3 Suction systems and suction catheters, both electrical and manual (ideally wall suction).
4 Pulse oximeters and ECG monitors (one for each bed).
5 Resuscitation trolley containing drugs and equipment (particularly oropharyngeal airways, laryngoscopes with spare bulbs, endotracheal tubes and introducers, bag-valve-masks (child and adult), masks with reservoir bags.
6 Mobile screens.
7 Mobile oxygen cylinders and one oxygen concentrator for each bed, with face masks and nasal cannulae (infant, child and adult).
8 Wall sockets (six per bed).
9 One basic infant ventilator and one child/adult ventilator.
10 Nasal or mask CPAP systems (neonatal, child and adult).
11 Two automatic external defibrillators (AEDs).
12 Infusion pumps (if there are sufficient staff).
13 IV drip stands.
14 Basic CVP monitoring system.
15 Blood warmer (ideally).
16 Fridge for pharmacy drugs.
17 Fridge for blood for transfusion.
18 Lockable cupboard for drugs not needing refrigeration.
19 Metal lockable cupboard for controlled drugs.
20 Cupboard for storing IV fluids.
21 End-of-bed chart tables and specially designed high-dependency care charts.
22 One portable ultrasound scanner.
23 One portable fetal heart monitor.
24 Burette giving sets.
25 Portable examination light.
26 Portable fans.
27 Suitable storage boxes (preferably easy to clean and label).
28 Blackboard for documenting priority issues for each patient.
29 Wall-mounted pathways of care.
30 Hand wash facilities.
31 Separate sluice and patient and staff toilet and washing facilities.
32 Steriliser.

For details of procedures that are likely to be used in high-dependency care, see Section 2.13 (on obstetrics) and Section 7 (on children and all-age trauma).

### 1.15 Pain control in pregnancy and childhood

#### Introduction

It is ethically wrong and a failure of professional duties for any patient to suffer uncontrolled pain.

- Uncontrolled pain has adverse cardiovascular, respiratory, immunological and metabolic consequences, as well as long-term psychological effects.
- Both pharmacological and non-pharmacological approaches are valuable in both acute and chronic pain.
- Attempts should be made to anticipate and prevent pain rather than trying to relieve it when it is established. This method usually results in less analgesia being needed. ‘As-required’ regimens should be avoided. Analgesics should be used in regular and adequate doses.
- There is little place for IM pain relief, particularly as a repeated treatment. Many patients would rather suffer and hide their pain than receive IM analgesia.
- If a conscious child has to be restrained for a procedure, this must be done kindly but firmly by a person or persons (ideally a parent or caregiver) and not by contraptions such as straitjackets or the tying down of limbs.
- It is vital to ask for and value the patient’s own judgement concerning the adequacy of pain relief provided.
- When beginning a course of treatment for pain it is important to realise that such treatment may continue for a long time. Pain must be controlled quickly from the onset to ensure confidence in treatment, with an emphasis on preventative measures.

#### Assessment of pain

- Establish the severity of pain that is being experienced.
- Help to select the right amount and type of pain relief.
- Indicate the success of pain management.

#### Methods for assessing pain

- Description by the patient (self-reporting), possibly involving the use of a self-report scale (see Figures 1.15.1 and 1.15.2).
- Observation of behavioural changes (e.g. crying, guarding of the injured part, facial grimacing). This method is best for children in collaboration with carers. The Alder Hey Triage Pain Score may be useful in this context (see Appendix on p. 80).
- Physiological changes (e.g. vasoconstriction, tachycardia, tachypnoea). However, these can also be due to serious medical causes.
- Expectation of pain because of the pathophysiology involved (e.g. obstructed labour, placental abruption, fracture, burn or other significant trauma).
- Keeping a diary of long-term pain.

![Visual scale for assessing the severity of pain](image-url)
Problems with assessing pain
- Suffering being hidden by a frightened patient, especially a child.
- Difficulty in differentiating anxiety from pain.
- Family members (and healthcare professionals) may underestimate or overestimate pain.
- Pre-verbal and non-verbal children (and any older patient with learning difficulties or with sensory handicap) may not be able to adequately express their need for pain control.
- Cultural factors (beliefs, perceptions and behaviour).

Treatment of pain
Many patients, particularly babies and children, are undertreated for pain because of:
- Fear of the harmful side effects of medications
- Failure to accept that children feel pain in the same way that adults do
- Fear of receiving IM injections
- Limited availability of the required spectrum of pain medications.

Methods for reducing pain without drugs

Environmental factors
Negative aspects of the environment should be minimised or removed. These include an overly ‘clinical’ appearance, and evidence of invasive instrumentation. Needles should be kept out of sight. An attractive, decorated environment with toys, mobiles and pictures may help the child to feel more relaxed.
- Privacy is important.
- Pain caused by fractures can be reduced by splinting to immobilise them.
- Pain from burns can be reduced by applying a light covering.
- Parents should be present with their child during invasive procedures, unless there are very good medical reasons why they should be excluded, or they choose not to be present.

Supportive and distractive techniques for children
Age-appropriate distraction strategies include:
- The presence of familiar objects (comforters) (e.g. pillow, soft cuddly toy)
- Singing, concentrating on nice things, jokes, games and puzzles
- Imaginary journeys
- Blowing soap bubbles
- Breathing out (but not hyperventilation, which may increase anxiety)
- A mirror that allows the child to see the view through a nearby window
- Listening to stories or music.

