PLUS –
Oral ibuprofen 10mg/kg for
children over 6 months old
and if oral route available
Give Ketamine (IN or IV)
as first line analgesia and
omit opioid if patient is
hypotensive
REASSESS
(30–60 mins)
PERSISTENT PAIN
REPEAT OPIOID
– PLUS –
IV Ketamine 0.2 mg/kg
if response to repeat opiate
not adequate after 10 mins
REASSESS (30 mins)
PERSISTENT PAIN
MANAGED PAIN
Be prepared to support
breathing and reverse
opioid adverse effects,
especially in < 1 yr olds
Consider further dose of
Ketamine or anaesthesia with
ongoing analgesia infusion as
per dosing guideline
MANAGED PAIN
Continue provision of:
• Core Principles alongside essential physical and psychological interventions
• Current analgesia regularly as per dosing guidance.

Annexe 3: Pain assessment tools

Modified FLACC assessment tool

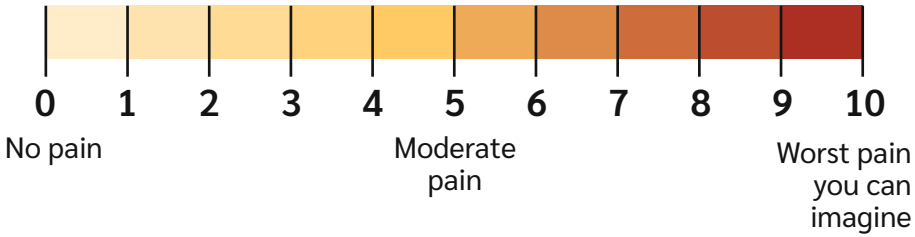
	0	1	2
Face	Neutral	Occasional frown /grimace. Withdrawn, disinterested	Constant girmace / frown. Chin quivering / Jaw clenching
Legs	Normal position, relaxed	Uneasy, restless, tense	Kicking or legs drawn up
Activity	Laying quietly, normal position, moves easily	Squirming, shifting back & forth	Arched, rigid or jerking movements
Cry	No cry	Moans, whimpers; occasional complaints	Crying steadily, screams or sobs: frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging, or being talked to. Distractible	Difficult to console or comfort

Observe the awake child for 1–3 minutes (5 minutes asleep).

The original scoring system assigns a score of 0–2 to each of the five sections (Face, Legs, Activity, Cry, Consolability) which when summed results in a final score between 0 and 10. Alternatively, this modified version of the tool allows the highest score from any section to determine pain levels. E.g. If a score of 2 is given for any of the sections (Face, Legs, Activity, Cry, Consolability) then the patient is assumed to be in severe pain.

Wong-Baker FACES Pain assessment tool

Numerical Rating Scale (NRS)



For both of these assessment tools, the child should be asked to show where their level of pain is, on the scale.

Care givers can use the scales to give a proxy score.

The NRS can be delivered verbally.

Pediatric Injury Severity Score (ISS) based pain assessment

1. Initial assessment (primary survey)

- **Breathing:** Observe breathing status – normal, laboured, rapid, or absent.
- **Circulation:** Check for bleeding or signs of hypotension.
- **Consciousness:** Assess using AVPU scale (Alert, Voice, Pain, Unresponsive).

2. Severity indicators

Indicators:	Minor (ISS <9)	Moderate (ISS 9–15)	Major (ISS >15)
Breathing	Normal or slightly faster breathing	Laboured or rapid breathing	Absent or severely laboured breathing
Circulation	No significant bleeding	Minor to moderate bleeding	Major bleeding or signs of hypotension
Consciousness	Conscious and alert	Altered mental status but not unresponsive	Unresponsive or significantly altered mental status
Injuries	Superficial or minor visible injuries	Visible injuries that are more than superficial	Multiple injuries in different body regions
Likely pain severity	**Mild**	**Moderate**	**Severe**

3. Decision Rule

- If any major injury indicators are present, assume ISS >15 and anticipate severe pain.
- If any moderate injury indicators are present without major injury signs, assume ISS 9–15 and anticipate moderate pain.
- If only minor injury indicators are present, assume ISS <9 and anticipate mild pain.

Annexe 4: Assessing bodyweight

Assessment of bodyweight in children can be challenging as no one size fits all. Incorrect bodyweight calculations can mean over– or under–dosing children in pain leading to toxicity or inadequate pain relief. Titration of medication helps to mitigate this, however, here are some useful tips to help estimate bodyweight to help you find a starting point.

Measuring tapes: Tapes such as the Broselow tape have been validated to provide an accurate estimation of ideal bodyweight based on the child's height. There are several variants commercially available, but the Broselow tape and PaedER (PädNFL) tape are shown to be the most accurate in non-obese children.

In areas where children are at high risk of malnourishment or are underweight for other reasons it is important to try and estimate the patient's weight either by using their "clothes-age" or weighing the child. If you are unsure about a child's weight and they seem smaller than they should according to these calculations, then be cautious and use a smaller dose as you can always give more. The consequences of over–dosing with potent intravenous medications maybe detrimental. Potential side effects of all opioids and ketamine includes respiratory depression and hypotension.

In areas where children are overweight or obese, then ideal rather than actual body weight should be used to calculate drug doses. Measuring tapes such as the Broselow tape can be very useful in these situations.

Bodyweight calculation:

Weight (in kg) = (Age + 4) × 2

Body weight is more variable over the age of 12 years so titration of analgesia is a safe and effective way to achieve optimal results for the patient. Titration of intravenous analgesia to effect can be achieved using the following method:

1. Estimate bodyweight
2. Administer half the calculated dose
3. Administer another quarter of the calculated dose every few minutes until the desired effect is achieved.

Monitoring is recommended after administration of opioids and ketamine, however titration of doses using this method is a safe way to administer analgesia when monitoring is not available or practical.

Annexe 5: Dosing tables

Oral Paracetamol

15 mg/kg or by age, 4–6 hourly, max 4 doses in 24 hours

Age	Dose	Volume of 120 mg/5ml preparation	Volume of 250 mg/5ml preparation
3–6 months	60 mg	2.5 ml	1.2 ml
6–24 months	120 mg	5 ml	2.5 ml
2–4 years	180 mg	7.5 ml	3.5 ml
4-6 years	240 mg	10 ml	5 ml
6–8 years	250 mg	10 ml	5 ml
8–10 years	375 mg	15 ml	7.5 ml
10–12 years	500 mg	20 ml	10 ml
12–16 years	500–750 mg	20–30 ml	10–15 ml

Oral Ibuprofen

10 mg/kg or by age, 6–8 hourly, max 4 doses in 24 hours

Age	Dose	Volume (100mg/5ml)	Volume (200mg/5ml)
6–24 months	50 mg	2.5 ml	1.25 ml
3–7 years	100 mg	5 ml	2.5 ml
8–12 years	200 mg	10 ml	5 ml
13 years +	200–400 mg	10–20 ml	5–10 ml

Oral Morphine Solution

Age	Weight	Dose
3 months	5 kg	0.5 mg
6 months	7 kg	0.7 mg
1 year	10 kg	2.0 mg
2 years	12 kg	2.4 mg
3 years	14 kg	2.8 mg
4 years	16 kg	3.2 mg
5 years	18 kg	3.6 mg
6 years	20 kg	4 mg
7 years	22 kg	4.4 mg
8 years	24 kg	4.8 mg
9 years	26 kg	5.2 mg
10 years	28 kg	5.5 mg
11 years	30 kg	6.0 mg
12 years	32 kg	6.5 mg

General dosing guideline:

- Standard dose 1 month to 1 year: 0.1 mg/kg (see chapter 5 for <1 month)
- Standard dose >1 year: 0.2 mg/kg
- Peak effect: 30–40 minutes
- Duration of effect: 90–120 minutes

Oral Transmucosal Fentanyl

Oral transmucosal fentanyl citrate is available as lozenges and presented with an applicator for administration making them acceptable to children as they resemble a lollipop. There are different flavours available.

