day IVI. Therefore, 1 mg/day of morphine sulphate IVI = 3 mg/day p.o. If the patient receives morphine sulphate 45 mg/day IVI, 3 × 45 mg = 135 mg/day p.o. is needed. What is the equivalent of oral oxycodone? The oral MME of oxycodone = 1.5. Therefore, the oxycodone dose is 135 mg/1.5 mg/day = 90 mg/day. Or, from Table I, it is seen that morphine sulphate 3 mg/day IVI = oxycodone 3 mg/day IVI. But oxycodone has an oral MME = 1.5. Therefore, the oral dose of oxycodone is 3 × 45/1.5 mg/day = 90 mg/day.

Table I: Oral and IV MME

Drug	MME p.o. to p.o.	MME IV to p.o.
Codeine phosphate	0.13 mg/day	Not IVI
Tramadol	0.15 mg/day	0.1 mg/day
Tapentadol	0.4 mg/day	-
Morphine sulphate	1 mg/day	3 mg/day
Oxycodone HCl	1.5 mg/day	3 mg/day
Buprenorphine	35.5 mg/day	75 mg/day

13.3 Acute pain in the emergency department

In South Africa, patients with acute painful conditions may report to an outpatient or emergency department. In the private sector, these departments function in the same facility. In state hospitals, these may differ according to the grading of the hospital or clinic.

Patients usually report to the emergency department and after assessment, they are managed according to the gravity of the problem, including resuscitation, optimisation and stabilisation.

Analgesia will always form part of the resuscitation process and the choice of analgesia will be determined by anatomical and physiological findings, as well as on special investigations and the interventional options available at the particular facility. The management of acute pain due to trauma and nontrauma is similar to that of postoperative pain (see section 13.5).

Although acute pathology in different organ systems present with acute pain, the analgesics used are often similar. Some conditions, however, may need a different approach and different drugs.

Pathology may be trivial, justifying oral analgesics and discharge after minor procedures (e.g. management of minor wounds or splinting of fractures). More serious pathology or trauma may need resuscitation, admission for medical management or surgery, or be referred for further management. Recurring, intractable acute pain usually requires admission and further investigation.

13.3.1 Analgesics used in the emergency department

Paracetamol and NSAIDs

The management of minor or moderate acute pain in an outpatient is usually easily achieved with the use of oral agents. Paracetamol, an NSAID with or without an opioid, are usually prescribed. The NSAID may be either a tNSAID or a selective cyclooxygenase-2 (COX) inhibitor (coxib). Paracetamol and all NSAIDs are opioid-sparing, but lack the opioid-related adverse effects. See section 13.5. for a further discussion on the use of paracetamol and NSAIDs.

Use of opioids in the emergency department

Parenteral analgesic should only be used under medical supervision. When potent opioids are used, patients must be kept for observation for long enough before discharge, bearing in mind the half-life of the narcotic, and the concomitant use of other sedatives which potentiate respiratory and haemodynamic effects in the specific patient (e.g. age, comorbidity and antihypertensive treatment). All opioids can cause hypotension and subsequently dizziness in absolutely hypovolaemic patients, patients with cardiac disease and relatively hypovolaemic patients, especially in patients on antihypertensives, patients who are elderly, and those with concomitant use of other sedatives. This is a major concern since sedative analgesics and other sedatives are a common cause of falls and fractures in elderly patients in and out of hospital.

IV *morphine sulphate* is still the most widely-available and widely-used agent to treat severe acute pain. The dose is 50 µg/kg every 3 minutes until the VAS is ≤ 3. In a patient with a mass of 70 kg, this is about 3 mg every 5 minutes. *Oxycodone*, *tramadol*, and *papaveretum* (Omnopon) are not superior to morphine sulphate.

Some perspectives regarding papaveretum:

- It is a combination of morphine chloride, codeine and papaverine.
- Note that papaveretum 20 mg contains 10 mg morphine base, which is *equivalent* to 13.3 mg morphine sulphate, while morphine sulphate 10 mg and 15 mg injections contain 7.6 mg and 11.4 mg of morphine base, respectively.

Tramadol:

- It is a prodrug that is metabolised to desmetramadol, which is a µ agonist responsible for most of the analgesia, and an activity and adverse effect similar to that of morphine and oxycodone.
- It is not safer than the so-called 'potent opioids'.
- Tramadol 100 mg IV is equivalent to approximately 10 mg of morphine sulphate.
- It is not safer to administer tramadol and discharge the patient immediately.
- The standard adult dosage of tramadol is an IV bolus of about 1–3 mg/kg over 3 minutes.

- Tramadol is renowned for nausea and vomiting. The same problem can occur with *codeine* in some patients.
- For further perspective, see section 13.5.

Pethidine:

- It has several unpleasant and therapeutic adverse effects and should not be used.

Pentazocine:

- It is a κ agonist and should not be used.
- It has several adverse effects, including hallucinations and skin ulcers.

Dihydrocodeine (DF118):

- It should not be administered intravenously, and therefore it has no place in the emergency scenario.

In the absence of venous access, opioids may be administered by *IMI*. However, this is not ideal in the emergency department because of the longer onset of action and a less predictable and titratable response, which requires a longer observation period before discharge.

The *combination of an opioid with a benzodiazepine* increases the risk of respiratory depression and oversedation, and lengthens the postprocedure observation time before safe discharge. These agents usually act synergistically. Therefore, the doses of both should be decreased by at least 50%. The *short-acting benzodiazepine midazolam* is preferred in the emergency department. Midazolam is titrated to effect at doses of 0.03–0.3 mg/kg depending on the hydration state, hypotension, vital organ function and age. Usually, 0.05 mg/kg is a safe titration dose.

Naloxone and flumazenil

The μ opioid antagonist, *naloxone*, should be available whenever IV narcotics are used. The dose is 5 μg/kg IVI (usually 0.4 mg). Since naloxone has a half-life of approximately 30–80 minutes, which is shorter than those of other opioids (except remifentanil), repeated doses may be required. Therefore, the patient must be observed for at least 2 hours (4 × 30 minutes = 120 minutes) to ensure that the opioid effect does not resurface.

Flumazenil is a benzodiazepine antagonist used to reverse benzodiazepine-related sedation, *as well as hypoventilation*. It has an elimination half-life of approximately 60 minutes, which is shorter than that of the shortest-acting benzodiazepine midazolam (120 minutes). The reversal effect of flumazenil lasts for approximately 2 hours, depending on the dose of the agonist, after which resedation from the agonist may occur. The dose is 3 μg/kg titrated over 15 seconds and repeated every 60 seconds up to 2 mg. The usual dose is 5–10 μ/kg.

13.3.2 Anaesthetic agents in the emergency department

Ketamine is an option for analgesia and it may be appropriate in selected scenarios. Adequate analgesia can usually be achieved with IV doses of up to 0.5 mg/kg, titrated at approximately 0.2 mg/kg. An initial dose of 2–4 mg/kg intravenously produces *anaesthesia* within 30 seconds, which lasts up to 10 minutes. Thereafter, repeated increments of half the induction dose can usually be given every 5–10 minutes without significant accumulation. The administration of 10 mg/kg IM is an alternative which induces anaesthesia or deep sedation (dissociation) within 3–4 minutes, which lasts approximately 15–20 minutes. *Oral ketamine* 10 mg/kg also produces sedation adequate to either establish venous access or perform short painful procedures in uncooperative patients. Although ketamine has been used *intranasally* in children, more studies are needed to establish the appropriate dose for procedural sedation and analgesia. The effective doses varied from 6–10 mg/kg.

Ketamine is not useful for procedures where decreased muscle tone is required (e.g. shoulder or hip dislocations). Hallucinations commonly occur during ketamine sedation and while waking up from ketamine anaesthesia.

Methoxyflurane (Penthrop) is a volatile anaesthetic agent with analgesic properties at sub-anaesthetic doses. The delivery of this agent in the outpatient setting is now possible owing to a disposable inhalational delivery system. The drug offers adequate analgesia for short intense periods of pain, such as during dressing changes or wound debridement.

Anaesthetic induction agents, such as propofol and etomidate, should not be used unless the doctor knows the effect of these potent agents in healthy and injured patient, changes in pharmacokinetics, and airway management (laryngoscopy, intubation, prevention of aspiration, influence of burns, and maxillofacial and neck injury). As soon a patient has been intubated, they become an intensive care patient and must be managed as such.

13.3.3 Specific conditions commonly seen in the emergency department

- Acute cardiac pain
- Acute abdominal pain: biliary colic, renal colic, dysmenorrhoea
- Posttraumatic pain
- Acute musculoskeletal pain (including acute spinal pain)
- Pain management in sports medicine
- Headaches

Acute cardiac pain

Acute cardiac pain results from acute myocardial ischaemia and includes acute MI and unstable angina. Pain or discomfort is typically precordial, radiating or referred to the left arm and jaw,