Drug treatment for pain using local anaesthetic drugs

Infiltration (the most widely used method)
Lidocaine 0.5–2%
- Used for rapid and intense sensory nerve block.
- Onset of action is within 2 minutes; the procedure must not be started until an anaesthetic effect is evident.
- Effective for up to 2 hours.
- Doses:
  - Neonates to 12 years: maximum dose given locally 3 mg/kg – 0.3 mL/kg of 1% solution or 0.6 mL/kg of 0.5% solution (7 mg/kg with 1 in 20000 adrenaline)
  - Children over 12 years and pregnant mothers: up to a maximum of 200 mg (500 mg if used with adrenaline) not more than 4-hourly.
- Adrenaline is rarely added in children and never for digits.
- Strength: 1% or 0.5%.
- Preparation of lidocaine 0.5% solution. Combine:
  - Lidocaine 1%, 1 part
  - Ringer-lactate or Hartmann’s solution or sterile distilled water, 1 part.

Do not use local anaesthetic containing adrenaline in areas served by an end artery or with a poor blood supply (e.g. finger, toe, penis), as tissue necrosis will occur.

Advantages of adding adrenaline include the following:
- Less blood loss
- Longer effect of anaesthetic (usually 1–2 hours)
- Lower risk of toxicity because of slower absorption into the general circulation.

The concentration of adrenaline to use is 1:200,000 (5 micrograms/mL). In children, the maximum dose of adrenaline is 5 micrograms/kg.

Note: It is critical to measure adrenaline carefully and accurately using a 1-mL or, at the most, 2-mL syringe. (An insulin syringe may be used if a regular 1-mL syringe is not available.) Mixtures must be prepared observing strict infection prevention practices.

<table>
<thead>
<tr>
<th>Desired amount of local anaesthetic needed (mL)</th>
<th>Ringer-lactate or Hartmann’s solution (mL)</th>
<th>Lidocaine 1% (mL)</th>
<th>Adrenaline 1:1000 (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>10</td>
<td>10</td>
<td>0.1</td>
</tr>
<tr>
<td>40</td>
<td>20</td>
<td>20</td>
<td>0.2</td>
</tr>
<tr>
<td>100</td>
<td>50</td>
<td>50</td>
<td>0.5</td>
</tr>
<tr>
<td>200</td>
<td>100</td>
<td>100</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Local infiltration into an abscess is not recommended, because local anaesthetics are ineffective in inflamed tissues.
Complications of local anaesthesia

Prevention of complications

- If more than 40 mL of 0.5% lidocaine are to be used, add adrenaline as described above. Procedures that may require more than 40 mL of 0.5% lidocaine are Caesarean section and repair of extensive perineal tears.
- Use the lowest effective dose.
- Inject slowly.
- Avoid accidental injection into a vessel. There are three ways of doing this:
  - the moving needle technique (preferred for tissue infiltration): the needle is constantly in motion while injecting, which makes it impossible for a substantial amount of solution to enter a vessel
  - the plunger withdrawal technique (preferred when considerable amounts are injected into one site): the syringe plunger is withdrawn before injecting, and if blood appears the needle is repositioned and another attempt is made
  - the syringe withdrawal technique: the needle is inserted and the anaesthetic is injected as the syringe is being withdrawn.

Symptoms and signs of lidocaine allergy and toxicity

Lidocaine can be absorbed through mucous membranes in a large enough dose to be toxic.

Symptoms of allergy: shock, redness of skin, skin rash/hives, bronchospasm, vomiting, serum sickness (see Sections 2.7.C and 5.1.B on anaphylaxis in mothers and children, respectively).

<table>
<thead>
<tr>
<th>Mild toxicity</th>
<th>Severe toxicity</th>
<th>Life-threatening toxicity (very rare)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbness of lips and tongue</td>
<td>Sleepiness</td>
<td>Tonic–clonic convulsions</td>
</tr>
<tr>
<td>Metallic taste in mouth</td>
<td>Disorientation</td>
<td>Respiratory depression or arrest</td>
</tr>
<tr>
<td>Dizziness/lightheadedness</td>
<td>Muscle twitching and shivering</td>
<td>Cardiac depression or arrest</td>
</tr>
<tr>
<td>Ringing in ears</td>
<td>Slurred speech</td>
<td></td>
</tr>
<tr>
<td>Difficulty in focusing eyes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Adrenaline toxicity

This is caused by excessive amounts or inadvertent IV administration, and results in:

- restlessness
- sweating
- hypertension
- cerebral haemorrhage
- rapid heart rate
- cardiac arrest.

Bupivacaine 0.25%

- This is used to provide longer-lasting local anaesthesia.
- Onset of action is up to 30 minutes.
- It is effective for up to 8 hours.
- Maximum dosage is 2 mg/kg (in mothers the pre-pregnant weight is used for calculations).

For uses of other preparations of bupivacaine, see Section 1.24.

Local anaesthetics given through the surface of the skin or mucous membranes

1 Lidocaine: apply on gauze to painful mouth ulcers before feeds (apply with gloves, unless both the family member and the patient are HIV-positive, in which case the family member does not need protection from infection). It acts within 2–5 minutes.