Lozenges are available containing 200–800 mcg of fentanyl citrate. Lozenges with the dose closest to that calculated for the child's bodyweight should be provided to minimise the risk of side effects.

Mild side effects include nausea, vomiting, mild sedation and pruritis. Respiratory depression is rare and if does occur, is not usually associated with hypoxia.

Children from 4–5 upwards can be instructed to suck the lollipop, ideally between gum and cheek but not to chew, bite or crush. Fentanyl lozenges are useful for rapid delivery of analgesia to multiple patients.

General dosing guideline:

- Standard dose: 10–20 mcg/kg/dose
- Peak effect: 10–30 minutes
- Duration of effect: up to 2 hours

Intranasal Fentanyl 50 mcg/ml

Age	Weight	Dose	Volume
3 months	5 kg	7.5 mcg	0.15 ml
6 months	7 kg	10 mcg	0.2 ml
1 year	10 kg	15 mcg	0.3 ml
2 years	12 kg	18 mcg	0.36 ml
3 years	14 kg	21 mcg	0.42 ml
4 years	16 kg	24 mcg	0.48 ml
5 years	18 kg	27 mcg	0.54 ml
6 years	20 kg	30 mcg	0.6 ml
7 years	22 kg	33 mcg	0.66 ml
8 years	24 kg	36 mcg	0.72 ml
9 years	26 kg	39 mcg	0.78 ml
10 years	28 kg	42 mcg	0.84 ml
12 years	32 kg	48 mcg	0.96 ml
12 + years	34–39 kg	50 mcg	1.0 ml
	40–44 kg	60 mcg	1.2 ml
	45–49 kg	70 mcg	1.4 ml
	> 50 kg	75 mcg	1.5 ml

General dosing guideline:

- Standard dose: 1.5 mcg/kg/dose
- Peak effect: 5 mins
- Duration of effect: 30–60 minutes
- Can be repeated after 60 minutes
- Instructions on IN administration are on page 44.
- Divide volumes >0.4 ml between nostrils

Intranasal Diamorphine

Age (years)	Weight (kg)	Volume of 0.9% Saline added to 5mg Diamorphine powder (ml)	Volume of 0.9% saline added to 10mg Diamorphine powder (ml)	Dose in 0.2 ml of solution in (mg)
> 1	10	1	2	1
2	12	0.8	1.6	1.25
3	14	0.7	1.4	1.42
4	16	0.6	1.2	1.66
5	18	0.5	1	1.81
6	20	0.5	1	2
7	22	0.45	0.9	2.2
8	24	0.4	0.8	2.5
9	26	0.4	0.8	2.5
10	28	0.35	0.7	2.85
11	30	0.35	0.7	2.85
12	32	0.3	0.6	3.3
12 +	35	0.3	0.6	3.3
	40	0.25	0.5	4
	50	0.2	0.4	5
	60	–	0.3	6

General dosing guideline:

- Standard dose: 0.1 mg/kg/dose
- Peak effect: 5 mins
- Duration of effect: 20–60 minutes
- Can be repeated after 60 minutes.
- Instructions on IN administration are on page 44.

Intranasal Ketamine

Age	Weight	Dose	Volume (50 mg/ml solution)
3 months	5 kg	7.5mg	0.15
6 months	7 kg	10 mg	0.2 ml
1 year	10 kg	15 mg	0.3 ml
2 years	12 kg	18 mg	0.36 ml
3 years	14 kg	21 mg	0.42 ml
4 years	16 kg	24 mg	0.48 ml
5 years	18 kg	27 mg	0.54 ml
6 years	20 kg	30 mg	0.6 ml
7 years	22 kg	33 mg	0.66 ml
8 years	24 kg	36 mg	0.72 ml
9 years	26 kg	39 mg	0.78 ml
10 years	28 kg	42 mg	0.84 ml
12 years	32 kg	48 mg	0.96 ml

General dosing guideline:

- Standard dose: 1.5 mg/kg/dose
- Peak effect: 5–10 mins
- Duration of effect: 30–60 minutes

Intravenous Paracetamol

Age	Weight	Dose
1 month	4 kg	40 mg
3 months	5 kg	50 mg
6 months	7 kg	70 mg
1 year	10 kg	150 mg
2 years	12 kg	180 mg
3 years	14 kg	210 mg
4 years	16 kg	240 mg
5 years	18 kg	270 mg
6 years	20 kg	300 mg
7 years	22 kg	330 mg
8 years	24 kg	360 mg
9 years	26 kg	390 mg
10 years	28 kg	420 mg
12 years	32 kg	480 mg
12+ years	< 50 kg	500 mg
	> 50 kg	1 g

General dosing guideline:

- <10 kg: 10 mg/kg/dose – max 3 doses in 24 hours
- >10 kg: 15 mg/kg/dose – max 4 doses in 24 hours

Dosing frequency:

- <10 kg: Give every 6–8 hours
- >10 kg: Give every 4–6 hours

Intravenous Fentanyl

50 mcg/mL concentration

Age	Weight	Dose	Volume
1 month	4 kg	4 mcg	0.08 ml
3 months	5 kg	5 mcg	0.1 ml
6 months	7 kg	7 mcg	0.12 ml
1 year	10 kg	10 mcg	0.2 ml
2 years	12 kg	12 mcg	0.24 ml
3 years	14 kg	14 mcg	0.28ml
4 years	16 kg	16 mcg	0.32 ml
5 years	18 kg	18 mcg	0.36 ml
6 years	20 kg	20 mcg	0.4 ml
7 years	22 kg	22 mcg	0.44 ml
8 years	24 kg	24 mcg	0.48 ml
9 years	26 kg	26 mcg	0.52 ml
10 years	28 kg	28 mcg	0.56 ml
12 years	32 kg	32 mcg	0.64 ml

General dosing guideline:

- Standard dose: 1 mcg/kg
- Peak effect: 5 minutes
- Duration of effect: 30–60 minutes

Intravenous Morphine

1 mg/mL concentration

Age	Weight	Dose	Volume
1 month	4 kg	0.4 mg	0.4 ml
3 months	5 kg	0.5 mg	0.5 ml
6 months	7 kg	0.75 mg	0.75 ml
1 year	10 kg	1 mg	1 ml
2 years	12 kg	1.2 mg	1.2 ml
3 years	14 kg	1.4 mg	1.4 ml
4 years	16 kg	1.6 mg	1.6 ml
5 years	18 kg	1.8 mg	1.8 ml
6 years	20 kg	2 mg	2 ml
7 years	22 kg	2.2 mg	2.2 ml
8 years	24 kg	2.4 mg	2.4 ml
9 years	26 kg	2.6 mg	2.6 ml
10 years	28 kg	2.8 mg	2.8 ml
12 years	32 kg	3.2 mg	3.2 ml

General dosing guideline:

- Standard dose: 0.1 mg/kg/dose
- Peak effect: 20 minutes
- Duration of effect: 60–120 minutes

Intravenous Ketamine

Age	Weight	Dose
1 month	4 kg	0.8 mg
3 months	5 kg	1.0 mg
6 months	7 kg	1.4 mg
1 year	10 kg	2 mg
2 years	12 kg	2.4 mg
3 years	14 kg	2.8 mg
4 years	16 kg	3.2 mg
5 years	18 kg	3.6 mg
6 years	20 kg	4 mg
7 years	22 kg	4.4 mg
8 years	24 kg	4.8 mg
9 years	26 kg	5.2 mg
10 years	28 kg	5.6 mg
11 years	30 kg	6 mg
12 years	32 kg	6.4 mg

General dosing guideline:

- Standard dose: 0.2 mg/kg/dose
- Peak effect: 30 seconds–1 min
- Duration of effect: 15–30 minutes

Annexe 6: Limb immobilisation techniques

Simple immobilisation techniques: Upper limb

Where resources may be limited and conditions less than ideal, simple immobilisation techniques for upper limb fractures help to prevent further injury, reduce pain, and stabilise the fracture until definitive care can be provided.