2 TAC (tetracaine–adrenaline–cocaine): apply to a gauze pad and place over open wounds; it is particularly useful when sutting. Care needs to be taken close to mucous membranes to avoid toxicity from absorption of cocaine. If available, other topical anaesthetic agents such as lidocaine–adrenaline–tetracaine seem to be equally effective and avoid the potential toxicity associated with cocaine.

Systemic drug treatment for pain

The World Health Organization (WHO) has altered the previous three-step approach to the treatment of pain, removing the use of codeine between Step 1 and Step 2 (see Figure 1.15.3). Although widely available, codeine is unpredictable in its effects, due to its very variable metabolism between individuals, with the potential for both toxicity and inadequate analgesia. It is now recommended that if Step 1 drugs do not control pain, morphine should be used next.

Non-opioid analgesics

Paracetamol

- This is the most widely used analgesic and anti-pyretic.
- It does not cause respiratory depression.
- It is dangerous in overdose but a very safe and effective drug if used in recommended doses.
- It is given by mouth, rectally or intravenously.
  - The maximum daily dose should not be given for more than 3 days.
  - Caution is needed in patients with liver impairment.
  - There are no anti-inflammatory effects.
  - Paracetamol can be combined with NSAIDs and both have a morphine-sparing effect, lowering the dose, and therefore severity of side effects of morphine.
Non-steroidal anti-inflammatory drugs (NSAIDs) (e.g. ibuprofen, diclofenac)

- These are anti-inflammatory, anti-pyretic drugs with moderate analgesic properties.
- They are less well tolerated than paracetamol, causing gastric irritation, platelet disorders and bronchospasm.
- They should be avoided in patients with gastric ulceration, platelet abnormalities or significant asthma.
- NSAIDs are especially useful for post-traumatic and bone pain because of their anti-inflammatory effect.
- They are given by the oral or rectal route (e.g. diclofenac).

Caution: do not give NSAIDs in the third trimester of pregnancy, as they may close the ductus arteriosus and predispose to pulmonary hypertension of the newborn. They may also delay the onset and progress of labour.

There is a risk of gastric haemorrhage through whichever route the NSAIDs are given.

Opiate analgesics

For a discussion of the importance of properly storing, handling and monitoring the use of morphine, see Section 1.6.

**Morphine**

- Morphine is the most important drug in the world for pain control, and the WHO recommends that it should be universally available.
- In resource-limited countries it is mostly administered orally, which is useful for chronic or anticipated pain but less effective for acute pain. The latter requires IV administration of morphine.
- At an appropriate dose, analgesia occurs without impaired consciousness.
- Nausea and vomiting are rare with oral treatment, but when morphine is given intravenously for the first time it may produce this side effect.

**Intravenous use of morphine**

- In single doses it has minimal haemodynamic effects in a supine patient with normal circulating blood volume.
- In hypovolaemic patients it can contribute to hypotension. Therefore:
  - monitor the patient’s cardiovascular status
  - have an IV fluid bolus of Ringer-lactate or Hartmann’s solution ready (20 mL/kg for a child and 500 mL to 1 litre for pregnant mothers).
- In excessive dosage it can produce a dose-dependent depression of ventilation and decreased respiratory rate, leading to apnoea.
- Patients who are receiving morphine in hospital (where it is often intravenously administered) need observation and/or monitoring of respiratory rate and sedation.
- Morphine is better controlled by the IV than the IM route. If using the IV route, give a small dose initially and repeat every 3–5 minutes until the patient is comfortable. Individuals vary widely with regard to the dose needed to provide pain relief. **It is rarely appropriate to give morphine intramuscularly.** and for patients who are in shock, giving morphine IM is dangerous, as it can be initially poorly absorbed, and then quickly absorbed when perfusion improves, potentially leading to too high a blood level of the drug.
- Morphine can also be given by subcutaneous infusion in hospital (e.g. as a post-operative analgesic), especially if small battery-operated syringe drivers are available.
- Intravenous morphine can be dangerous in situations of raised intracranial pressure without the means to provide respiratory support.
- During late pregnancy or delivery, morphine can cause respiratory depression in the neonate.

**TABLE 1.15.3 Orally administered drugs for mild or moderate pain**

<table>
<thead>
<tr>
<th>Medicine</th>
<th>Neonate 0–29 days</th>
<th>Infant 30 days to 3 months</th>
<th>3 months to 12 years</th>
<th>Maximum daily dose</th>
<th>In pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paracetamol</td>
<td>10 mg/kg every 6–8 hours Maximum 4 doses in 24 hours 5 mg/kg if jaundiced</td>
<td>10 mg/kg every 4–6 hours</td>
<td>15 mg/kg up to 1 g every 4–6 hours Maximum 4 doses/4 g in 24 hours</td>
<td>4 doses in 24 hours 500 mg to 1 g 6-hourly</td>
<td></td>
</tr>
<tr>
<td>Ibuprofen</td>
<td>Not recommended</td>
<td>Not recommended</td>
<td>5–10 mg/kg every 6 hours</td>
<td>40 mg/kg/day Do not use in pregnancy</td>
<td></td>
</tr>
<tr>
<td>Diclofenac</td>
<td>Not recommended</td>
<td>Not recommended</td>
<td>Over 6 months 0.3–1 mg/kg 3 times daily</td>
<td>3 mg/kg/day Do not use in pregnancy</td>
<td></td>
</tr>
</tbody>
</table>
Naloxone
Naloxone is an opiate antagonist that reverses the sedative, respiratory-depressive and analgesic effects of morphine, and so should be given to treat morphine overdose.

Preparations of non-opioid drugs:
Paracetamol: oral suspension, 120 mg/5 mL, 250 mg/5 mL; tablets, 500 mg.
Ibuprofen: oral suspension, 100 mg/5 mL; tablets, 200 mg, 400 mg.

| TABLE 1.15.4 Intravenous paracetamol for mild or moderate pain |
|----------------------|----------------------|----------------------|
| Age/weight | Dose | Maximum dose in 24 hours |
| Preterm over 32 weeks | 7.5 mg/kg every 8 hours | 25 mg/kg |
| Term neonate | 10 mg/kg every 4–6 hours | 30 mg/kg |
| Pregnant woman or child less than 50 kg body weight | 15 mg/kg every 4–6 hours | 60 mg/kg |
| Pregnant woman or child more than 50 kg body weight | 1 g every 4–6 hours | 4 g |

Intravenous paracetamol
- Paracetamol IV is formulated as a 10 mg/mL aqueous solution (in ready-to-use 50 mL and 100 mL vials for infusion over 15 minutes).
- It is useful, effective and safe.
- The peak analgesic effect of IV paracetamol occurs within 1 hour, with a duration of approximately 4–6 hours.
- Ensure that the correct dose is given, as serious liver toxicity can occur in overdose.

| TABLE 1.15.5 WHO advice: oral and rectal morphine for severe pain in hospital |
|----------------------|----------------------|----------------------|
| Age | Dose | Interval |
| 1 month to 1 year | 80–200 micrograms/kg | Every 4 hours |
| 1–2 years | 200–400 micrograms/kg | Every 4 hours |
| 2–12 years | 200–500 micrograms/kg | Every 4 hours |
| Over 12 years and in pregnancy | 5–10 mg | Every 4 hours |

Note: the upper doses seem quite high – if a child weighs 20 kg, they would be receiving 10 mg – the same as an adult.

We suggest that you start with the lower dose and give more frequently, e.g. every hour if needed, until the patient is comfortable, then increase the dose if morphine needs to be given every hour. The Table immediately below (Table 1.15.6) already has lower doses.

Almost all patients with chronic pain can be managed with oral morphine when this is given in the doses shown in Tables 1.15.6 and 1.15.7 in combination with non-opioid analgesics.

These are starting doses and can be increased as necessary on an individual patient basis if pain is not controlled.

| TABLE 1.15.6 British National Formulary (BNF) and BNF for Children (BNFc) recommended doses for oral and rectal morphine |
|----------------------|----------------------|----------------------|
| Age | Initial dose (adjust according to response) | Interval |
| 1–3 months | 50–100 micrograms/kg | Every 4 hours |
| 3–6 months | 100–150 micrograms/kg | Every 4 hours |
| 6–12 months | 200 micrograms/kg | Every 4 hours |
| 1–2 years | 200–300 micrograms/kg | Every 4 hours |
| 2–12 years | 200–300 micrograms/kg | Every 4 hours |
| 12–18 years | 5–10 mg | Every 4 hours |
| Adults/pregnant mothers | 5–10 mg | Every 4 hours |

Diclofenac: tablets, 25 mg, 50 mg; dispersible tablets, 10 mg.

Notes on ibuprofen and diclofenac
- Do not use in patients less than 1 year old, or in pregnancy.
- Caution is needed in patients with asthma, liver or renal failure.
- Contraindications include dehydration, shock, bleeding disorders and hypersensitivity to aspirin.
- NSAIDs and paracetamol can be used in combination.

If rectal drugs are available, the doses are similar to oral doses.
Preparations of morphine
1 Prepared mixture:
   - 10 mg/5 mL
   - 30 mg/5 mL
   - 100 mg/5 mL.
2 Morphine oral solutions can be made by dissolving powder in clean water, and are available in Africa at concentrations of 5 mg/5 mL, 50 mg/5 mL and 100 mg/5 mL.
3 Tablets: 10 mg, 20 mg and 50 mg.
4 Suppositories: 15 mg and 30 mg.
5 Slow-release tablets: 10 mg, 30 mg, 60 mg and 100 mg.
6 Slow-release suspension sachets: 5 mg, 20 mg, 30 mg, 60 mg, 100 mg and 200 mg.

Note: See Section 1.16 on palliative care for use of morphine at home.

Parenteral morphine
IV morphine is only needed if oral or rectal preparations are not going to be absorbed (e.g. in shock) or where rapid emergency onset is needed. IV morphine is potentially less safe, especially if staff shortages mean that the correctly calculated dose is not given.

TABLE 1.15.7 Intermittent IV (bolus) morphine dosage*

<table>
<thead>
<tr>
<th>Age</th>
<th>Dose</th>
<th>Interval</th>
<th>Maximum dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neonate</td>
<td>25–50 micrograms/kg</td>
<td>Every 6 hours</td>
<td></td>
</tr>
<tr>
<td>1–6 months</td>
<td>100 micrograms/kg</td>
<td>Every 6 hours</td>
<td>2.5 mg/dose</td>
</tr>
<tr>
<td>6 months to 2 years</td>
<td>100 micrograms/kg</td>
<td>Every 4 hours</td>
<td>2.5 mg/dose</td>
</tr>
<tr>
<td>2–12 years</td>
<td>100–200 micrograms/kg</td>
<td>Every 4 hours</td>
<td></td>
</tr>
<tr>
<td>Over 12 years and in pregnancy</td>
<td>10 mg</td>
<td>Every 4 hours</td>
<td></td>
</tr>
</tbody>
</table>

* We suggest that the total dose recommended is drawn up in 10 mL 0.9% saline and that 2 mL boluses of this solution are given every 3–5 minutes until the patient is comfortable. Also, if pain returns despite regular paracetamol/nonsteroidal analgesia, further dose of oral/IV morphine can be given within 6 hours if the respiratory rate is normal and the patient is not sedated.