Slings

Purpose: To support the arm and minimise movement of the fractured area.

Application: A triangular bandage can be used to create a sling. Place the arm at a right angle (90 degrees) across the chest, with the hand elevated slightly above the level of the elbow to reduce swelling. The bandage is then draped over the neck and the injured arm, tying the ends at the opposite side of the neck. Adjust to ensure comfort and adequate support without excessive pressure around the neck. For humeral fractures an additional strap can be used to splint the arm to the side of the chest and reduce movement.

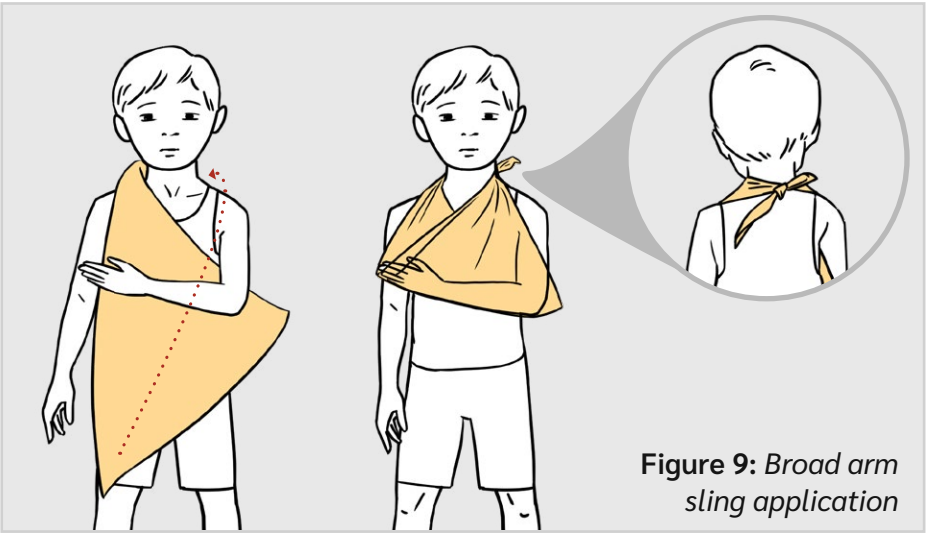


Figure 9: *Broad arm sling application*

Sam Splint/rigid splints

Purpose: To provide rigid support and further immobilise the fractured limb.

Application: The flexible Sam Splint can be moulded to fit the contour of the arm and then wrapped with a bandage or medical tape. Ensure the splint extends beyond the joints above and below the fracture site. Wrap the splint and limb with care to avoid over-tightening, which could impair circulation or exacerbate swelling. Vacuum splints and box splints are other examples of rigid splints that are useful in these situations. If these are not available then any straight, rigid object maybe used to keep the fractured limb straight and reduce movement.

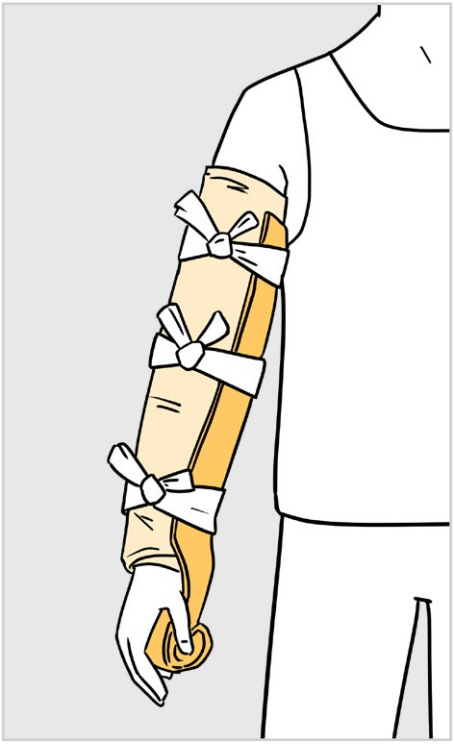


Figure 10: *Forearm fracture splint*

Padding and bandages

Purpose: To cushion the fracture site and provide additional support.

Application: Soft materials (e.g., gauze, clean cloths) can be gently placed around the fractured area before applying a splint. This padding helps absorb shock and increases comfort. Secure the padding with bandages, ensuring even pressure distribution.

Elevation

Purpose: To reduce swelling and pain.

Application: If possible, after immobilisation, aim to keep the injured limb elevated above the level of the heart. This can be achieved by adjusting the sling height or using pillows and soft materials to prop up the limb when possible.

Simple immobilisation techniques: Lower limb

Managing lower limb fractures in children requires effective, yet simple immobilisation techniques. These methods aim to stabilise the fracture, minimise pain, and prevent further injury during transport to a medical facility.

Soft splints

Purpose: To gently support and conform to the shape of the injured leg, accommodating swelling.

Application: Soft materials like blankets, towels, or pillows can be used. Place the material under the injured limb, then fold or roll it around the limb. Secure the soft splint with bandages or cloth strips, ensuring the material extends beyond the joints above and below the fracture. Avoid tight bandaging that could impair circulation.

Rigid splints

Purpose: To provide firm support and restrict movement of the fracture site.

Application: Use available rigid materials such as boards, thick cardboard, or metal strips (e.g. Sam Splint). The splint should extend beyond the joints above and below the fracture. Pad the splint with soft materials to prevent pressure points. Secure the splint with bandages, wrapping both above and below the fracture site, without applying pressure directly over the injury. Vacuum splints and box splints are other examples of rigid splints that are useful in these situations.

Traction splints (if trained)

Purpose: Specifically for femur fractures, to alleviate pain, prevent further injury, and reduce bleeding by aligning the limb and counteracting muscle spasm.

Application: This technique requires specific training and equipment (traction splint) and is not commonly used by untrained personnel. If available and if one is trained, carefully apply the traction splint according to manufacturer instructions, ensuring gentle, continuous pull along the length of the limb.

Elevation and padding

Purpose: To reduce swelling and provide additional support.

Application: Elevate the injured limb if possible, using soft materials like rolled blankets or clothes. Additionally, padding around the fracture site before splint application can absorb shock and increase comfort.

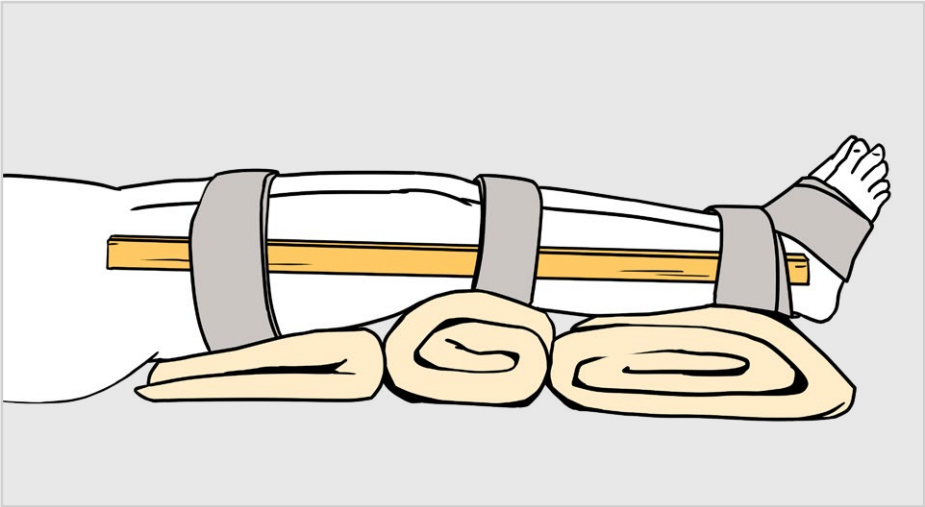


Figure 11: *Lower limb splint*

Annexe 7: Simple regional anaesthetic techniques

The use of anatomically guided regional techniques will provide children with effective and long-lasting pain relief. The following techniques can be delivered quickly, by one clinician, with minimal equipment and inexpensive drugs.