Intravenous infusion of morphine requires continuous monitoring including oxygen saturation and respiratory rate and sedation score every 5 minutes for the first 15 minutes after start of the infusion and every 15 minutes subsequently for one hour and at least every 30 minutes after that. It should only be undertaken in a high dependency care situation. In resource limited situations, intermittent IV boluses as in Table 1.15.7 are safer.

Monitoring during morphine administration:
Side effects occur only in overdose and should not be seen at the doses stated here. They include the following:
1 Respiratory depression. If the respiratory rate is:
   - < 20 breaths/minute in patients aged less than 6 months
   - < 16 breaths/minute in those aged less than 2 years
   - < 14 breaths/minute in those aged 2–10 years
   - < 12 breaths/minute in those aged 10–18 years and in pregnant mothers
   alert medical staff and ensure that bag-valve-mask and naloxone are available.
   Monitor SaO₂ as appropriate (it should be higher than 94% in air).
2 Constipation. Use prophylactic laxatives.
3 Monitor for urinary retention.
4 Patients with liver and renal impairment may need lower doses and longer time interval between doses. Caution in patients with head injuries.
Always ventilate with bag-valve-mask first if patient is unresponsive before giving naloxone. This is because arrhythmias and pulmonary oedema can be caused if naloxone is given to a patient with high blood carbon dioxide concentrations.

Naloxone doses to reverse opioid induced respiratory depression
1 Neonate to 1 month of age: 5–10 microgram/kg repeated every 2–3 minutes until adequate response
2 1 month to 12 years of age: 5–10 microgram/kg, subsequently 100 mcg/kg
3 12 to 18 years and in pregnancy: – 0.2–2.0 mg/kg. Repeat at intervals of 2–3 minutes to a maximum of 10 mg.

If respiratory rate is low, but the patient’s oxygen saturation is acceptable (>94%) with facemask oxygen, in order to avoid complete reversal of analgesia draw up 400 microgram naloxone into 20 mL and give 1–2 mLs every 2 minutes until the patient is rousable and the respiratory rate increased to an appropriate rate for age.

Preparations of naloxone: Ampoule 20 microgram/mL
Give IV or IM if IV is not possible. Repeat after 2–3 minutes if there is no response; the second dose may need to be much higher (up to 100 micrograms/kg). An IV infusion may be needed if protracted or recurrent depression of respiration occurs because naloxone is short acting compared with most opioids.

Starting dose for naloxone infusion: 60% of the dose that maintained adequate respiration for 15 minutes.
Alternatively: Neonate – 5 to 20 microgram/kg/hour, adjusted according to response; 1 month to 18 years and in pregnancy – 5 to 20 microgram/kg/hour.
(For the newborn, to treat respiratory depression due to maternal opioid administration during labour or delivery 200 microgram as a single IM dose is recommended or 60 microgram/kg.)
Prevention and treatment of nausea and vomiting due to initial high-dose morphine

1. Cyclizine. This covers the widest range of causes of nausea and vomiting with the least side effects. It is not recommended orally in children < 2 years and rectally < 6 years.

   The IV doses are:
   - 1 month to 6 years: 500 microgram to 1 mg/kg 8 hourly
   - 6 to 12 years: 25 mg 8 hourly
   - 12 to 18 years and in pregnancy: 50 mg 8 hourly

2. Domperidone – where gastric emptying is a problem, then as in Table 1.15.8 for doses.

TABLE 1.15.8 Domperidone for prevention and treatment of nausea and vomiting

<table>
<thead>
<tr>
<th>Domperidone</th>
<th>Oral</th>
<th>Rectal</th>
</tr>
</thead>
<tbody>
<tr>
<td>From 1 month up to 35 kg in a child:</td>
<td>Not recommended for children weighing &lt; 15 kg</td>
<td>Children weighing 15–35 kg, 30 mg twice daily</td>
</tr>
<tr>
<td>250–500 microgram/kg 3–4 times daily, up to a maximum of 2.4 mg/kg in 24 hours</td>
<td>Children weighing &gt; 35 kg or in pregnant mothers, 60 mg twice daily</td>
<td>Suppositories, 30 mg</td>
</tr>
<tr>
<td>Over 35 kg and in pregnant mothers:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10–20 mg 3–4 times daily, up to a maximum of 80 mg daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tablets, 10 mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suspension, 5 mg/5 mL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Both of the above can cause extrapyramidal side effects, including acute dystonia, which can be treated with diazepam IV 100 microgram/kg, or, if over 12 years and in pregnancy, 5–10 mg IV.

Specific clinical situations in which analgesia may be required

Invasive procedures

- These are often painful, undignified, or both. Ideally they should be undertaken in a treatment room so that other patients are not frightened by the procedures, and so that the patient’s bed-space remains a safe place that is not associated with such events.
- Such procedures often have to be repeated. Therefore provide optimal treatment on the first occasion in order to reduce the likelihood of dread of future procedures.
- Fear is often the main emotion that needs to be addressed, so explain each step.
- Both pharmacological and non-pharmacological methods should be used.
- For major procedures that require powerful analgesia/sedation, two healthcare workers should be present – one to perform the procedure and the other to administer analgesia and sedation and ensure that the airway is maintained.
- Major procedures include chest drain insertion and repeated lumbar puncture. Such procedures may be best undertaken under general anaesthesia or ketamine if this can be given safely (which may not be the case in resource-limited countries).
- For venous cannulation, size-appropriate catheters must be available. For example, it is not appropriate to use an 18- or 20-gauge cannula in a neonate. Although the use of local anaesthetic creams (e.g. EMLA) prior to cannulation represents best practice, they are expensive. In some circumstances, the urgency of the situation will not allow use of local anaesthetic creams.
- Give analgesics at an appropriate time before the procedure (30 minutes beforehand for IM and 30–60 minutes beforehand for oral medication depending on the drug used) aiming for maximal effect during the procedure.
- Check the level of anaesthesia by pinching the area with forceps. If the patient feels the pinch, wait 2 minutes and then retest.
- Wait a few seconds after performing each step or task for the patient to prepare for the next one.
- Handle tissue gently and avoid undue retraction, pulling or pressure.
- Talk to the patient throughout the procedure.

Analgesia during labour

For severe pain, give morphine bolus 2.5–5 mg and repeat once after 5 minutes if the pain is not controlled. Then wait 2–4 hours before repeating.

Nitrous oxide plus oxygen can be effective in reducing pain during labour (see Section 2.3).

Barbiturates and sedatives should never be used to relieve anxiety in labour.

Severe pain

- Severe pain is likely to occur in obstetric emergencies, post-operatively, and in patients with major trauma, significant burns, or displaced or comminuted fractures.
- Give IV morphine as described in Table 1.15.6.
- A further dose can be given after 5–10 minutes if sufficient analgesia is not achieved.
- Monitor ABC (heart rate, respiratory rate, chest wall expansions, blood pressure, SaO₂).
- Have IV Ringer-lactate or Hartmann’s solution available (20 mL/kg for children and 500 mL to 1 litre for pregnant mothers as a bolus if hypotension occurs following IV morphine injection: this is unusual).
- Ketamine could be used as an alternative.

Head injuries

- An analgesic dose does not necessarily cause sedation.
- If the patient is conscious and in pain, the presence of a potential deteriorating head injury is not a contraindication to giving morphine. Give IV up to a maximum dose of 100 micrograms/kg for a child or 5 mg for a pregnant mother.
- If the patient’s conscious level does deteriorate, assess ABC. If hyperventilation occurs, ventilate with a bag-valve-mask.
- If necessary, a dose of naloxone will help to distinguish whether reduced conscious level is due to morphine or increasing intracranial pressure, as it will reverse the effects of the morphine, including the analgesic effect.

Pre-operative management

This should include patient assessment, including a history of previous painful experiences from the patient and family (the parents of a child). The following questions should be asked.
- What sort of painful things have happened in the past?
Pain management in high-risk situations

- How does the patient usually react to sudden pain? And to chronic pain?
- Does the patient tell you (or others) if he or she is in pain?
- What does the patient do to get relief from pain?
- Which actions appear to be most effective?

**Pain management during surgery**

- Morphine/NSAIDs can reduce post-operative pain (but do not give NSAIDs to pregnant patients).
- Consider wound infiltration with bupivacaine or lidocaine.
- Use local or regional anaesthetic as part of the overall strategy (see Section 1.24).

Prophylactic anti-emetics for children aged 4 years or older and in pregnancy when morphine is part of the post-operative pain control plan can be very effective (see Table 1.15.10).

**Post-operative pain management**

- Provide analgesia before the pain becomes established; the amount of pain can often be anticipated depending on procedure.
- Use safe and effective doses of morphine along with other analgesics to reduce the amount of morphine required.
- Avoid intramuscular injections.
- Assess, give analgesia, and then reassess.
- Those most at risk of poor pain control are children with limited or no verbal ability.
- If the pain seems to be out of proportion to surgical trauma, consider the possibility of surgical complications and arranged reassessment by surgeons.
- If the patient is asleep, assume that the pain level is acceptable. Don't wake them up to make an assessment, count the respiratory rate and check regularly whether they are still asleep. If they are awake and lying quietly do not assume that they are comfortable without asking them.

**Special issues with regard to pain in the newborn infant**

- Most studies (some of them controlled) have shown that neonates (both premature and full term) react to pain.
- Infants can easily be forced to put up with suffering.
- Small doses should be measured and given with an oral syringe.
- Adequate general anaesthesia, using morphine when needed, should be given for all surgical procedures on neonates.
- Local anaesthetics must be used when they would be used in an older child undergoing the same procedure.

**Pain control during procedures in neonates**

- A sugar-dipped dummy, coated with 2 mL of 25–50% sucrose 2 minutes before the procedure, can be helpful.
- Breastfeeding during procedures may be equally helpful. A sugar-dipped dummy, coated with 2 mL of sucrose 2 minutes before the procedure, can be helpful. If this is not possible, a small dose of sucrose given intranasally may be helpful.
- In all cases, comfort and containment (swaddling) should be provided by a parent or nurse.