The table below gives the maximum safe dose of local anaesthetic agents in children. **Do not exceed these doses.**

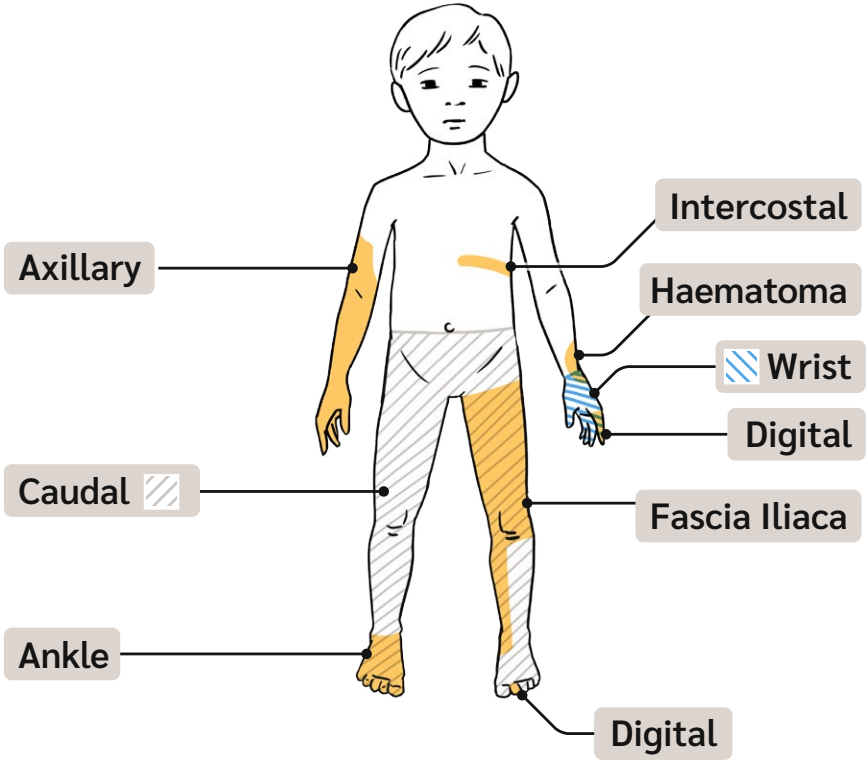
Maximum safe dose of local anaesthetic agents in children

Agent	Onset	Duration analgesia	Maximum recommended dose	Maximum dose with adrenaline
Lignocaine	5–15 min	2–5 h	3 mg/kg (0.3 ml/kg 1% or 0.15 ml/kg 2%)	7 mg/kg (0.7 ml/kg 1% or 0.35 ml/kg 2%)
Ropivacaine, Bupivacaine or Levobupivacaine	10–30 min	Up to 12 h	2.5 mg/kg (1 ml/kg 0.25%) (0.5 ml/kg 0.5%)	2.5 mg/kg (1 ml/kg 0.25%) (0.5 ml/kg 0.5%)

Drawing up the correct volume for the weight of the child is a safe way to ensure maximum doses are not exceeded. If a larger volume is required for the chosen technique then the local anaesthetic can be diluted using water for injections or 0.9% NaCl.

The following blocks are safe and simple techniques that can be performed when ultrasound is not available. The volumes above are within safe maximums for 0.25% levobupivacaine (a longer lasting agent). **If using an alternative local anaesthetic then you may need to dilute it to avoid exceeding the maximum safe dose. Check doses carefully.**

Figure 12: *Regional anaesthetic technique block map*



Local infiltration

The simplest application of local anaesthetics is local infiltration of wound edges. Use the table on page 86 to calculate the maximum safe volume you can use. Levobupivivaine 0.25% provides a large volume for larger wounds. Onset time is not significantly longer but duration of action is. Using a preparation with adrenaline allows higher safe dosing and also reduces wound edge bleeding. Injecting the wound edges is painful so it is important to prepare the child and consider distraction techniques and systemic analgesia. A dose of IN fentanyl prior to infiltration is advised if available.

Intercostal Nerve Block

Indication: Management of acute pain associated with rib fractures, or for patients requiring a chest drain (when time permits).

Positioning and landmarks: Sitting or supine. Junction of the middle and posterior thirds of the chosen rib space.

Dose: 0.06–0.1 ml/kg 0.25% Levobupivacaine per rib, observing maximum recommended doses. Consider adding adrenaline to reduce systemic absorption. Need to also block the rib above and below the rib fracture.

Technique: Mark the inferior border of the ribs to be blocked (figure 13 marks the injection site). Insert needle and advance until hit bone. Then aim caudally to walk off the rib. Advance slightly further until a slight give or pop is felt. Aspirate prior to injecting LA as in close proximity to intercostal artery and vein.

Complications:
1% risk of pneumothorax.

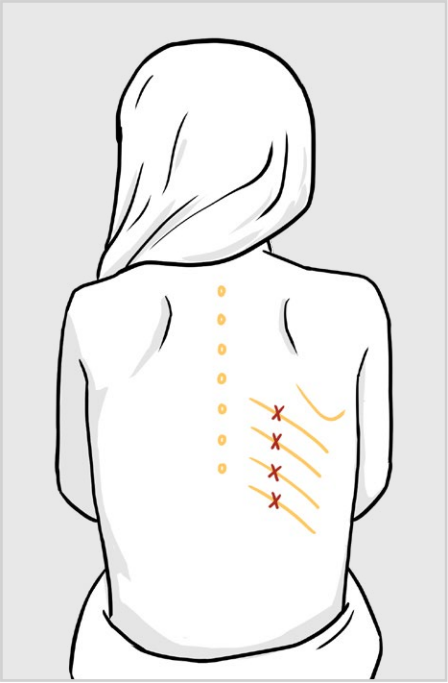


Figure 13: *Intercostal nerve block injection landmarks*

Haematoma Block

Indication: Fracture of long bones in the upper or lower limb. Especially useful for distal radius fractures requiring closed reduction.

Positioning: Comfortable position for patient.

Dose: Up to 0.5 ml/kg 0.25% Levobupivacaine

Technique: Thoroughly clean the area around the injury. Identify the fracture site from origin of deformity or swelling. Aim needle towards the distal side of the fracture and advance until it contacts bone. Angle needle tip more proximally until it is between the proximal and distal portions of bone associated with the fracture, advance into the fracture haematoma and inject local anaesthesia directly into the haematoma.