**Pain management in high-dependency care**

- Where possible, all invasive procedures should be elective. Every effort should be made to avoid unexpected emergency procedures, such as intubation, by adequate monitoring of airway, oxygenation and chest movement.
- Emergency procedures are frequently extremely painful, dangerous to the patient, and often can be avoided by early recognition of a deteriorating condition (see Section 1.11).
- Muscle relaxants should be avoided if possible and never used unless the patient is pain free, sedated and being ventilated.
- Provide a day/night cycle (uninterrupted natural sleep can reduce the need for analgesia/sedation).
- Ensure that there is minimal noise and low lighting from 8 pm to 8 am.
- Emergency admissions at night should take place away from sleeping patients.
- Monitors should be set to alarm audibly only when this is essential.
- Consider the use of ear plugs, especially when the patient is paralysed.
- Provide human input through voice, touch, music, cuddling, rocking, holding and pacifying.
- Consider the use of distraction, play therapy, relaxation, behavioural techniques, hypnosis and aromatherapy, particularly for patients who are undergoing long-term intensive/high-dependency care.
- Provide privacy whenever possible.
- Be alert for depression after prolonged intensive care.
- Consider the use of methadone and clonidine for the control of morphine and sedation withdrawal after prolonged treatment.

**Sedation**

Sedation is not recommended for use in pregnancy after the first trimester, because of the risks of re-gurgitation and aspiration if the airway is not protected. A health worker skilled in anaesthesia should be asked for advice and help with managing conditions where sedation is being considered.

**Sedation in children**

- This may be useful when added to analgesics for lengthy or repeated procedures. The aim of sedation is to make the procedure more comfortable while allowing verbal contact with the patient to be maintained.
- Start with a small dose IV, wait for 2–3 minutes, observe the response, and repeat the dose if necessary.
- Sedation relieves anxiety but not pain.
- Sedation may reduce a patient's ability to communicate discomfort, and therefore should not be given without concomitant analgesia if there is pain.
- Side effects include hyper-excitability or prolonged sedation, delaying discharge after the procedure.

Sedation and anaesthesia form a spectrum. If you give enough "sedation" you can induce anaesthesia (i.e. loss of consciousness and the inability to feel pain). This is why it is not recommended in pregnancy, because of the increased risk of aspiration of stomach contents into the lungs, causing life-threatening pneumonia.

The fine distinction lies in the ability of the patient to maintain vital functions without assistance, and to respond to being roused (see Table 1.15.9).

Any healthcare worker who is administering a sedative, especially a benzodiazepine, must stay with the patient and have available a bag-valve-mask of suitable size and be able to use it to ventilate the patient if they develop abnormally slow breathing.
TABLE 1.15.9 The differences between sedation and anaesthesia

<table>
<thead>
<tr>
<th>Vital function</th>
<th>Sedation</th>
<th>General anaesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response to being roused</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>Respiration</td>
<td>Rate and depth may be slightly reduced</td>
<td>Rate and depth are markedly reduced or absent</td>
</tr>
<tr>
<td>Swallowing reflex</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>Gag reflex</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>Cough reflex</td>
<td>May be reduced</td>
<td>Absent</td>
</tr>
<tr>
<td>Cardiovascular stability</td>
<td>Mild hypotension may occur</td>
<td>Hypotension should be anticipated</td>
</tr>
</tbody>
</table>

Loss of any of the above reflexes is routine in anaesthetic environments, but should not occur when sedation is being provided.

Minimum information required to prescribe sedation

Anyone who is giving intravenous sedation could inadvertently produce anaesthesia, and must therefore be able to deal with the possible consequences. This means that they must be able to:
- support respiration
- manage and maintain the airway
- use suction appropriately
- intubate if necessary.

High-dependency nursing (see Section 1.14) or perioperative nursing care in the recovery room after surgery is required.

A combination of drugs may give better effects with fewer side effects than continually repeating doses of the same drug (e.g. morphine or ketamine combined with benzodiazepine). Each of the drugs should be given separately and the doses adjusted.

Some patients are difficult to sedate for predictable reasons (e.g. treatment for epilepsy may make the dose required much higher than normal).

Some patients are very resistant to sedation, possibly due to excessive anxiety, so the first dose of sedation may not succeed, and a higher dose may be needed.

Patients who need sedation should have their oral intake restricted as for anaesthesia.

Some children are more vulnerable to the effects of sedation, particularly those with respiratory or upper airway problems, causing complete upper airway obstruction and should not be sedated unless a health worker skilled in anaesthesia/airway management is present.

Sedation in children is difficult and potentially dangerous, and this practice is increasingly being abandoned.

Wherever possible, procedures in children should be done without sedation. Instead ensure that, if possible, a parent or other familiar caregiver can stay with the child to reassure and comfort them. Give good analgesia with ketamine, oral morphine and local anaesthesia, and use skillful restraint to keep the child still. Explain carefully to the child, if they are old enough to understand, what you are doing at each stage of the procedure, to reduce their anxiety and encourage their cooperation.

The minimum information required to prescribe sedation includes the following:
- age and weight if the patient is a child
- the procedure for which sedation is required
- the patient’s previous sedation history
- any other drugs that are being taken
- other major illnesses that affect respiratory function and upper airway competence
- current health status, including coughs, colds and pyrexia
- oral intake status.

TABLE 1.15.10 Patients at risk of airway obstruction/respiratory depression from the effects of sedation

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Underlying cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impaired upper airway Obstruction</td>
<td>Croup</td>
</tr>
<tr>
<td></td>
<td>Foreign body</td>
</tr>
<tr>
<td></td>
<td>Congenital stridor (e.g. Pierre–Robin syndrome, cleft palate)</td>
</tr>
<tr>
<td></td>
<td>Baby with very blocked nose</td>
</tr>
<tr>
<td>Impaired reflexes</td>
<td>Pre-existing neuromuscular problems</td>
</tr>
<tr>
<td></td>
<td>Swallowing difficulties</td>
</tr>
<tr>
<td></td>
<td>Known bulbar problems, especially if combined with reflux</td>
</tr>
<tr>
<td>Impaired central respiratory drive</td>
<td>Head injury</td>
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<tr>
<td></td>
<td>Drug effects (opiates)</td>
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<tr>
<td></td>
<td>Raised intracranial pressure</td>
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<tr>
<td></td>
<td>Impaired level of consciousness</td>
</tr>
<tr>
<td></td>
<td>Encephalopathy (hypoxic, metabolic, infective)</td>
</tr>
<tr>
<td>Impaired respiratory muscle function</td>
<td>Neuropathy and myopathy</td>
</tr>
<tr>
<td></td>
<td>Chronic illness and weakness</td>
</tr>
<tr>
<td></td>
<td>Malnutrition</td>
</tr>
<tr>
<td></td>
<td>Prematurity</td>
</tr>
<tr>
<td>Impaired lung function</td>
<td>Infant</td>
</tr>
<tr>
<td></td>
<td>Hip fracture</td>
</tr>
<tr>
<td>Impaired cardiovascular function</td>
<td>Chest infection</td>
</tr>
<tr>
<td></td>
<td>Pleural effusions</td>
</tr>
<tr>
<td></td>
<td>Chronic lung disease</td>
</tr>
<tr>
<td>Impaired left upper quadrant function</td>
<td>Haemorrhage</td>
</tr>
<tr>
<td></td>
<td>Sepsis</td>
</tr>
<tr>
<td></td>
<td>Drugs</td>
</tr>
</tbody>
</table>

Section 1.15
Sedative drugs commonly used for children
Promethazine (Phenergan)
Give 0.5 mg/kg deep IM or IV or 1–2 mg/kg orally, up to a maximum of 50 mg.

Chloral hydrate
Chloral hydrate is more suitable for younger babies (less than 18 months of age or less than 15 kg), but may paradoxically worsen agitation (e.g. in Down’s syndrome).

<table>
<thead>
<tr>
<th>TABLE 1.15.11 Sedative drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug</td>
</tr>
</tbody>
</table>
| Promethazine Tablets: 10 mg | Oral              | 30 minutes to 1 hour| Up to 12 hours| Not recommended for patients under 2 years of age
Children:
2–5 years, 15–20 mg
5–10 years, 20–25 mg
10–18 years, 25–50 mg |
| Promethazine Liquid injection: 25 mg/mL | Slow IV or deep IM injection | 30 minutes to 1 hour | Up to 12 hours | I month to 12 years:
0.5–1 mg/kg (up to a maximum of 25 mg) 12–18 years: 25–50 mg |
| Chloral hydrate Liquid: 100 mg/mL Suppositories: 100 mg and 500 mg | Oral or rectal | 30 minutes to 1 hour | 1–2 hours | Neonates to 12 years old:
30–50 mg/kg
12–18 years: 45–60 mg
Maximum dose 1 g |

Management of long-term pain and pain during terminal care
This is discussed in Section 1.16.

Appendix: Alder Hey Triage Pain Score
Cry/voice
Score 0: Child is not crying and, although they may be quiet, they are vocalising appropriately with carer or taking notice of surroundings.
Score 1: Child is crying but consolable/distractible or is excessively quiet and responding negatively to carer. On direct questioning the child says it is painful.
Score 2: Child is inconsolable, crying and/or complaining persistently about pain.

Facial expression
Score 0: Normal expression and affect.
Score 1: Some transient expressions that suggest pain/distress are witnessed, but less than 50% of the time.
Score 2: Persistent facial expressions suggesting pain/distress more than 50% of the time.

Posture
This relates to the child’s behaviour towards the affected body area.
Score 0: Normal.
Score 1: Exhibiting increased awareness of the affected area (e.g. by touching, rubbing, pointing, sparing or limping).
Score 2: Affected area is held tense and defended so that touching it is deterred; non-weight-bearing.

Movement
This relates to how the child moves their whole body.
Score 0: Normal.
Score 1: Movement is reduced or the child is noted to be restless/uncomfortable.
Score 2: Movement is abnormal, either very still/rigid or writhing in agony/shaking.

Colour (applicable only to children with paler skins)
Score 0: Normal.
Score 1: Pale.
Score 2: Very pale ‘green’, the colour that can sometimes be seen with nausea or fainting – extreme pallor.

Further reading
Freedom from Pain. Pharmacists working with doctors and nurses to secure this human right in Africa. A publication of Hospice Africa Uganda, PO Box 7757, Kampala. Email: info@hospiceafrica.org.ug