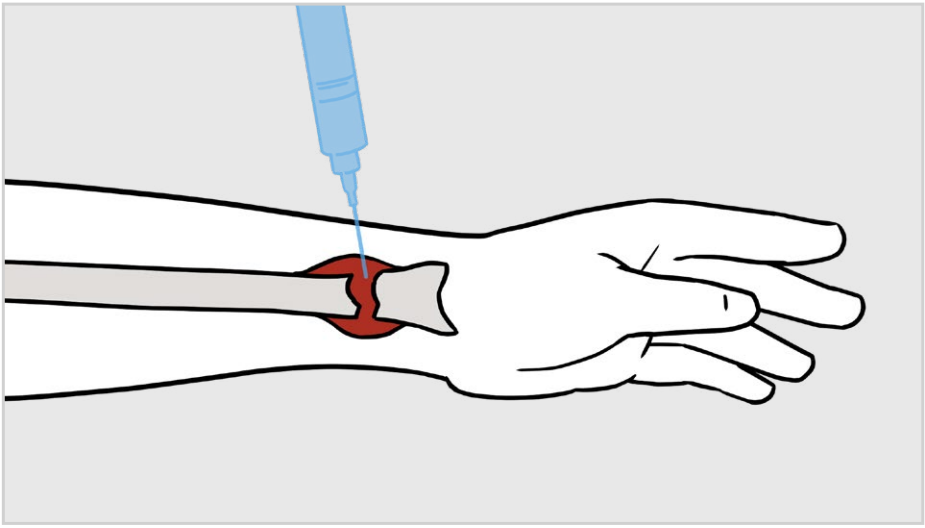


Figure 14: *Infiltration of distal radial fracture haematoma*

Upper limb

Axillary Brachial Plexus Block

Indication: Injuries/surgery below the elbow. Note that the lateral aspect of the forearm may not be covered by this block and an additional musculocutaneous nerve block may be required.

Positioning: Supine, arm abducted 90°, elbow flexed, hand behind head.

Landmarks: Pectoralis major, the coracobrachialis muscle, axillary artery.

Dose: 0.3 ml/kg 0.25% Levobupivacaine

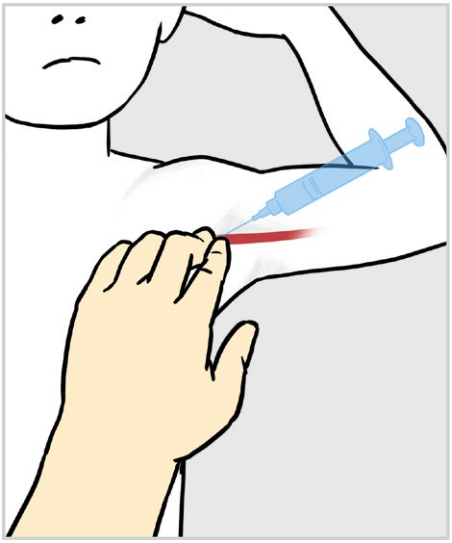


Figure 15: *Axillary brachial plexus block injection landmark and approach*

Technique: The axillary artery is palpated and stabilised using a two-finger palpation technique (see figure 15) as high in the axilla as possible. Using a small gauge needle, advance at an oblique angle towards the pulse of the axillary artery until bright red blood is aspirated. The needle is then advanced deeper until no blood can be aspirated. Half of the volume of LA should be injected here. The needle is then slowly withdrawn until blood can be aspirated again, then withdrawn further until there is no blood aspirated. At this point the remaining volume of LA is injected. Apply gentle pressure for 2 minutes post injection.

Complications: Small risk of an axillary haematoma. If this occurs, press on the artery firmly for 5 minutes.

Wrist Block

Indication: Traumatic injury or procedures on the hand or involving multiple fingers, including amputations and foreign body removal.

Positioning: The arm is abducted with the hand supinated.

Dose: 0.1 ml/kg 0.25% Levobupivacaine for each of the 5 nerves.

Technique: Use a small gauge needle (23G–25G). Five nerves need to be blocked, however only three needle insertion points are required. Identify the anatomical landmarks at the wrist (see figure 16; crosses represent needle insertion points).

Starting with the median nerve, advance the needle at 45 degrees to the skin towards the wrist between the tendons of palmaris longus (PL) and flexor carpi radialis (FCR) and perform a deep injection. As the needle is being withdrawn, flatten the approach towards the flexor retinaculum and perform a superficial 'fan shaped' injection to block the palmar cutaneous branch of the median nerve. For the ulnar nerve, insert the needle beneath the tendon of Flexor Carpi Ulnaris (FCU) towards the radial border of the forearm for the first injection, and then redirect subcutaneously around the ulnar aspect of the wrist to block the dorsal cutaneous branch. Finally, block the superficial terminal branches of the radial nerve with a subcutaneous injection between the radial styloid and the midpoint of the dorsum of the wrist.

Complications: Neuropraxia secondary to inadvertent intraneural injection. If paraesthesia occurs while performing the median nerve block, withdraw the needle by 1–2 mm.

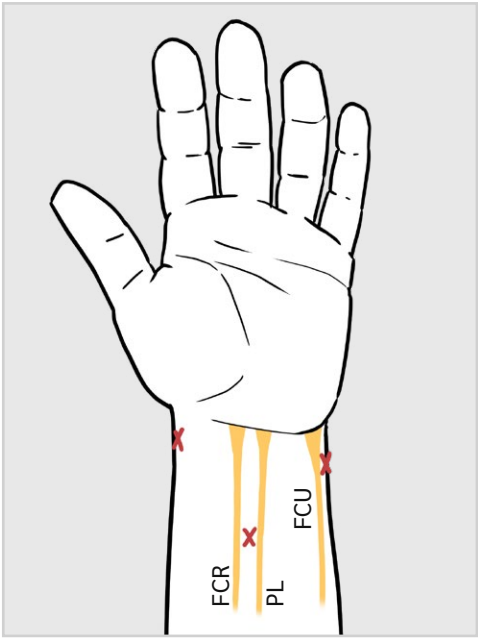


Figure 16: *Wrist block landmarks*

Digital (Finger) Blocks

Indication: Traumatic injury or procedures on single fingers. If more than one finger needs anaesthetising, then it may be more appropriate to perform a wrist block as described above.

Positioning: Comfortable position for the patient. Dorsum of hand facing up.

Dose: Up to 2 ml 0.25% Levobupivacaine. Divide doses between sides of digit. Do not use adrenaline containing solutions.

Technique: The neurovascular bundles for each digit run either side of the bones. Local anaesthetic therefore needs to be placed either side of the bone. Introduce the needle alongside the phalynx directed towards the bone and advance until contact with the bone has been made (see figure 17). Withdraw the needle 1 mm and inject half the prepared anaesthetic. Repeat on the other side of the bone on the same digit.

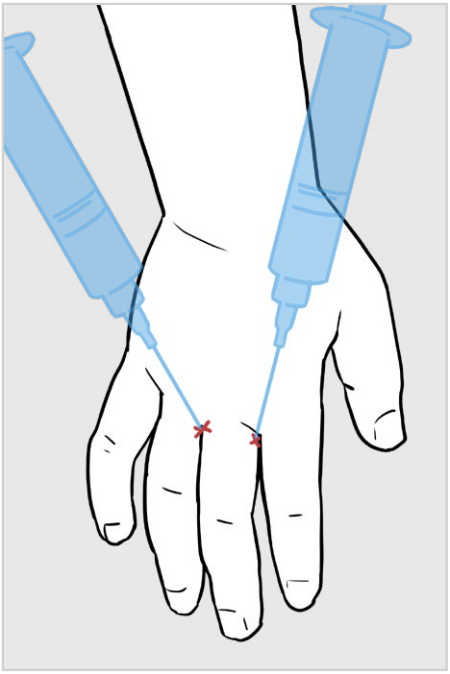


Figure 17: *Digital block landmarks and approach*

Lower limb

Digital (toe) Blocks

Indication: Traumatic injury or procedures on single toes. If more than one toe needs anaesthetising, then it may be more appropriate to perform an ankle block as described below.

The same principle, techniques and local anaesthetic doses apply to digital toe blocks and digital finger blocks previously described.

Ankle Block

Indication: Traumatic injury or procedures on feet and toes including phalangeal amputations and foreign body removal.

Positioning: Supine or prone – access to front and back of ankle.

Landmarks: Medial and lateral malleolus, extensor hallucis longus tendon, Achilles tendon, dorsalis pedis pulse.

Dose: 0.1 ml/kg 0.25% Levobupivacaine at each injection site.

Technique: Inject a subcutaneous ring of local anaesthetic along a line distal to the malleoli from the Achilles tendon laterally to medially to block the saphenous, superficial peroneal and sural nerves. The posterior tibial nerve requires a deep injection posterior to the medial malleolus either side of the posterior tibial artery. Finally the deep peroneal nerve is blocked with a deep injection medial to the dorsalis pedis artery and lateral to the extensor hallucis longus tendon.

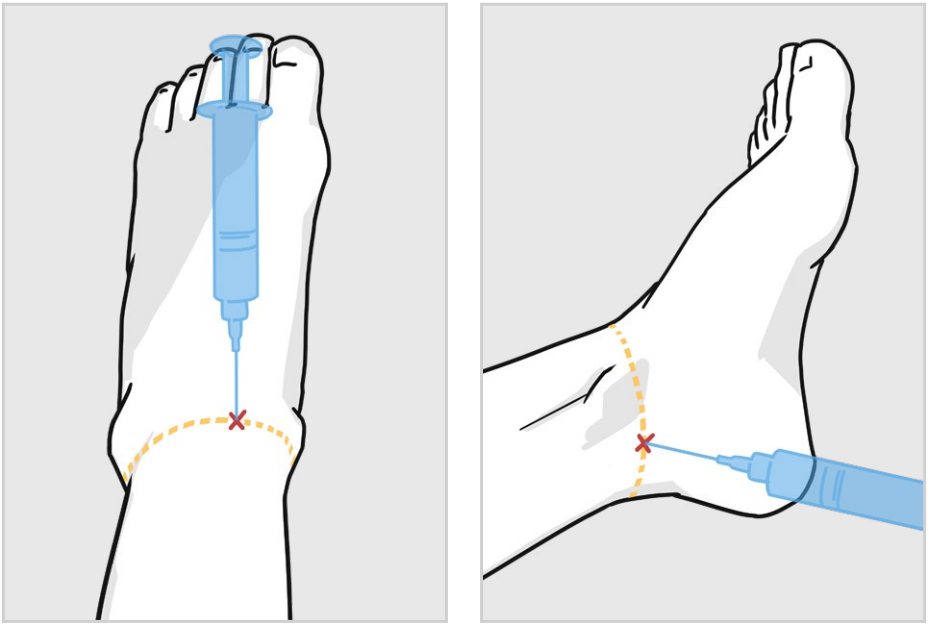


Figure 18: *Ankle block landmarks and approach*

Caudal Block

Indication: Traumatic injury or procedures on the abdomen and lower limbs. Spread is more predictable in children < 2 years of age but this can be considered in children up to the age of 6 years of age / 20 kg and will give a block up to T10. Motor block and urinary retention are expected.

Positioning: Lateral with knees and hips flexed (foetal position).

Landmarks: Sacral hiatus, Posterior Superior Iliac Spines.

Dose: 1 ml/kg 0.25% Levobupivicane

Technique: As this is a central/neuraxial block, it is important that the area is thoroughly cleaned with appropriate antiseptic e.g. chlorhexidine solution. With the child in position, identify the sacral hiatus at the apex of an equilateral triangle with the base of the triangle drawn as a line between the posterior superior iliac spines. The sacral hiatus is covered by the sacrococcygeal ligament which lies between the 2 palpable sacral cornu. This is where a 22G cannula should penetrate the skin in a cephalad direction at an approximate 45° angle. Once the ligament has been passed (and a "pop" felt), a flatter angle is achieved by descending the cannula before it can be advanced another 1–2 mm before sliding the plastic part of the cannula off the needle to the correct final position. Once the needle is withdrawn, the cannula is within the caudal space and should be observed for 2 minutes before being gently aspirated with a syringe to ensure no CSF or blood is draining from it. The pre-measured volume of local anaesthetic is then injected through the cannula before the cannula is removed.

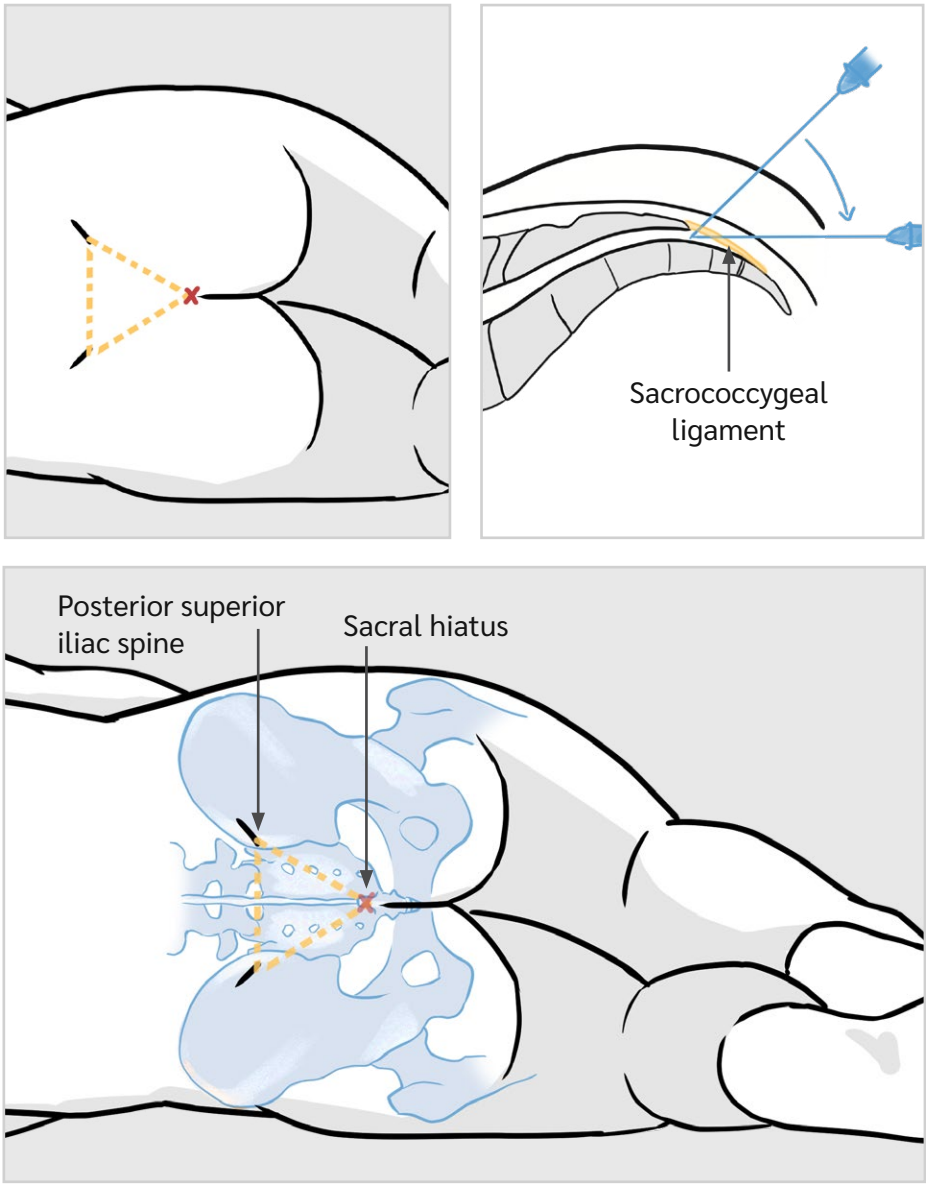


Figure 19: *Caudal block landmarks and approach*

Fascia Iliaca Compartment Block

Indication: Traumatic injury or procedures on the lower limb above the knee and for femoral shaft fractures. The fascia iliaca compartment block is effective in blocking the femoral and lateral cutaneous nerve of thigh and often the obturator nerves.

Positioning: Supine.

Landmarks: Pubic tubercle, anterior superior iliac spine (ASIS), inguinal ligament.

Dose: 0.5–1 ml/kg 0.25% Levobupivacaine

Technique: With the child in the supine position and the thigh slightly abducted and externally rotated, draw a line from the pubic tubercle to the ASIS along the inguinal ligament. Identify the injection point 0.5–1 cm distal to the junction of lateral and middle thirds of this line and infiltrate the skin with a little of the local anaesthetic. Insert a needle (ideally short bevel or blunt) perpendicular to the skin and advance. Two "pops" are felt as the needle pierces the fascia lata and then the fascia iliaca. Once in the fascia iliaca compartment, aspirate and then inject whole volume of anaesthetic. There should be no or very little resistance. Larger volumes are beneficial as this is a compartment rather than perineural block. The needle should remain inferior to the inguinal ligament and lateral to the femoral neurovascular bundle.

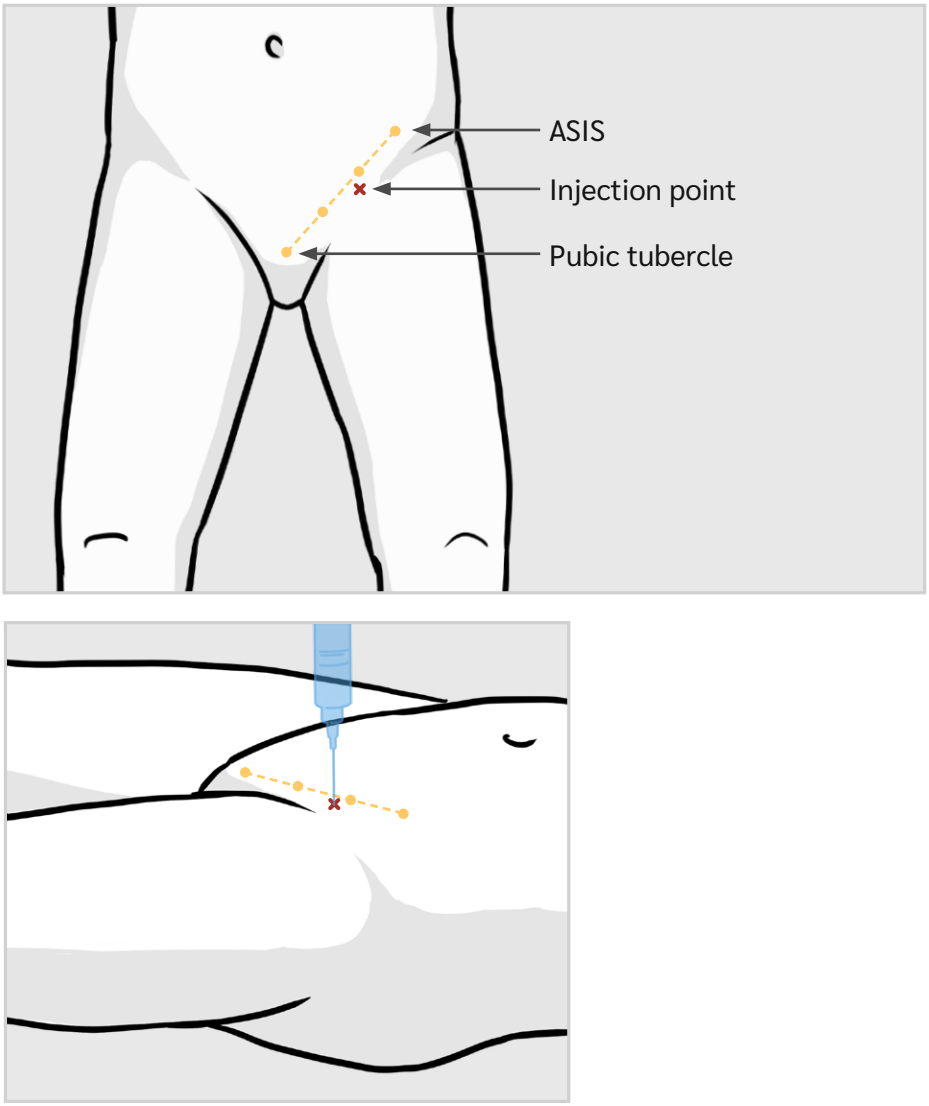


Figure 20: *Fascia iliaca compartment block landmarks and approach*

Annexe 8: Core principles and psychological approach to pain management

1. Creating a caring environment

Medical interventions can be intimidating for children, especially when they have experienced traumatic events. Helping the child feel safe in an environment where they are receiving care can have a huge impact on their ability to cope with medical interventions and their experience of pain. Maintaining a natural circadian rhythm by aiming to achieve normal light levels for the time of day will help. Having a daily routine and reducing loud noises and bright lights when possible (particularly at night) helps to promote physiological processes for coping with stressful events, which will improve mood and reduce pain.

Healthcare providers also have an important role in promoting a feeling of safety during their interactions with children they are caring for. Encountering new providers, undergoing medical procedures, being removed from reminders of their individuality and identity can leave children feeling scared and insecure. This affects their ability to engage with treatments and may increase their pain.

Children may not be able to express their feelings clearly and it will not always be obvious that a child feels unease.

Tips for improving a child's ability to cope with stressful experiences

- Normal light levels during the day and night, reduce unnecessary bright light and noise where possible.
- Promote sleep at night (e.g. reduce noise and light if possible).
- Maintain the child's individuality (e.g. allow them to wear their own clothes, bring reminders of home if they want).
- Try to maintain awareness of day and month.
- Maintain some routine for the child as far as possible (e.g. regular bedtime and waking up time).

Tips for healthcare providers to gain a child's trust and engagement

- Announce presence and reason for being there.
- Provide your name and role/job title.
- Confirm the child's name and use it when talking to the child or caregiver.
- Provide age-appropriate and simple explanations for procedures
- Obtain consent before physical interactions.
- Ask if the child has any questions or concerns using open-ended language: e.g. *What questions do you have for me?*
- Create an opportunity for the child to have some choices (even if this is only a choice about how a mandatory intervention WILL happen).
- Try to involve the child in medical decisions so they understand what the plan is. Use age-appropriate and non-technical language.
- Ask the child's ideas, concerns, and expectations regarding treatment.
- Respect personal privacy and their right to autonomy. This must sometimes be balanced with acting in their best interest.

2. Provide a sense of security and comfort

Providing a sense of security and comfort is important for reducing the threat that a child feels when injured and in pain, which may increase cooperation with procedures. When children feel threatened, their pain and distress are likely to be increased. Allowing a child to keep comforting items close to them, such as toys, teddies, comfort blankets, clean and comfortable clothing may help achieve this, but be aware that for some children, reminders of home may be distressing depending on their circumstances. For babies, a pacifier can act as a comforter. Wherever possible, allow family or familiar people to be with the child, particularly during transportation. Activities such as colouring, games and playing with toys helps distract their attention from hostile situations and anxieties by allowing them to engage with being a child.

Checklist: providing a sense of security and comfort

- Keep usual caregiver or familiar people and the child together whenever possible.
- Allow children to always bring comforting items with them, including toys or comforting objects.
- Provide children with clean and comfortable clothes or their own (clean) clothes when possible.
- Provide access to enjoyable activities as resources allow.

3. Engage with spiritual and cultural practices

Children and caregivers should be given the opportunity, space, and time to practice any spiritual or cultural practices that provide comfort and hope. It may be possible to help facilitate these in the hospital by providing space or privacy during these times. If the healthcare provider is comfortable, they can join the family in these practices, which will help build rapport and trust. Healthcare providers should be respectful of the family's preferences around these practices. They can help with pain management by providing a sense of control and hope to the family.

4. Respect the child and be honest

Respecting the child can take many forms.

1. **Space:** It is important to respect the child's personal space by asking their permission to enter it, introducing yourself and your role in their care, and asking for consent before physical contact with them.
2. **Communication:** Children want to be involved in conversations regarding their care, so communicating with the child and in a way in which the child will understand is important. Having conversations with the child's caregiver or standing over them can feel intimidating. When you are talking with a child, get down to their level.
3. **Symptoms:** Listen to the child's symptoms and acknowledge them while showing empathy towards them. This includes pain intensity, and emotions. The child knows their body and how they are feeling better than anyone else.
4. **Preferences and wishes:** Listen and acknowledge the child's ideas, concerns, and expectations. Provide the child with choices to give them a sense of control.
5. **Be truthful:** Do not lie to the child. You should never invalidate their experience of pain or their feelings. Pain is an individual experience and what is not painful for one person may be painful for another. Being honest will increase trust and respect between you. If a procedure is going to hurt, provide options of how to manage their pain.

5. Emotional support and reassurance

Healthcare providers can show emotional support and reassurance to children, their caregivers, and each other during stressful times. Taking time to listen to the child and caregiver's concerns, providing space for them to ask questions and providing reassurance is critical to foster trust and engagement in recovery from injury. Healthcare providers should ask open ended questions to elicit questions (e.g. *'what concerns do you have about this procedure', 'what questions can I answer regarding your recovery?'*).

Children who have experienced a traumatic injury may need reassurance that they are safe. This may be verbal or physical and provided by the caregiver or healthcare provider. Caregivers may need your encouragement or help to do this. Acknowledging to the caregiver and child that they are going through a difficult and stressful time can provide emotional support and encouragement to engage in treatment.

Healthcare providers may also want to consider how they can emotionally support each other whilst treating children in stressful environments. Holding debrief sessions after the end of shift or mentor/buddy programmes to discuss any distressing cases with another member of the team are extremely valuable and may help prevent burnout.

6. Distraction

There is high-quality evidence that distracting children of any age can help reduce pain perception. Distraction should be age-appropriate and could include blowing bubbles (toddlers), watching screens, colouring, listening to music, playing games, or engaging in any other activity that the child enjoys. This can also help to manage the child's anxiety and distress.

Storytelling and narrative distraction

Use stories to engage the child's mind and imagination. Create or tell stories, possibly incorporating the child's own experiences or favourite characters.

7. Relaxation

Pain increases sympathetic nervous system activity, making the child more tense, and increasing their perception of painful experiences. Relaxation can be used to reduce this. There are different types of relaxation exercises healthcare providers can engage in, such as breathing exercises, guided imagery, or playing music.

Guided imagery

If the child feels able encourage them to close their eyes and take deep breaths as you guide them through a calming visualization. This could be blowing bubbles, floating on a cloud, or walking on a beach. Ask the child what is calming for them.

Breathing exercises

Asking the child to take deep breaths can help them to relax and provide a sense of control and focus. Use one of the two diagrams below to guide you. The healthcare provider or caregiver can model the breathing exercises to help the child.

Figure 21: *Paced breathing*

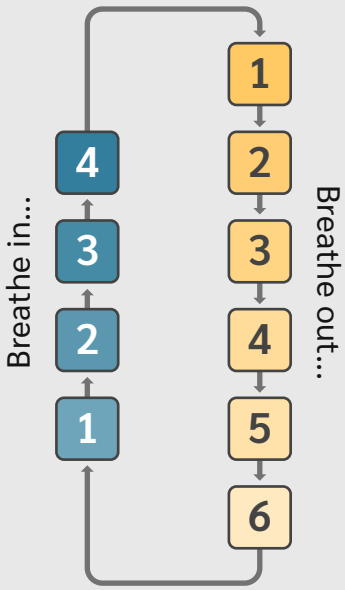
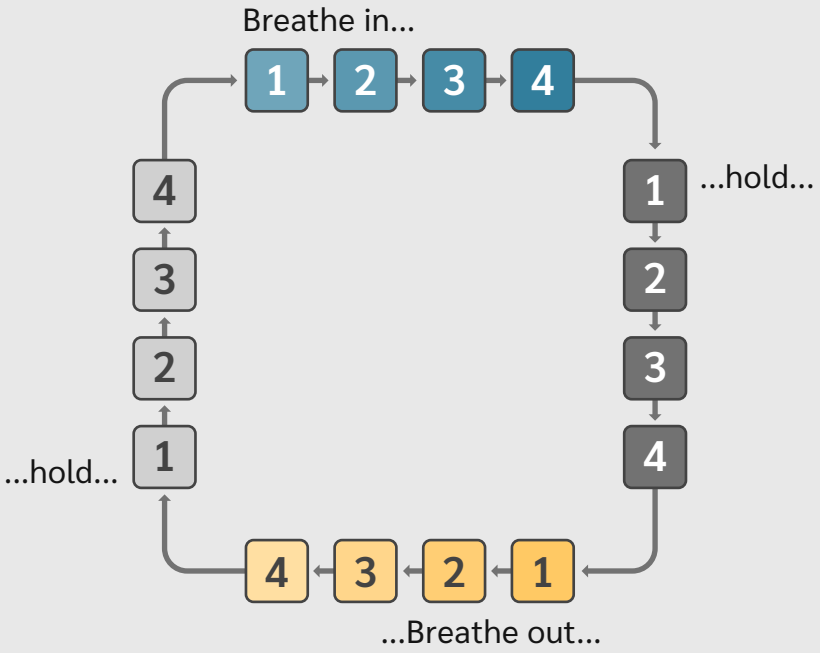


Figure 22: *Square breathing*



8. Positive reinforcement

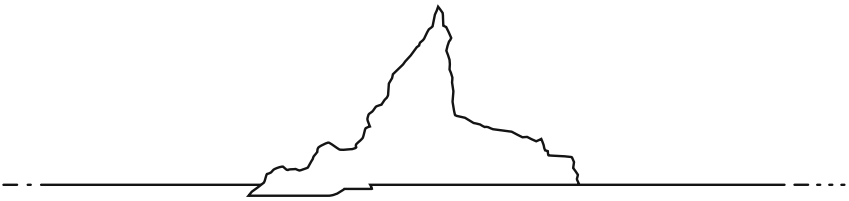
Healthcare providers should positively reinforce children's behaviours that are helping them to be calm and manage their pain. This can be achieved by recognising that the child is in a stressful situation or experiencing pain and recognising what they are doing to help with this (e.g. deep breathing, distraction, staying calm, staying still during a procedure). Healthcare providers should praise the child for their role in delivering their care and how well they are coping. This will boost the morale of the child and let them know that you appreciate their effort, encouraging them to repeat this in the future.

Healthcare providers can also positively reinforce the role that caregivers play in caring for their child. Recognising positive behaviours such as comforting the child, doing deep breathing with them during painful procedures, or providing distraction. Caregivers may be unsure of how they can help a child in these situations, and positively reinforcing their behaviours will give them the confidence to be actively engaged in their care.

9. Communication

Communication is critical in any healthcare interaction. Where possible, children should be communicated with so that they can understand the message, decision, or options available to them. Healthcare providers should take care not to stand over the child when talking to them, as it can make them feel crowded, unsafe, and it can be intimidating. Effective communication will:

- Increase rapport and trust between the healthcare provider, the child, and caregivers.
- Improve engagement with treatment and treatment goals.
- Increase patient knowledge and empower them to ask questions about their care.



2024

This guide has been produced by
Paediatric Blast Injury Partnership UK with:

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This manual and *Paediatric Blast Injury Field Manual* can be downloaded here: