



Paediatric procedural sedation

Emergency department manual 2013



A collaboration of the Emergency Care Improvement and Innovation Clinical Network, Department of Health, the Royal Children's Hospital Melbourne and Victorian Managed Insurance Authority



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Acknowledgements

This manual forms part of a program of training for administering paediatric procedural sedation in Victorian emergency departments. It is a modification of the 2011 *Paediatric procedural sedation emergency department manual*.

In 2011 the Victorian Department of Health's Emergency Care Improvement and Innovation Clinical Network (ECIICN) led the development of the manual and other resource material to standardise the approach to paediatric procedural sedation in emergency departments. The manual was the result of a collaboration with the Victorian Managed Insurance Authority (VMIA), and was supported by an expert clinical reference group. That work built on the efforts of clinicians over several years at The Royal Children's and Sunshine hospitals, with funding support from the VMIA.

The ECIICN has updated this manual as a key reference document for the 2013 training program which is designed to expand and embed standardised practice in paediatric procedural sedation in emergency departments.

A number of clinicians have contributed to the evolution of the program and the content of the manual. Their generous contributions are gratefully acknowledged as follows:

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To receive this document in an accessible format phone the Commission for Hospital Improvement on 9096 0578.

Authorised and published by the Victoria Government, 50 Lonsdale St, Melbourne.

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Print managed by Finsbury Green.

Disclaimer

The material provided in this resource is intended to assist health services in providing safe paediatric procedural sedation in emergency departments for appropriate cases. Victorian emergency departments vary widely in their staffing and resources. This material cannot address all of the local circumstances that may apply. It is the responsibility of local health services to decide if paediatric procedural sedation in their emergency department is appropriate and, if so, to develop policies and procedures tailored to their local environment.

Every effort has been made to ensure this material is accurate and up to date at the time of writing (August 2013). Evidence and recommendations may change over time. It is the responsibility of lead clinicians and health services to periodically review their policies and procedures to ensure currency.



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1 Purpose and rationale

Advances in medical practice over the last 20 years have increased the need for invasive investigations and procedures. These can range from painless imaging to painful or distressing procedures where children may require sedation. Sedation has both benefits and risks. If managed well sedation can be very effective and safe, but if managed poorly it carries the risks of unconsciousness, suppression of vital protective airway reflexes and hypoventilation. Inadequate sedation can result in distress for the child, which can be remembered for a lifetime.

The keys to safe and successful treatment are:

- choosing when sedation is appropriate
- choosing what type of sedation is needed
- having procedures to maximise effectiveness and safety.

Procedural pain refers to short-lived pain associated with diagnostic investigations and treatments such as blood tests, dressing changes, suturing, insertion or removal of catheters, tubes or intravenous lines, wound care and lumbar punctures.

The goals of procedural sedation are to:

- minimise physical discomfort, pain or psychological distress
- maximise the potential for amnesia
- control behaviour (particularly movement)
- provide optimal circumstances for successful completion of the procedure
- ensure patient safety.

Recognising the importance of providing safe and effective procedural sedation for children, the Royal Children's Hospital and Sunshine Hospital, with funding support from the Victorian Managed Insurance Authority (VMIA), developed a paediatric procedural sedation program in 2004. The aim was to establish a standardised practice for paediatric sedation in both hospitals' emergency departments in order to provide more effective analgesia and sedation, and to reduce the risk associated with sedation in children. The program was revised in 2006 and 2008. Not only did the program detail the required procedures for sedation, it also credentialed clinical staff to undertake or assist with paediatric procedural sedation.

The Emergency Care Improvement and Innovation Clinical Network (ECIICN) was established by the Department of Health Victoria in 2008 to work with emergency clinicians to improve the quality of patient care in emergency departments. There are a large number of children treated in Victoria's emergency departments each year with at least 30 emergency departments seeing more than 3,000 paediatric presentations. Hence a key area of focus for the ECIICN is to facilitate the use of best practices in caring for children in emergency departments

The ECIICN identified an opportunity to improve patient safety and the patient experience in emergency departments by reducing variation in practice with respect to paediatric procedural sedation. The Royal Children's Hospital program formed a good basis for a standardised approach to risk assessment, sedation procedures, monitoring and documentation. It required updating and adaptation for more widespread use in emergency departments, and for training an initial cohort of trainers to oversee local implementation, including training and credentialing.¹

In 2011 the ECIICN collaborated with VMIA and a group of clinical experts to develop a program to standardise the approach to paediatric procedural sedation in EDs. The sedation program sought to develop and roll out a standardised approach to sedation in ED with the aim of minimising distress and anxiety for children and parents and providing optimum conditions for safely completing procedures.

This manual aims to provide a foundation for a safe standardised approach to the management of procedural pain, distress and anxiety in children in emergency departments. It incorporates guidelines and recommendations developed by paediatric, emergency medicine and anaesthesiology societies.^{2,3,4,5,6,7,8,9}

The manual is designed for both medical and nursing staff, and aims to address the theory and practice of procedural sedation of children in the emergency department setting. It focuses on two agents, nitrous oxide and ketamine, which have been shown to be safe and effective in children. Both agents have been used successfully for many years at the hospitals where this program was originally developed and are widely used in Australia. While this manual includes a chapter on propofol, this agent should only be used in older adolescents by senior staff with expertise in its use and should not be used in children where safer agents are available.

This program is multifaceted and includes:

- this manual
- lectures and practical demonstrations, including direct scenario-based experience
- assessment of knowledge and practical skills related to paediatric procedural sedation
- other resource materials.

Together with completion of appropriate life support training as determined by individual health services, satisfactory completion of the program forms the basis for credentialing clinical staff to perform or assist with paediatric procedural sedation.¹

Sedation episodes should be audited periodically as part of quality assurance activities so that any unexpected adverse event can be examined to determine if remedial actions or changes to procedures are required.

The methods described in this manual cannot be guaranteed to be safe and efficacious in all circumstances. Unexpected adverse events are possible even in healthy children. Those medical staff with appropriate training and experience in an emergency department should only use sedative agents where adequate facilities and back-up procedures are available.

2 Clinical governance

The capacity to deliver clinical procedures in Victorian emergency departments varies. This is due to variability of staffing, resources, scope of practice and clinical expertise. As local circumstances differ, it is the responsibility of the health service to decide if a procedure such as paediatric procedural sedation is appropriate in its emergency department. The appropriate use of clinical governance policies should ensure that all requirements are in place for the safe delivery of paediatric procedural sedation.

2.1 Definition

Clinical governance is a systematic and integrated approach to maintaining and reviewing clinical responsibility and accountability that improves quality and safety of patient care in health services and results in optimal patient outcomes.

2.2 Victorian context

Victoria has a long-established system of devolved governance for health care delivery. Public hospitals are organised into local health services that are governed by boards of directors. In turn, these health services boards are accountable to the Minister for Health for the overall governance and performance of the health service.

2.3 Health service

As part of the governance arrangements in health services they are required to have a formal and effective clinical governance structure to provide safe and high-quality patient care.¹⁰

Clinical governance occurs at all levels in a health service and includes a program of review, approval and improvement of internal processes and outcomes at every level from the board, the chief executive, the management team, clinicians and non-clinical staff.

Each health service is responsible for:

- reviewing its own clinical governance structure to ensure consistency within the statewide framework
- reporting annually, as part of its quality of care report, on clinical governance structures and activities
- ensuring adequate internal documentation to comply with the framework.

A health service decides, through its clinical governance processes, what procedures are appropriate to be performed within its service, and the required policies and procedures.

Therefore, the provision of paediatric procedural sedation should be supported by demonstrable competencies, credentialing aligned with scope of practice for that facility, and appropriate documentation and review of sedation practices in emergency departments.¹ Strong models of clinical governance utilise a multidisciplinary approach that would, in this case, engage the expertise of the anaesthesia department.

Good clinical governance means it would be entirely appropriate for a health service, after consideration and evaluation, to decide that a given procedure is not appropriate in certain clinical settings. Reasons might include resource availability, staff training and skill mix, equipment needs and lack of appropriate back-up.¹⁰

2.4 Emergency department

Administration of procedural sedation in the emergency department requires consent, health service approval and the establishment of related policies/procedures according to local clinical governance processes (see Table 1 for example).

A healthcare team with the skills to ensure the sedation is appropriate, effective and safe, and that any adverse events are managed successfully, should perform procedural sedation. Staff training and credentialing requirements need to be specific to the sedation technique being used and to the context of that health service.¹ It is the health service's responsibility to ensure that these training and credentialing requirements are fulfilled.¹⁰

KEY PRACTICE POINT

Health services have responsibility, through clinical governance processes, to decide what policies and procedures are suitable for their clinical environment, and to develop appropriate policies to support safe implementation.

Table 1: Key clinical governance questions regarding procedural sedation

Overall
Is procedural sedation of children appropriate in our emergency department?
Clinical policies and procedures
Do the policies and procedures specify the types of procedures that can be carried out in the emergency department?
Do the policies and procedures specify which children are suitable for sedation in the emergency department?
Do the policies and procedures specify who must obtain consent and how this will be documented?
Do the policies and procedures specify where procedural sedation can be performed?
Do the policies and procedures specify the authorisation required?
Do the policies and procedures specify the staff required and their training?
Should the policies and procedures place limitations on the agents that can be used?
Should the policies and procedures limit the times of day that procedural sedation should be performed?
Is the equipment described in the policies and procedures (administration of nitrous oxide, patient monitoring and paediatric resuscitation) available in the emergency department?
Do the policies and procedures for paediatric sedation adequately address pre-procedural assessment and preparation, procedural and post-procedural monitoring, handling of adverse events and processes for safe discharge?

3 General principles

3.1 Overview

Children experience a more intense physical and emotional reaction to painful or threatening procedures than adults. The goals of providing sedation to children in the emergency department include:

- minimising pain, anxiety and psychological distress
- minimising patient movement which may jeopardise the procedure
- maximising the potential for amnesia
- maximising the chances of procedural success
- ensuring patient safety
- allowing the patient to return to his or her pre-sedated state as quickly as possible.¹¹

In addition to minimising the negative psychological experience for the child, a successful sedation may reduce fear and distress in subsequent presentations to healthcare facilities.

Sedation for diagnostic or interventional procedures includes the administration (by any route or technique) of drugs that result in depression of the central nervous system. Sedation is a continuum from reduced anxiety to a state of deep sedation, not including general anaesthesia.¹² The response to sedative drugs is not always predictable and staff need to be prepared to deal with a patient who becomes much more sedated than intended.

Sedation carries the potential for:

- unintentional loss of consciousness
- depression of protective airway reflexes
- depression of respiration
- depression of the cardiovascular system
- drug interactions.

There is also the possibility of excessive sedation related to individual variations in response to drugs (particularly seen in children). Nonetheless, studies have shown that sedation of children in the emergency department can be performed safely.^{13,14,15,16,17,18,19,20}

Patient selection is a major factor in achieving the goal of safe and successful sedation. The approaches described in this program are intended for use in the emergency department on patients who are generally healthy or have only mild systemic disease. More severely ill patients, those with complex medical problems and very young children, should not be sedated in the emergency department. It is also unreasonable to expect sedation to be effective for extremely painful or prolonged procedures. Patients who are extremely anxious prior to the procedure need special consideration and might be more suitable for general anaesthesia.

Preparing the patient, the family, the environment and staff for a procedure under sedation is also important. Patients who are extremely anxious prior to the procedure need special consideration and might also be more suitable for general anaesthesia.

KEY PRACTICE POINT

Children who should not be sedated in the emergency department are those at higher risk, have complex medical problems, are more severely ill, are undergoing extremely painful or prolonged procedures, or are very young.

3.2 Levels of sedation

The definitions of minimal, moderate and deep sedation used in this guideline are based on those of the American Society of Anesthesiologists.²¹

- **Minimal sedation** is a drug-induced state during which patients respond normally to verbal commands. Although cognitive function and physical coordination may be impaired, the airway reflexes, ventilatory and cardiovascular functions are unaffected.
- **Moderate sedation** is a drug-induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation. No interventions are required to maintain a patent airway and spontaneous ventilation is adequate. Cardiovascular function is usually maintained.
- **Deep sedation** is a drug-induced depression of consciousness during which patients cannot be easily aroused but respond purposefully following repeated or painful stimulation. The ability to independently maintain ventilatory function may be impaired. Patients may require assistance in maintaining a patent airway and spontaneous ventilation may be inadequate. Cardiovascular function is usually maintained.
- **General anaesthesia** is a drug-induced loss of consciousness during which patients are not arousable, even by painful stimulation. The ability to independently maintain ventilatory function is often impaired. Patients often require assistance in maintaining a patent airway, and positive pressure ventilation may be required because of depressed spontaneous ventilation or drug-induced depression of neuromuscular function. Cardiovascular function may be impaired.

It should be noted that the same agent could cause different levels of sedation depending on the dose given and whether other agents (such as analgesics) are also administered.

Ketamine does not fit this scheme of sedation depth. It produces dissociative sedation, which has been defined as a trance-like cataleptic state characterised by profound analgesia and amnesia, with retention of protective airway reflexes, spontaneous respiration and cardiopulmonary stability.⁸

KEY PRACTICE POINT

The same agent can cause different levels of sedation depending on the dose given and whether other agents, such as analgesics, are also administered.

3.3 Decreasing the need for sedation

Factors that may decrease the need for sedation include pharmacological and non-pharmacological strategies.

3.3.1 Pharmacological strategies

Systemic pain relief

Analgesia may decrease patient anxiety and so decrease the need for sedation. Paracetamol, ibuprofen, codeine, codeine and paracetamol mixture (for example, Painstop[®]), oxycodone or sucrose are the most commonly used. Reduction of pain may also address patient anxiety. For severe pain, intranasal fentanyl or intravenous morphine may be required. Analgesia should never be administered intramuscularly.

Topical pain relief

Topical use of ALA drops (Laceraine[®], adrenaline/lignocaine/amethocaine) or similar agents applied directly to open wounds is effective. Anaesthetic cream (such as AnGel[®], amethocaine 4%; or EMLA[®], lignocaine/prilocaine) applied to the skin prior to intravenous cannula insertion, blood taking or lumbar puncture will also provide effective local anaesthesia. The cream should cover the area you wish to use and must only be applied to intact skin. The onset of anaesthesia for amethocaine 4% is 30 to 60 minutes with a duration of action of approximately four to six hours.

Non-painful wound repair

Consider the use of tissue glues (Dermabond[®], octyl-2-cyanoacrylate; Histoacryl[®], n-butyl-2-cyanoacrylate) or Steristrips[®] in place of sutures. This approach is often quick, painless and has similar cosmetic outcomes to suturing when used appropriately. Dermabond[®] as it dries can cause a burning sensation, which some children find distressing. Prior application of ALA topically prior to use of the glue, and/or blowing on the laceration once glued, has been reported to reduce this sensation.

Sucrose for infants²²

Small amounts of sweet solutions (such as oral sucrose) placed in an infant's mouth can reduce procedural pain. The mechanism is an orally mediated increase in endogenous opioid. The analgesic effect lasts for five to eight minutes, making it an ideal strategy for management of short-term pain. Sucrose is only effective when given directly onto the infant's tongue. Dosing recommendations are provided in Table 2. Sucrose is more effective if given with a 'dummy' as this promotes non-nutritional sucking which also contributes to calming. Do not give sucrose to those with known fructose or sucrose intolerance, or to those who are critically ill on intravenous analgesia and sedation and who have low pain scores on handling.

Procedures that are known to cause pain and/or distress in infants may include:

- blood tests (heel pricks, venipuncture or arterial stabs)
- intravenous cannula insertion
- lumbar puncture
- suture removal
- dressings
- urinary catheter insertion
- intramuscular or subcutaneous injections
- eye examination
- adhesive tape removal
- nasogastric tube insertion.

Table 2: Dose guide for sucrose (24–33 per cent)²²

Patient group	Nil orally	Weight <1500 grams	Neonates	Infants one – 18 months
Amount to be given per procedure	0.2 ml	0.2 – 0.5 ml	0.2 – 1 ml	1 – 2 ml
Total amount in 24 hours	1 ml	2.5 ml	5 ml	5 ml

Although the latest Cochrane analysis concluded that sucrose is effective and safe in reducing pain,²³ a recent randomised double-blind study found no significant effect on the neural activity in sensory pain circuits in the brain or the spinal cord, suggesting that pain perception is not altered.²⁴

KEY PRACTICE POINTS

Use of topical anaesthetics and systemic analgesics can reduce the requirement for sedation.

Non-painful wound closure techniques should be used where appropriate

3.3.2 Non-pharmacological strategies

Non-pharmacological approaches will, in some children, reduce or avoid the need for sedation. In many instances it will make procedures less distressing for patients, family and staff.

The integration of non-pharmacological techniques will help achieve the goals of sedation by:

- decreasing the anticipatory anxiety of the child and family before the procedure
- reducing the pain and anxiety of the child and distress of their parents during the procedure
- promoting effective coping with subsequent medical procedures.

Staff with little training can use non-pharmacological techniques described here. They can also model them for the parents and other primary caregivers. These approaches and techniques may be more difficult to apply in children:

- younger than three years
- cognitively impaired
- with significant behavioural disorder
- previously traumatised by medical procedures.

3.4 Preparing the child and parent

A 'safe' person

All staff team members need to know who is responsible for what during the procedure, and in particular who can function as a 'safe' person in providing emotional/social support to the child and family.

Parent Role

Most children want their parents to be present and most parents want to be there. Invite parents and the child to be part of the team as active participants. Parents can assist by interacting with their children to relax or distract them. Evidence though is mixed as to whether parents' presence is helpful during painful procedures: this depends on what they do.

Staff can model coping-promoting behaviours, especially if there is not enough time or resources to coach parents directly.⁵ Research has identified the following behaviours which promote coping and those which promote distress.

Behaviours that promote coping:

- non-procedural talk and distraction
- prompting children to use coping behaviours
- breathing techniques (such as slow deep breathing)
- humour.

Behaviour to be avoided:

- apologising, criticising, bargaining with the child
- giving the child control over when to start the procedure
- catastrophising and becoming agitated.

Preparing the child

Find out a bit about them (their likes and dislikes) and ask them what they would like to be doing right now. Find out about their knowledge and expectations of the procedure. Let them ask questions. Be honest about what will happen and correct any misconceptions (see language section below on discussing pain). Find out their previous experiences with medical procedures and any coping skills. Instil confidence and provide age-appropriate information about the procedure, including any sensations to expect such as smells, noises or physical sensations. Children need to know what they will look and feel like afterwards (for example, if there will be a bandage, tube or intravenous cannula). If necessary, use books, drawings or a doll to demonstrate. Tell the child when the procedure will happen with enough time to prepare, but not so long that it increases anticipatory anxiety.

Agree on goals and interventions with the child (for example, breathing to feel calm and talking about their last birthday party). Involve the child in how they can be helpful, such as asking them to hold the mask.

Environment

Remember children may see you as big and threatening, so aim to be calm and friendly. Do not get the equipment ready in front of children. They may, however, need to see and touch it before the procedure to feel less anxious. Keep unexpected events to a minimum and explain any surprises, like a loudspeaker noise. Maintaining a quiet and controlled environment can be important for alleviating anxiety and distress.

Holding

Use 'positioning for comfort' and avoid forceful restraint. Have the child sitting rather than lying wherever possible. Do not use parents for restraint, only comfort holding.²⁵

Language

Choices of words or phrases and imagery in the first seconds of the therapeutic encounter may set the stage for the child's response. It is very important to comment positively on some aspect of the child's physical state. Be very careful with your choice of words. Use language to suggest that the child will get well and return home.

Acknowledge what is happening and suggest its positive side. Make positive suggestions related to treatment procedures and imply change, possibly for the better ('As I wash the cut, the hurt can wash away'). Emphasise the qualitative sensation the child may experience (such as cold, tingling or pressure) so that the child focuses on what they are feeling and not just on the hurt.

If the procedure is likely to cause some pain, describe the pain in familiar terms that they will understand. Parents will have examples of pain without distress that their child has experienced during play or seen in someone else. Avoid deceptive statements such as 'this shouldn't hurt', as children do not forget dishonest statements easily. Instead provide suggestions for coping like 'I wouldn't be surprised if this hardly bothers you, especially when you see what's happening on the video cartoon'.

Immediately before the procedure

Remain calm and firm. Do not focus on feelings once the procedure is imminent. Do not bargain, negotiate or apologise as it increases distress. Give children a sense of control by letting them make choices (for example, where to sit for the procedure, which hand to use for the IV insertion, which flavour for the nitrous oxide mask). Do not give the child a choice about when to start the procedure, as this will increase their anticipatory anxiety. Just before the procedure, stop talking about the procedure or focusing on it in any way and encourage the use of relaxation and distraction.

During the procedure

Distraction, without tricking, actively encourages the child to focus on something positive. Find out from the child what they like doing best (for example, which sport, which computer game or the name of a pet).

Use age-appropriate distraction such as bubbles, windmills, stories, music, toys, electronic games, non-procedural talk and imagery. To promote relaxation, encourage breathing exercises, muscle relaxation and imagining a favourite place, sport or activity. Prompt the child to use coping behaviours and praise all attempts.

Post procedure

Only say it is finished at the very end of the procedure. Focus on positive coping efforts and continue distraction. Allow the child time to recover. Instil a sense of achievement no matter what happened. Use pain medication as required. Avoid focusing on any further procedures.

KEY PRACTICE POINT

Careful preparation of the child and parents and the use of non-pharmacological techniques such as distraction can reduce the need for sedation and reduce the child's distress.

3.5 Principles of sedation episodes

A sedation episode can be regarded as having four components, each with the following key activities.

1. Pre-procedure

- Decrease the need for sedation
- Risk assessment and completion of the risk assessment and record form (Appendix 1 or equivalent)
- Fasting
- Parent information and consent (Appendix 2 or equivalent)
- Staff
- Prepare child and parent
- Location
- Equipment
- Observation
- Medication calculation and documentation
- 'Right patient' and 'Right procedure' checking
- Documentation.

2. During procedure

- Drug administration and recording
- Monitoring.

3. Post procedure

- Monitoring
- Discharge criteria and instructions.

4. Documentation

- Ensure all documentation is completed and filed in the medical record
- Ensure appropriate procedural and diagnostic codes are recorded on emergency department administrative systems.

3.6 Pre-procedure

The key pre-procedure activities are:

- decrease the need for sedation
- risk assessment
- fasting
- parent information and consent
- prepare child and parent
- staff
- location
- equipment
- observations
- medication calculation and documentation
- 'Right patient', 'Right procedure' checking
- documentation.

3.6.1 Risk assessment

Health evaluation prior to sedation includes a standard history and physical examination as well as a review of health issues specific to children undergoing procedural sedation.

Weight should be recorded in the medical record or observation chart and medication chart to allow easy calculation of medication doses during the sedation or in case of an emergency. Allergies should also be recorded on both these forms.

The risk assessment and record form (Appendix 1 or similar) should be used. Its purpose is to ensure that all important considerations are met prior to, during and after sedation in the emergency department. It includes a risk assessment that aims to identify children at higher risk of complications (in particular airway complications and cardiovascular instability) who might be unsuitable for sedation in the emergency department.²⁶ A form (or one similar approved by local governance) should be completed for all sedations and should be regarded as mandatory to ensure safe sedation. The completed form should be filed as part of the patient's medical record.

Components of risk assessment

Is there increased risk of airway compromise leading to obstruction?

- Snoring, stridor, sleep apnoea
- Craniofacial abnormalities
- History of airway difficulties
- Children younger than one year.

Is there increased risk of hypoventilation?

- Patients with reduced sensitivity to CO₂ retention (such as chronic lung disease)
- Neuromuscular disorders
- Abnormalities of the respiratory centre such as brainstem tumours.²⁶

Is there increased risk of aspiration?

- Vomiting, bowel obstruction, gastro-oesophageal reflux
- Altered mental status
- Cerebral palsy
- History of aspiration.

Is there increased risk of bronchospasm or laryngospasm?

- Asthma, recent upper or lower respiratory tract infection.

Is there increased risk of cardiovascular compromise?

- Cardiac disease, hypovolaemia, sepsis.

Is there a history of sedation failure?

Is there moderate or severe systemic disease which limits the activity of the child?

Is there a drug-specific contraindication?

There are drug-specific contraindications that need to be considered as part of a sedation plan. Drug-specific contraindications are addressed in detail in the sections relating to the particular agents, and the main exclusion criteria for agents are listed on the back of the risk assessment and record form (Appendix 1).

KEY PRACTICE POINT

Any positive finding on risk assessment or any drug-specific contraindication precludes procedural sedation in the emergency department, except with the approval of an authorised senior doctor (emergency physician or anaesthetist).

3.6.2 Fasting

Most children who present to the emergency department will have consumed solids and/or fluids within the previous four hours.

The relationship between minimum fasting times and the risk of adverse outcomes in sedation has not been well studied and is the subject of some debate. Some recent data indicate that fasting and adverse events in emergency department sedation in children are not closely linked.^{27,28} The decision to sedate an unfasted patient for emergency procedures should be based on a careful assessment of the urgency of the procedure, the desired sedation depth, the fasting status and individual patient risk factors.²⁹

Recommended minimum fasting times in this program are based on a consensus of emergency department consultants at Sunshine Hospital and the Royal Children's Hospital in Melbourne. They are listed on the back of the risk assessment and record form (Appendix 1), and should be recorded.

When the procedure does not need to be performed immediately, the patient should be fasted for the recommended minimum fasting time. In circumstances where the child's fasting status is not assured, the increased risks of vomiting during sedation must be carefully weighed against the benefits and the lightest effective sedation should be used.

Recommended minimum fasting times

Nitrous oxide	Two hours for solids and liquids
Parenteral agents	Four hours for solids or milk and two hours for clear liquids

Please note that after an injury even prolonged fasting does not guarantee an empty stomach.

If a child is not fasted for the minimum recommended time and the procedure is considered urgent, approval of the authorised senior doctor is required before sedation can be administered.

Options for patients who are not fasted

- Children could sit in the waiting room until the required time, if they do not require continuing management of the injury or other conditions.
- If the procedure is non-urgent and the child is not fasted, consider having the child return at a later time when adequate fasting is assured.

3.6.3 Parent information and consent

It is important that the reasons for the procedure and sedation are clearly explained to the parent and they understand what is going to happen and how they can help their child during this procedure. A patient information sheet has been developed to assist you in guiding your discussion with the parent (see Appendix 2).

Consent must be obtained from the parent or legal guardian of the child for both the sedation and the procedure before any drug administration. This is usually done together, but consent for both is required. Who can obtain consent and how it is documented will be dictated by local clinical governance procedures.

The Australia and New Zealand College for Anaesthetists' *Guidelines on consent for anaesthesia or sedation* set out the key elements for consent.³⁰

- Consent must be voluntary. There must be the option to decline or request an alternative.
- An appropriate competent person must provide consent, in most cases this will be a parent or guardian.
- Consent must be informed. The person consenting to the administration of sedation must be provided with information that a reasonable person might wish to know and/or consider significant in their decision-making. This will include a discussion of the risks associated with sedation procedures and of alternative approaches. Written information such as the *Parent information sheet for paediatric procedural sedation in the emergency department* (see Appendix 2) should be provided.
- Consent should be documented. As a minimum, a note should be made in the medical record of who provided consent, the provision and discussion of relevant information including risks, and the agreement to administration of sedation for the procedure.

3.6.4 Prepare the child and parent

Build up trust and rapport with the child and parent and explain the procedure to them in a calm and friendly manner (see Section 3.4 on page 13).

3.6.5 Staff

Key	
	Doctor
	Nurse
	Doctor or Nurse
	Senior doctor

Nitrous oxide



One doctor or nurse to perform the procedure.



Another doctor or nurse credentialed in nitrous oxide use.

Parenteral agents



One doctor to perform the procedure.



Another doctor to administer the sedation and monitor the patient. This doctor must be credentialed by the health service for the agents being used **and** in paediatric resuscitation, in particular paediatric airway management.



One registered nurse capable of supporting airway management and advanced monitoring of patients. This nurse must be credentialed by the health service for the agents being used **and** in paediatric resuscitation.



Appropriate senior doctor available on site with the ability to **immediately** respond if required. Whether this doctor is required to be actually in the room is a matter for local policies and procedures.

All required staff must be present before any drug is administered. One staff member must be continuously responsible for observation of the patient's oxygen saturation, heart rate, blood pressure, airway patency, the adequacy of ventilation and the level of sedation throughout the sedation episode.

3.6.6 Location

The treatment areas in which sedation can be performed will be defined in local policies and procedures. This will ensure that all necessary equipment and staff are available in the case of an adverse event.

As a guide, sedation with nitrous oxide can be performed in the procedure room or other approved location as long as monitoring equipment, oxygen, suction and airway support equipment is present, and there is ready access to paediatric resuscitation facilities and drugs. Sedation with parenteral agents should only be performed in a treatment area with advanced monitoring and resuscitation facilities, including equipment to monitor heart rate, blood pressure and oxygen saturation, as well as oxygen, suction, airway support equipment, paediatric resuscitation equipment and drugs.

3.6.7 Equipment

Equipment must be checked and available prior to commencing sedation. A reminder of the necessary equipment is listed on the back of the record of sedation. This includes:

For all agents:

- Bag-valve-mask set up for appropriate size connected to O₂ source. Appropriate range of masks, with the mask fitting snugly over the child's nose and mouth.
- Suction working with a Yankauer sucker attached.
- Pulse oximeter, to monitor oxygen saturation pre, during and post procedure.

Additionally, for parenteral agents:

- ECG monitoring equipment.
- Blood pressure monitoring.
- Paediatric resuscitation equipment, in particular airway support equipment.

Note: If the child is very unsettled pre-procedure it may be helpful to apply the blood pressure cuff, oxygen saturation probe or attach the ECG leads once sedation is taking effect.

3.6.8 Observations

An initial set of observations must be obtained prior to the administration of sedation. This should be documented on the emergency department observation chart. If the child is agitated and unsettled prior to the procedure consider the accuracy of observations due to their distress.

Observations include:

- pulse
- respiratory rate
- oxygen saturation
- blood pressure and pulse rate (parenteral agents).

3.6.9 Medication calculation and documentation

- All medications used in sedations, including nitrous oxide, require written orders on the medication chart.
- Calculate the correct dose of sedation medication for the child based on their measured weight.
- Write the dose, route and time of administration on the medication chart (and on other charts as dictated by local policies and procedures).
- All sedation episodes require completion of the risk assessment and record form (Appendix 1 or equivalent). The pre-procedure section should be completed before sedation is commenced.

3.6.10 'Right patient', 'Right procedure'

As an added safety measure, prior to the procedure two staff involved in the procedure should confirm:

- the child's identity by ID band or positive identification
- or mark the site (if applicable)
- the procedure to be performed.

3.6.11 Documentation

Document date, type of procedure, and pre-procedure check list prior to the procedure on the risk assessment and record form (Appendix 1 or equivalent).

3.7 During the procedure

3.7.1 Drug administration and recording

Parenteral sedation drugs can only be administered by medical officers and accompanied by written orders. Drugs should always be checked with a second person prior to administration. Drug syringes should be labelled with the content and concentration. Credentialed nurses or doctors, according to local policies and procedures, can administer nitrous oxide.¹

Drugs administered must be recorded on the medication chart in accordance with hospital policy.

3.7.2 Monitoring the child

Communication between all staff involved with the procedure is essential to ensure safe practice and detection of possible complications. The treating doctor must be informed of any observations that fall outside normal values to ensure appropriate interventions.

Pulse oximetry should be continuously monitored in all episodes of sedation. Heart rate, oxygen saturation, respiratory rate and depth of sedation (see Tables 3 and 4) should be recorded every five minutes following the administration of the sedation medication until the child is beginning to rouse after the procedure.

During parenteral sedation, use continuous cardiac monitoring and record blood pressure every five minutes.

Note: After the procedure is completed the stimulation (pain) associated with the procedure is reduced, and this may cause the child to become more sedated.

Table 3: Depth of sedation as measured using the University of Michigan Sedation Scale (UMSS score)³¹

UMSS scores:
0 = Awake and alert
1 = Minimally sedated (may appear tired/sleepy, responds to verbal conversation and/or sound)
2 = Moderately sedated (somnolent/sleeping, easily roused with light tactile stimulation or simple verbal command)
3 = Deep sedation (deep sleep, rousable only with deep or significant physical stimuli)
4 = Unrousable

Table 4: Normal vital sign values for children³²

Age	Weight (kg)	Minimum systolic BP min (mmHg)	Heart rate (beats per minute)	Respiratory rate (breaths per minute)
Three months	6	50	100–170	30–50
Six months	8	60	100–170	30–50
One year	10	65	100–170	30–40
Two years	13	65	100–160	20–30
Four years	15	70	80–130	20
Six years	20	75	70–115	16
Eight years	25	80	70–110	16
10 years	30	85	60–105	16
12 years	40	90	60–100	16

KEY PRACTICE POINT

Any change in vital signs, sedation scores or an oxygen saturation reading less than 94 per cent should be immediately communicated with the doctor responsible for the sedation as this might require immediate intervention for airway compromise or cardiovascular depression.

3.8 After the procedure

3.8.1 Monitoring the child

The child must be observed by a member of staff until fully recovered.

Following the procedure, observations and sedation scores should be taken and recorded at least every 15 minutes. However, if the child remains deeply sedated following the procedure, they should have observations and sedation scores recorded every five minutes until they are more awake, show age-appropriate activity and respond to their parents.

The child should not eat or drink until fully alert.

3.8.2 Discharge criteria and instructions

As each patient responds to sedation differently, it is impossible to set a specific 'discharge time'. A child cannot be discharged until all discharge criteria are met. It is essential to assess each patient individually by using the following discharge criteria. They are also listed on the back of the risk assessment and record form (Appendix 1).

Discharge criteria

- Resumption of pre-sedation level of consciousness.
- Resumption of purposeful neuromuscular activity.
- Ability to ambulate (if appropriate) or able to sit without support.
- Ability to verbalise appropriate for their age.
- Vital signs are within normal limits for their age.
- Ability to tolerate oral fluids (initial fluids can include water, an icy pole or cordial).

For a very young or disabled child, the aim is to achieve as close as possible to the pre-sedation level of responsiveness or the normal level of functioning for the particular child. This should be achieved by communicating with the parent or guardian to establish what is normal for that child. In addition, a responsible adult needs to be available to accompany the child home.

A parent or guardian should be given written discharge instructions and these should also be explained and discussed. An example of such information is included in Appendix 2.

3.9 Documentation

Ensure all documentation is complete on the risk assessment and record form and other relevant clinical record forms. This includes type of procedure and sedation used, drugs administered, deepest level of sedation and sedation team members (Appendix 1 or equivalent).

All side effects or adverse events should be documented according to health service policy and in the medical records and the risk assessment and record form.

Further reading

Eldridge C, Kennedy R. Non-pharmacologic techniques for distress reduction during emergency medical care: a review. *Clin Pediatr Emerg Med* 2010;11:244–50.

National Clinical Guideline Centre 2010. Sedation in children and young people: Sedation for diagnostic and therapeutic procedures in children and young people.

<<http://www.nice.org.uk/nicemedia/live/13296/52124/52124.pdf>>

4 Nitrous oxide

4.1 Background

Nitrous oxide (N₂O) is an anaesthetic gas, which can be delivered in variable concentrations with oxygen. N₂O causes modest analgesia and sedation with minimal respiratory and cardiovascular depression; the exact mechanism of action is unknown.⁶

Studies in children have shown N₂O to be an effective and safe analgesic during painful procedures.^{6,13,14,19,33,34,35,36,37} Importantly, it can be delivered painlessly through inhalation. Its quick onset of action (three to five minutes) and recovery make it ideal for use in the emergency department. N₂O was commonly used as a mixture of 50 per cent or less, but in recent times 70 per cent (with 30 per cent oxygen) has demonstrated a similar safety profile.

N₂O in the emergency department is available in two different forms:

- A variable concentration-mixing device (for example, Quantiflex™ monitored dial mixer), this allows N₂O to be administered in a concentration varying between 0 and 70 per cent.
- A premixed cylinder of 50 per cent oxygen and 50 per cent N₂O (for example, Entonox™).

Fasting requirements for patients who receive N₂O as a single agent are controversial. In a study on N₂O sedation by the Royal Children's Hospital Melbourne Emergency Department, the frequency of vomiting was not associated with the duration of pre-procedural fasting.²⁸ Current guidelines from the Royal Australasian College of Physicians recommend a fasting period of two hours if a concentration of N₂O of more than 50 per cent is used.⁷ If N₂O is used in conjunction with other sedative agents or opiates (such as parenteral morphine or fentanyl or intranasal fentanyl), a longer fasting time is required. The combination of N₂O and intranasal fentanyl has been shown to lead to deeper levels of sedation and increases the rate of vomiting.³⁸

KEY PRACTICE POINT

The recommended minimum fasting time when using nitrous oxide is two hours for solids and liquids.

N₂O can be used where short-acting analgesia is required for procedures that may cause pain, discomfort or anxiety.

It is useful for:

- suturing (with topical anaesthesia)
- intravenous cannula insertion (with topical anaesthesia)
- removal of foreign bodies from soft tissues
- minor fracture manipulation/moulding of plaster
- burns dressings
- injection of local anaesthetic
- incision and drainage of small easily accessible abscesses
- other painful procedures.

It is not useful for:

- very painful procedures (such as manipulation of a significantly displaced fracture)
- incision and drainage of larger, deep or complex abscesses
- facial (perioral) lacerations
- procedures requiring immobility.³⁹

4.2 Adverse reactions

N₂O is usually well tolerated by children.

Mild side effects

- Vomiting.
- Nausea.
- Dizziness.
- Light-headedness.
- Occasionally nightmares.

Parents should be warned that vomiting is common (six per cent of cases⁷) and can occur after arriving home.²⁸

Major side effects

These are rare and include:

- aspiration if vomiting occurs while the patient is deeply sedated. With deeper sedation airway patency can be lost. Patients with underlying airway problems, acute respiratory infections or illnesses are more vulnerable and should not be sedated using N₂O in the emergency department
- N₂O induced inactivation of methionine synthetase resulting in depletion of vitamin B12 which can affect bone marrow and the nervous system. N₂O induced bone marrow toxicity is progressive but reversible and can be prevented by the administration of calcium folinate. Neurotoxicity associated with N₂O is rare but can be rapid and irreversible, even after brief exposure.⁶ Those at risk include some vegetarians, the newborns of vegetarian mothers, patients with gastrointestinal pathology, the elderly, patients taking proton pump inhibitors and H₂ blockers or repeated exposure⁶
- impaired homocysteine metabolism, although the significance of this is unknown.

There are no data to guide the appropriate maximum duration or number of times a patient can be safely exposed to N₂O. If N₂O is to be used repeatedly it may be reasonable to administer methionine, vitamin B12 and possibly folic acid or calcium folinate.⁶

Risks to staff

N₂O can also have adverse effects on staff. Occupational exposure should be minimised by ensuring a suitable scavenging system is used and a consistent and adequate mask seal on the patient's face is maintained. The scavenging system should be connected directly to piped wall suction only (never portable) and turned to a medium flow.

Exposure to N₂O should be avoided during pregnancy. The data on fertility risks of N₂O are unclear, even in staff exposed to the agent repeatedly.^{40,41}

4.3 Contraindications

N₂O should not be used in the following situations:

Increased risk of airway loss

- Younger than one year of age.
- Acute respiratory infection (URTI) or exacerbation of asthma.
- Airway obstruction or history of difficult airway management.

Risk of expansion of air-filled closed space

- Chest injury, suspicion of pneumothorax or lung cyst.
- Abdominal distension or bowel obstruction.
- Significant head injury.
- Decompression sickness or air embolism.
- Middle ear disease, including otitis media.

Increase in pulmonary vascular pressure

- Pulmonary hypertension.

Patients at risk for N₂O induced bone marrow suppression, neurotoxicity or increased homocysteine levels

- History of B12 or folate deficiency.
- Nutritionally compromised patients, vegetarians, patients on H₂ blockers or proton pump inhibitors.
- Concurrent underlying serious illness, severe infection or extensive tissue damage.
- Patients with metabolic diseases associated with homocysteine metabolism (methionine synthetase deficiency, homocystinuria and methylmalonic acidemia).

4.4 Administration

N₂O administration requires:

- Risk assessment (see risk assessment and record form – Appendix 1).
- Fasting – Two hours for solids and liquids (see Section 3.6.2 on page 17).
- Parent information and consent (see Section 3.6.3 on page 18).

4.5 Staff

A minimum of **two** staff members should be present:

- Proceduralist.
- Sedation accredited nurse or doctor to administer N₂O.
- Staff trained in paediatric life support.

4.5.1 Cautions

- Staff or parents thought to be pregnant should avoid being present during N₂O administration.
- A scavenging unit should be used at all times when administering N₂O to decrease the exposure to staff.

4.6 Equipment

All the equipment as described earlier in the 'General principles' (Section 3.6.7 on page 20) should be in the room, functioning and checked.

For N₂O sedation, the following additional equipment is required:

- Separate oxygen source with mask other than the N₂O oxygen source.
- Bacterial filters for use in the N₂O circuit. In disposable circuit, the bacterial filter is built into the circuit.
- Scented essences for distraction therapy (for example, chocolate or strawberry essence). Please note that the essence should be applied with gauze or cotton wool balls to the inside of the mask, not to the filter, as this decreases the filter's efficiency.

It is important that the child is familiarised with the equipment prior to its use. This will result in improved cooperation and decreased anxiety.

4.7 Pre-procedure

- Check that the oxygen and N₂O hoses are connected to the wall outlets.
- Check the gauges to ensure that there is an adequate supply of oxygen and N₂O (if tanks are used rather than the wall supply).
- Check inspiratory/expiratory hoses are correctly connected and the reservoir bag inflates with no leak.
- Select the appropriate-sized face mask or mouth piece.
- Attach the bacterial filter between inspiratory hose and face mask if it does not come as part of the tubing kit.
- Ensure the scavenging system is correctly attached to the expiratory hose of the system and turned on.
- Engage with the child and the family. Familiarise them with the environment and equipment and use distraction.
- Attach the oxygen saturation probe.

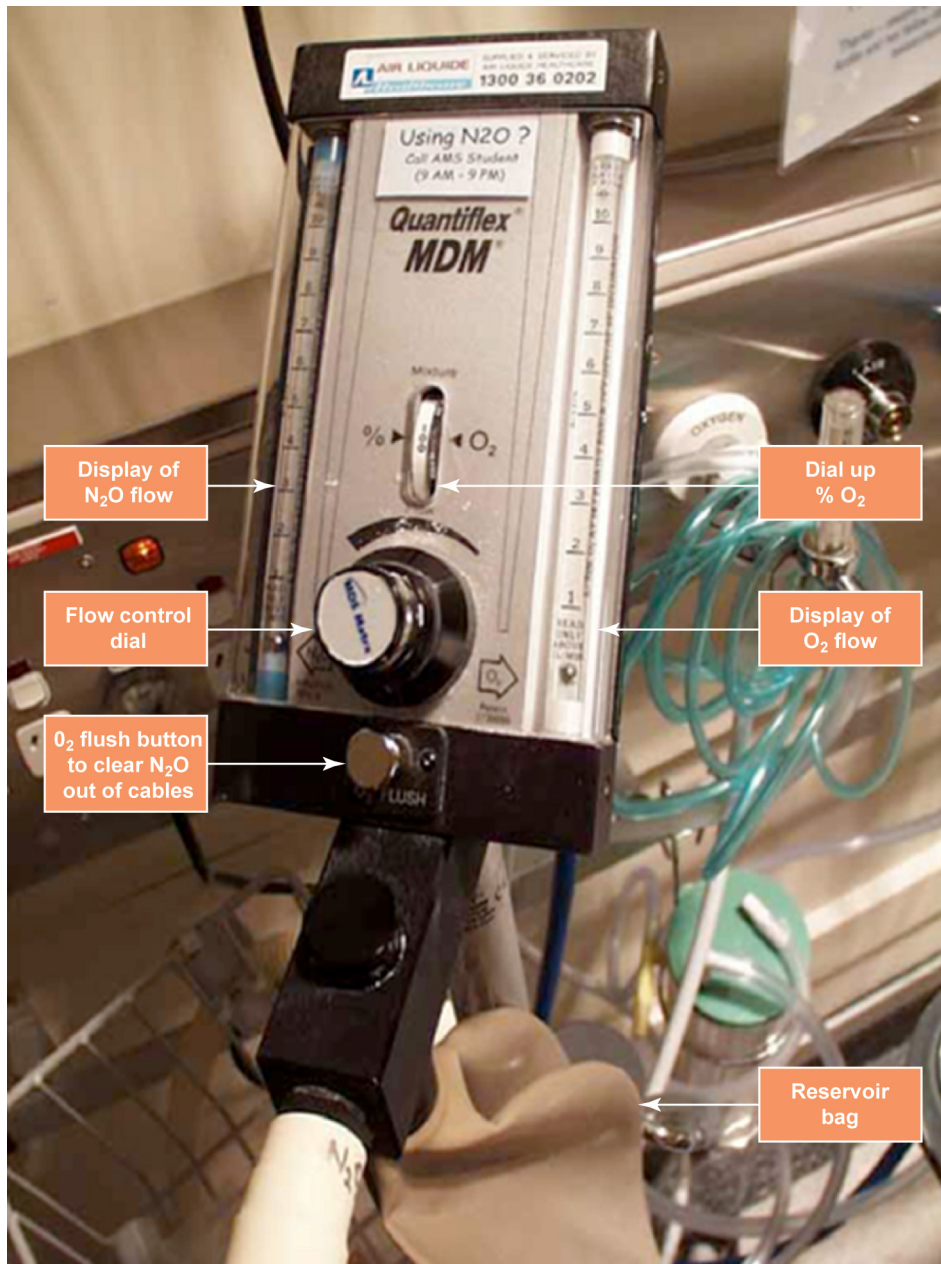
4.8 During procedure

- Adjust the flow of oxygen/N₂O to achieve the desired concentration (usually 50–70 per cent N₂O).
- Apply the face mask ensuring adequate seal.
- Monitor the reservoir bag and ensure there is a supply of N₂O for the patient to breathe and that the bag does not overextend.
- N₂O/oxygen mix should be applied for three minutes prior to the procedure to ensure maximum analgesic effect.
- The patient should continue to breathe N₂O/oxygen mix for the duration of the procedure.
- Monitor sedation levels and adjust percentage of N₂O versus oxygen as required.
- Monitor continuously and document every five minutes:
 - respiratory rate
 - oxygen saturation (including five minutes post procedure)
 - heart rate
 - conscious state/level of sedation.
- Document use of N₂O on the chart(s).

4.9 Post procedure

- Administer 100 per cent oxygen for two minutes after the procedure is finished to avoid diffusion hypoxia.
- Turn off suction scavenger.
- Discard bacterial filter or disposable tubing set.
- Place face mask in box for sterilisation or discard as per hospital policy.
- Monitor the child until their conscious state returns to baseline.
- Ensure all documentation is complete.
- Discharge criteria (see Section 3.8.2 on page 22).

Figure 1: Nitrous quantiflex MDM (Medication Delivery Machine)



4.10 Pre, during and post procedure

See 'Preparing the child and parent' and 'Principles of sedation episodes' (Sections 3.4, 3.5, 3.6, 3.7, 3.8 and 3.9 on pages 13-23).

4.11 Special notes on Entonox™

Entonox is the fixed 50:50 mixture of N₂O and oxygen. It is stored in blue tanks (the standard packaging for all N₂O) and has a demand valve circuit. This means that the patient has to take a breath of a certain depth to allow gas to flow from the tank to the patient. Children under four years of age are less able to create the necessary negative pressure to open the demand valve. The Entonox machine does not allow scavenging of exhaled gas.

Entonox is mobile and easily transferable between cubicles, it is often effective in the initial management of deformed limb fractures until more sustained analgesia can be organised. However, the Quantiflex™ monitored dial mixer is preferred, whenever possible, as it allows variation of the N₂O concentration from 30–70 per cent, allows administration of 100 per cent oxygen as a 'washout' after the procedure, and minimises room air pollution with a scavenger system.

Indications for use, adverse reactions, contraindications and fasting times are as described previously.

Differences before the procedure

- Check that there is an adequate supply of gas in the blue tank (use a fresh cylinder if less than 5000 kPa).
- Check that the Entonox tank valve is open.
- Check the cylinder connection to regulator pipe.
- A mouth piece rather than a mask may be used.

Differences during the procedure

- Observe that the patient has adequate demand/tidal volume to activate the valve on the Entonox circuit, by listening to the inspiratory/expiratory noise from the circuit.

There are no differences in after procedure care or discharge criteria.

5 Ketamine

5.1 Background

Ketamine is a dissociative anaesthetic agent. This unique dissociative state can be described as a general trance-like state characterised by profound analgesia, sedation, amnesia and immobilisation.^{9,15,42} Protective airway reflexes and spontaneous respiration as well as cardiovascular stability are maintained. This trance-like state has been described by the expression, 'the lights are on, but no one's home', as the eyes may remain open with a disconnected stare.

Ketamine acts by binding to N-methyl-D-aspartate (NMDA) receptors and creates dissociation (disconnection) between the cortex and the limbic system, preventing the higher centres from perceiving visual, auditory or painful stimuli.

Ketamine dissociative sedation is different from moderate or deep sedation or general anaesthesia and cannot be described in these terms to assess depth of sedation. It also does not follow the typical dose-response relationship of other sedative agents, which have a continuum of gradually increasing levels of sedation and concurrent cardiorespiratory depression.^{9,43}

Ketamine is a valuable agent for short painful procedures, especially in children who might otherwise require other general anaesthetic agents. It has many features that are attractive in the emergency department setting, such as rapid onset (less than five minutes IM or IV), consistently effective analgesia and amnesia, and airway stability.

Its safety in children has been documented in a number of studies.^{16,17,44,45} Ketamine produces acceptable sedation in the vast majority of cases (up to 98 per cent).¹⁶ In a large meta-analysis of 32 emergency department studies including 8,282 children who received ketamine the emesis rate was 8.4 per cent. The rate was higher in adolescents and typically occurred late during the recovery phase. Recovery agitation (emergence phenomena) occurred in 7.6 per cent, with clinically significant agitation in 1.4 per cent. The incidence of airway and respiratory adverse events was 3.9 per cent, with younger children (less than two years), children aged over 12 years and those co-administered benzodiazepine or anticholinergic at higher risk.^{17,18} Twenty-two cases of laryngospasm were identified in this dataset. It appeared to develop idiosyncratically and did not seem related to specific risk factors. Only one of these patients required intubation.⁴⁶

In the emergency department setting, ketamine is administered by intramuscular (IM) or intravenous (IV) injection. Both routes are safe and effective.⁴⁷ Although there are limited data directly comparing IM and IV use, sedation with IM ketamine lasts longer,⁴⁸ time to discharge from drug administration is shorter with IV ketamine,⁴⁵ and there is more vomiting with IM administration.^{45,48}

To determine the best route of administration for an individual patient, the sedation team will assess a number of factors. Generally, IV administration should be used if it can be inserted quickly with minimal distress to the child, for prolonged procedures or if an IV is already in situ.⁹ Some doctors may feel more comfortable with IV access in case of an adverse event, however there are no reported cases in which prophylactic IV access averted a ketamine-associated

adverse event.^{9,47} Anecdotally, if the ketamine is administered immediately after insertion of the IV cannula (using a topical anaesthetic such as AnGel[®] or EMLA[®]), then many children do not recall the IV insertion procedure.

The recommended ketamine dosing for IV injection is the initial dose of 1 mg/kg slowly over one minute followed by further doses of 0.5 mg/kg as required to a maximum total dose of 5 mg/kg.^{9,15} For IM injection the dose is 4 mg/kg.

Indications for use

- Very painful procedures.
- Laceration repair in young children.
- Reduction of fractures or dislocations.
- Abscess incision and drainage.
- Wound exploration for foreign body.
- Removal of foreign bodies from eye, ear, nose and skin.

5.2 Adverse reactions

- Respiratory depression
- Airway malposition
- Hyper-salivation
- Laryngospasm
- Cardiovascular stimulation
- Musculoskeletal effects
- Seizures
- Intracranial pressure elevation
- Ataxia
- Emergence reaction
- Vomiting

Respiratory depression

Severe respiratory depression is rare but is more frequent if ketamine is administered as a rapid IV bolus, when CNS abnormalities are present or in young infants. Neonates and small infants have greater difficulty maintaining a patent airway with any sedative agent. Ketamine is contraindicated in infants less than one year of age.

Airway malposition

Malposition of the airway can occur. It is critical to continuously pay attention to airway patency; reposition head or jaw if snoring respirations or stridor develop.

Hyper-salivation

Ketamine stimulates salivary and tracheobronchial secretions. Atropine or glycopyrolate have in the past been recommended as adjunctive agents to be co-administered with IV or IM ketamine. Current data do not support its use and there is some indication that it increases airway and respiratory adverse events.^{9,17}

Laryngospasm

Laryngospasm is rare but clinicians need to be prepared to manage this complication at any time. In a large meta-analysis of 8,282 children who received ketamine there were 22 cases of laryngospasm. This complication appears to develop idiosyncratically and does not seem related to specific risk factors. Only one of these patients required intubation.⁴⁶ Most cases of laryngospasm can be managed with assisted ventilation and oxygen.

Cardiovascular stimulation

Ketamine is a sympathomimetic agent and can produce mild to moderate increases of blood pressure, heart rate, cardiac output and oxygen consumption. Ketamine should not be used in patients with angina, heart failure or hypertension.⁹ In patients with maximal sympathetic drive (for example, severe hypovolaemia, pericardial tamponade), the intrinsic cardiac depressant effects of ketamine may be revealed.

Musculoskeletal effects

Skeletal muscle hypertonicity and random movement of head and extremities are often observed. Parents might interpret this as lack of sedation and need to be forewarned.

Seizures

Ketamine has anticonvulsant properties, however there are case reports of brief seizures related to ketamine in patients with underlying seizure disorders.⁹ In a case series, the rate of seizures has been reported at ~0.5 per cent.⁴⁵

Intracranial pressure elevation

There is inconclusive evidence that ketamine increases intracranial and intraocular pressure.⁹

Ataxia

Ataxia can be pronounced during recovery. Allow adequate recovery time and check that the child can stand and walk safely prior to discharge.

Emergence reactions

Ketamine often stimulates hallucinations and dreaming during recovery. They are more frequent in adults than in adolescents and rare in children under 10 years of age. In a study of 1,022 children, 18 per cent had mild agitation and two per cent had more pronounced agitation; only two children required treatment and both responded rapidly to small dosages of midazolam.¹⁶ In a large meta-analysis, recovery agitation was found to occur in 7.6 per cent with clinically significant agitation in 1.4 per cent.¹⁷ Low IV dose or high IM doses were found to be risk factors for recovery agitation. Although evidence is limited, a number of strategies have been used to reduce emergence reactions.⁹ These include planned topics for dreaming, dim lighting and maintaining a quiet environment. Although there is no clear evidence for specific age limits, it may be prudent to avoid ketamine sedation in adolescents. Patients with psychosis or behavioural abnormalities should not be given ketamine due to the risk of increased recovery reactions.

In the past, co-administration of low dose benzodiazepines was used to prevent and treat ketamine emergence reactions. Two randomised controlled trials of ketamine with or without low-dose midazolam failed to show any difference in the rate of recovery agitation.^{49,50} Therefore, midazolam should not be used routinely as an adjunctive agent for ketamine sedation.⁹ Any unpleasant recovery reactions associated with ketamine can be rapidly and reliably controlled with small doses of benzodiazepines.⁸

Vomiting

Vomiting may occur, especially during recovery. There are no documented reports of clinically significant ketamine-associated aspiration syndrome.⁹ A large randomised placebo-controlled trial showed a significantly lower rate of vomiting when ondansetron was given with IV ketamine sedation (five vs. 13 per cent; $p=0.02$).⁵¹

5.3 Contraindications

Contraindications are summarised in Table 5. In particular it should be noted that younger than one year of age or adolescence (>12 years) are contraindications to ketamine use.

Children younger than one year are at increased risk of airway complications. Procedures requiring sedation in infants should take place in the operating theatre under general anaesthetic.

Children over 12 years of age experience an increase in emergence reactions. Therefore, ketamine should be avoided in this age group. Other options such as general anaesthesia or sedation using propofol (by an authorising senior doctor) should be considered.

Table 5: Contraindications and adverse effects of ketamine

Contraindications	Potential adverse effects of ketamine
Children <one year	Increased risk of airway complications
Children >12 years	Increased risk of severe emergence reactions
Previous adverse reaction to ketamine	Contraindication to use
Active respiratory tract infection or disease Procedures involving the lower airway or pharynx	Increased airway secretions and laryngospasm
Heart disease	Increases heart rate, oxygen consumption and workload of the heart
Bowel obstruction	Increases incidence of vomiting as a result of the bowel obstruction and potential airway complications when sedated
Psychosis, ADHD	More severe emergence reaction/recovery agitation
Porphyria, thyrotoxicosis	Anecdotal evidence of enhanced sympathomimetic responses
Unstable epilepsy	Increased seizures
Glaucoma	Increased intraocular pressure
Central nervous system masses, hydrocephalus	Increased intracranial pressure

5.4 Administration

The recommended fasting times for ketamine, whether IV or IM, are four hours for solids and milk and two hours for clear liquids.

Ketamine administration requirements

- Risk assessment (see risk assessment and record form – Appendix 1).
- Fasting – Four hours for solids or milk and two hours for clear liquids (see Section 3.6.2 on page 17).
- Parent information and consent (see Section 3.6.3 on page 18).

Additional information on obtaining consent for ketamine

The very rapid onset (like flicking a switch) of a trance-like state, open eyes and occasional random movements seen during ketamine administration can be frightening for parents. Therefore it is important to explain these to parents before the procedure. The parent information sheet on paediatric sedation (Appendix 2) provides good talking points in the discussion with parents about the expected events during the sedation and possible sequelae after the procedure.

5.5 Staff

A minimum of three staff members should be present:

- **Proceduralist.**
- **Sedation doctor** to administer the ketamine. This doctor must be credentialed in ketamine sedation and paediatric resuscitation skills.
- **Nurse** (must be credentialed in ketamine sedation and paediatric resuscitations skills).

An appropriate senior doctor (emergency physician, paediatrician, anaesthetist, or other authorised senior doctor as per local policies and procedures) must approve the sedation episode and be available **immediately** during the procedure to assist if required. Whether they need to be present at the procedure is a matter for local policies and procedures.

All required personnel must be present, equipment checked and available prior to the administration of ketamine.

5.6 Location

Sedation with ketamine can only be performed in an area with resuscitation facilities as prescribed in local policies and procedures (see Section 3.6.6 on page 19).

5.7 Equipment

- Bag-valve-mask set up for appropriate size.
- Oxygen and tubing.
- Resuscitation trolley with full intubation equipment setup (ETT, laryngoscope, introducer, McGills forceps and ties).
- Appropriate size Guedel airway.
- Suction with a Yankauer sucker attached.
- Pulse oximetry.
- ECG monitoring equipment.
- Blood pressure monitoring.

A three-lead cardiac monitor, saturation probe and non-invasive BP monitoring should be applied for the duration of the procedure and recovery period.

5.8 Observations

Observations should be continuously monitored and documented every five minutes until the child returns to a normal conscious state:

- Pulse.
- Respiratory rate.
- Blood pressure.
- Oxygen saturation.
- Sedation score (as measured by UMSS).

5.9 Drug administration

There is no reversal agent for ketamine. The following table explains the differences between administration of ketamine IV and IM.⁸ Ketamine IV must be given as slow IV push over one minute to avoid transient respiratory depression, and is only be administered by a **credentialed sedation doctor**.

Table 6: Comparison of IV and IM ketamine

Route of administration	Intravenous (IV)	Intramuscular (IM)
Advantages	Ease of repeat dosing Faster recovery	No IV needed
Clinical onset	one minute	3–5 minutes
Duration of sedation (approx.)	15 minutes	15–30 minutes
Recovery (approx.)	60 minutes	90–150 minutes
Initial dose	1 mg/kg	4 mg/kg
Subsequent dose	0.25–0.5 mg/kg	Insert IV and give further doses 0.25 mg/kg IV
Maximum dose	5 mg/kg	5 mg/kg (combined IM and IV)

Ketamine vials contain 200 mg in 2 ml (100 mg/ml). A table to assist with calculation of weight-based doses is included in Appendix 3. The highly concentrated nature of the ketamine solution and the small volumes required pose some challenges to accurate drug dosing. In particular, unless allowance is made for the dead space volume of the syringe hub and needle (about 0.07 ml in a 1 ml syringe), higher or lower doses than intended can be administered. This is a particular risk for IV administration.

The recommended way of administering doses is to draw up the calculated initial dose, in a separate syringe.

For IV administration

Initial dose:

1. Calculate the initial dose.
2. Draw up into a 1 ml syringe.
3. Transfer this (using the drawing up needle) into an appropriate size syringe and dilute with normal saline to a final concentration of 10 mg/ml. For example for a 20 kg child, add the calculated dose 20 mg (which is 0.2 ml of ketamine from a vial with concentration 200 mg/2ml) to 1.8 ml of normal saline.
4. Administer slowly over 1 minute.

For subsequent doses, there are two options:

1. Use the same method for drawing up as the initial dose; or
2. Make up 20 mg ketamine to 20 ml with normal saline (1 mg/ml). The pre-calculated number of mg (ml) is given, rounded down to the nearest ml.

For IM administration

1. Calculate initial dose
2. Draw up calculated ketamine volume plus 0.1 ml in a 1 ml syringe
3. Change to injecting needle and prime needle (discarding drug if necessary) leaving only calculated ketamine volume in syringe.
4. Administer into a large muscle such as the thigh.

All syringes should be accurately labelled with drug and dose in accordance with the National Recommendation for User-applied Labelling of Injectable Medicines, Fluids and Lines.⁵²

Ketamine should be prescribed (on the medication chart) as a bolus and subsequent doses.

5.10 Pre, during and post procedure

See 'Preparing the child and parent' and 'Principles of sedation episodes' (Sections 3.4, 3.5, 3.6, 3.7, 3.8 and 3.9 on pages 13-23).

KEY PRACTICE POINT

Routine use of oxygen during the procedure is not recommended as it may mask hypoventilation.

6 Other sedation agents

This manual focuses on the use of nitrous oxide and ketamine as the sedation agents of choice for paediatric procedural sedation. Both have a long history of safe use in children.

Other sedation agents can be used for paediatric procedural sedation but do not form part of this sedation program. If using other agents the same principles of safe sedation apply as described in the 'General principles' (Sections 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, pages 13–23), including credentialing of the doctor to use the agent, patient selection and preparation, separation of roles for the person performing the procedure and the person administering sedation, monitoring to detect adverse events and post-procedure care.

Some other agents that may be used include midazolam, midazolam combined with fentanyl, propofol, ketofol, and, to a lesser extent, chloral hydrate.

In the past midazolam was used frequently for emergency department sedation in children. Although a useful sedative, anxiolytic and amnestic agent,¹⁵ midazolam lacks analgesic properties and has a long duration of effect. In addition, a portion of children given midazolam will become paradoxically agitated. There have also been reports of unpredictable sedation,^{53,54} paradoxical reactions with restlessness,^{53,54} and poor palatability.⁵⁵ In terms of patient flow in the emergency department midazolam compares poorly with nitrous oxide, which has almost immediate discharge readiness upon completion of the procedure. For these reasons midazolam is not recommended.

Propofol is the parenteral agent of choice for sedation of adolescents when appropriate staff and facilities are available. It should only be used in older adolescents by senior doctors with expertise in its use and who are credentialed by the health service to use it in their emergency department. Due to propofol's potential cardiac, respiratory and airway complications, it should not be used in children where safer agents are available.

The use of ketofol, a combination of ketamine and propofol for procedural sedation and analgesia in the emergency department setting shows promise. The combination may minimize the adverse effects of ketamine or propofol as single agents. In particular, it may be a suitable alternative to propofol in older children where the emergence phenomena associated with ketamine make it relatively contraindicated.⁵⁶

We recognise that clinicians may find themselves assisting with a sedation episode using one of these agents and want further information. Some information for propofol and ketofol is provided, however these agents are outside the scope of this sedation program. A list of key papers is provided in the further reading section to direct clinicians to appropriate information.

6.1 Propofol

Propofol is a highly lipid-soluble, ultra short-acting alkyl phenol agent with pure sedative properties. It provides no analgesia but is capable of inducing a state of deep sedation allowing tolerance of painful procedures. First published use in the paediatric emergency department setting was in 1999 and it has since been shown to be safe and effective when used under controlled conditions.

The advantages of propofol include:

- favourable pharmacokinetics, with rapid onset (<one minute) and recovery (five to 15 minutes)
- substantial potency that reliably produces effective conditions for procedural sedation
- low incidence of vomiting and other undesirable after effects.

The disadvantages of propofol are:

- the need to provide separate analgesia for painful conditions/procedures
- a higher risk of airway compromise, respiratory depression and hypotension
- painful injection: propofol has a low pH so tends to burn when pushed.

6.1.1 Adverse reactions

- Respiratory depression. The most serious and common adverse effect of propofol is potent respiratory depression. Respiratory depression with transient hypoxia is fairly common (five to 20 per cent of patients). This means that clinicians using propofol must be competent in airway and respiratory support, and have all necessary equipment for this readily available.
- Airway complications. Patients frequently need airway repositioning.
- Hypotension. Propofol lowers mean blood pressure by 10 to 25 per cent, which can be significant in haemodynamically unstable patients.
- Allergic reactions. Propofol is manufactured as a lipid emulsion that contains soy and egg lecithin so there is the potential for allergic reactions in those patients who have egg or soy allergies. If these allergies are known, propofol should not be used.

Warning

Combination of propofol with an opiate may increase the risk of respiratory depression and apnoea. Notwithstanding, patients should still receive adequate analgesia as required pre- and post-administration of propofol for procedural sedation.

6.1.2 Indications and contraindications

Propofol is indicated for brief, very painful procedures in children over the age of 12. In this age group, ketamine should be avoided due to the high incidence of emergence reactions.

Propofol should not be used in:

- patients under the age of 12 years
- patients with a potentially difficult airway
- patients with egg or soy allergy
- haemodynamically unstable patients.

KEY PRACTICE POINT

Propofol should not be used in children aged less than 12 years.

6.1.3 Administration

Propofol administration requirements

- Risk assessment (see risk assessment and record form – Appendix 1).
- Fasting – Four hours for solids or milk and two hours for clear liquids (see Section 3.6.2 on page 17).
- Consent and parent information (see Section 3.5.3 on page 18).

Observations

Observations should be continuously monitored and documented every five minutes until the child returns to normal conscious state:

- Pulse.
- Respiratory rate.
- Blood pressure.
- Oxygen saturation.
- Sedation score.

6.1.4 Staff

A minimum of three staff members should be present:

- **Proceduralist**
- **Sedation doctor** to administer drugs and manage the airway. This doctor must be credentialed in propofol sedation and paediatric resuscitation.
- **Sedation nurse** (must be credentialed in sedation with parenteral agents).

The procedure must be authorised by the responsible senior doctor (as per local clinical governance requirements). Appropriate clinical support to manage adverse effects must be immediately available during the procedure.

KEY PRACTICE POINT

Propofol is a potent agent with risks above those of ketamine. Specific credentialing of doctors for its use in the emergency department is recommended.

6.1.5 Location

Sedations with propofol must be performed in an area with resuscitation facilities and equipment for continuous monitoring.

6.1.6 Equipment

- Bag-valve-mask set up for appropriate size.
- Oxygen and tubing.
- Resuscitation trolley with full set of intubation equipment (ETT, laryngoscope, introducer, McGills forceps and ties).
- Appropriate size Guedel airway.
- Suction with a Yankauer sucker attached.
- Pulse oximetry.
- ECG monitoring equipment.
- Blood pressure monitoring equipment.

A minimum of three-lead cardiac monitor, saturation probe and non-invasive BP monitoring should be applied for the duration of the procedure and recovery period.

If available, capnography should be used.

6.1.7 Drug administration

Propofol can only be administered intravenously. An initial slow IV bolus of 1 mg/kg should be used, with additional boluses of 0.5 mg/kg to achieve required level of sedation.

6.1.8 Pre, during and post procedure

See 'Preparing the child and parent' and 'Principles of sedation episodes' (Sections 3.4, 3.5, 3.6, 3.7, 3.8 and 3.9 on pages 13-23).

Further reading

Pharmacology and selection of agents

Kost S, Roy A. Procedural sedation and analgesia in the emergency department: a review of sedative pharmacology. *Clin Pediatr Emerg Med* 2010;11:233–43.

Bennett J, DePiero A, Kost S. Tailoring pediatric procedural sedation and analgesia in the emergency department: Choosing a regimen to fit the situation *Clin Pediatr Emerg Med* 2010;11:274–81.

Intranasal fentanyl

Crellin D, Ling RX, Babl FE. Does the standard intravenous solution of fentanyl (50 microg/mL) administered intranasally have analgesic efficacy? *Emerg Med Australas* 2010;22:62–7.

Propofol

Mallory MD, Baxter AL, Yanosky DJ, Cravero JP; Pediatric Sedation Research Consortium. Emergency physician-administered propofol sedation: a report on 25,433 sedations from the pediatric sedation research consortium. *Ann Emerg Med* 2011; 57:462–8.

David H, Shipp J. A randomized controlled trial of ketamine/propofol versus propofol alone for emergency department procedural sedation. *Ann Emerg Med* 2011;57:435–41.

Ketofol (ketamine/propofol)

Arora S. Combining ketamine and propofol (“Ketofol”) for emergency department procedural sedation and analgesia: a review. *West J Emerg Me.* 2008 9:20–3.

William EV, Andolfatto G. A prospective evaluation of “ketofol” (ketamine/propofol combination) for procedural sedation and analgesia in the emergency department. *Ann Emerg Med* 2007;49:23–30.

Green SM, Andolfatto G, Krauss B. Ketofol for procedural sedation? Pro and con. *Ann Emerg Med* 2011;57:444–8.

Shah A, Mosdossy G, McLeod S, Lehnhardt K, Peddle M, Rieder M. A blinded, randomized controlled trial to evaluate ketamine/propofol versus ketamine alone for procedural sedation in children. *Ann Emerg Med* 2011;57:425–33.

Andolfatto G, Willman E. A prospective case series of pediatric procedural sedation and analgesia in the emergency department using single-syringe ketamine-propofol combination (ketofol). *Acad Emerg Med* 2010;17:194–201.

7 Appendices

These appendices are additional resources to assist health services in providing safe paediatric procedural sedation in emergency departments. These documents cannot address all local circumstances that may apply and it is the responsibility of health services implementing paediatric procedural sedation in emergency departments to ensure that the documents used are appropriate for their emergency department.

- Appendix 1 Paediatric procedural sedation in the emergency department:
Risk assessment and record form
- Appendix 2 Parent information sheet for children receiving procedural sedation
in the emergency department
- Appendix 3 Ketamine dosage for paediatric procedural sedation
in the emergency department

Appendix 1

Paediatric procedural sedation in the emergency department: Risk assessment and record form

Paediatric procedural sedation
in the emergency department:
Risk assessment and record form

AFFIX PATIENT LABEL

Date:	Time:
Procedure:	

Sedation agent used				
<input type="checkbox"/> N ₂ O	N ₂ O inhaled:	O ₂ %:	N ₂ O %:	Duration (minutes):
<input type="checkbox"/> Ketamine	Route of administration:		Total dose:	
<input type="checkbox"/> Other agent:	Route of administration:		Total dose:	

Sedation team	Name	Pre-procedure check ('time-out') completed. Two to sign.
Proceduralist		
Sedation nurse		
Sedation doctor (if required)		

* No. column below – refer to corresponding number on back of this form.

Pre-procedure (This section should be completed prior to the procedure)	No.*
<input type="checkbox"/> Sedation drug – recorded on medication chart	
<input type="checkbox"/> Allergies – recorded on medication chart	
<input type="checkbox"/> Weight in kg – recorded on medication chart and observation chart	
<input type="checkbox"/> Risk assessment checked List if any:	1
<input type="checkbox"/> Exclusion criteria checked List if any:	2
<input type="checkbox"/> Minimum fasting time completed Actual fasting time: solids ____ hr liquids ____ hr	3
<input type="checkbox"/> Location and equipment checked and functioning	4
<input type="checkbox"/> Adequate staff available	5
<input type="checkbox"/> Risks discussed, consent obtained and sedation handout given to parents	
<input type="checkbox"/> 'Time out' or 'positive patient identification' Tick and sign above	6
<input type="checkbox"/> Non-pharmacological techniques planned (for example, distraction box, DVD set up to watch)	
<input type="checkbox"/> Baseline vital signs recorded on observation chart prior to commencing sedation	
During procedure	
<input type="checkbox"/> Continuous oximetry, plus ECG monitoring and BP every five minutes for parenteral agents. Vital signs documented every five minutes.	
<input type="checkbox"/> All IV sedation drugs administration by a credentialed physician	
<input type="checkbox"/> Depth of sedation score:	7
Post procedure	
<input type="checkbox"/> Staff present continuously, vital signs recorded every 15 minutes once roused, quiet area for ketamine	
<input type="checkbox"/> Nil orally until fully alert	
<input type="checkbox"/> Fulfils discharge criteria	8
<input type="checkbox"/> Post-sedation handout provided and discussed	
<input type="checkbox"/> Side effect or adverse event of sedation: <input type="checkbox"/> No <input type="checkbox"/> Yes List if any:	
Any other comments:	

Reference: Paediatric procedural sedation: Emergency department manual 2011.

1 Risk assessment	<ul style="list-style-type: none"> • Risk of laryngospasm or upper airway obstruction, e.g. upper respiratory tract infection, craniofacial abnormalities, snoring, sleep apnoea, stridor • Risk of vomiting or aspiration, for example, vomiting, bowel obstruction, gastro-oesophageal reflux • Significant respiratory disease, for example, asthma exacerbation, pneumonia • Cardiovascular impairment, for example, cardiac disease, pulmonary hypertension, hypovolaemia, sepsis • Abnormal conscious state/risk of raised ICP, for example, head injury, meningitis, space occupying lesion, significant neurological disease, for example, neuromuscular disorder • History of sedation failure, sedation adverse events or allergy • Age <one year • Moderate or severe systemic disease which limits activity 	<p>Any positive findings on risk assessment or exclusion criteria indicate that sedation in the emergency department is likely to be contraindicated.</p> <p>Approval of the designated authorising officer is required.</p>			
2 Exclusion criteria	<table border="0"> <tr> <td>Nitrous oxide</td> <td>Ketamine</td> </tr> <tr> <td> <ul style="list-style-type: none"> • <three years (relative) • Head injury or loss of consciousness • Chest injury, pneumothorax, lung cyst • Bowel obstruction • Middle ear disease eg otitis media • B12 or folate deficiency • Abnormal homocysteine metabolism </td> <td> <ul style="list-style-type: none"> • <one or >12 years (relative) • Glaucoma • Head injury, CNS lesion, epilepsy • ADHD, psychosis </td> </tr> </table>		Nitrous oxide	Ketamine	<ul style="list-style-type: none"> • <three years (relative) • Head injury or loss of consciousness • Chest injury, pneumothorax, lung cyst • Bowel obstruction • Middle ear disease eg otitis media • B12 or folate deficiency • Abnormal homocysteine metabolism
Nitrous oxide	Ketamine				
<ul style="list-style-type: none"> • <three years (relative) • Head injury or loss of consciousness • Chest injury, pneumothorax, lung cyst • Bowel obstruction • Middle ear disease eg otitis media • B12 or folate deficiency • Abnormal homocysteine metabolism 	<ul style="list-style-type: none"> • <one or >12 years (relative) • Glaucoma • Head injury, CNS lesion, epilepsy • ADHD, psychosis 				
3 Fasting times	<table border="0"> <tr> <td>Nitrous oxide: two hours for solids and liquids</td> <td>Ketamine: four hours solids, two hours liquids</td> </tr> </table>	Nitrous oxide: two hours for solids and liquids	Ketamine: four hours solids, two hours liquids		
Nitrous oxide: two hours for solids and liquids	Ketamine: four hours solids, two hours liquids				
4 Location and equipment	<ul style="list-style-type: none"> • Location prescribed in policies and procedures available and checked • Functioning suction device • Bag-mask-valve set up for appropriate size and able to deliver O₂ • O₂ available by mask • Pulse oximetry operative, plus ECG monitoring operative for ketamine and IV midazolam • Blood pressure monitoring operative for ketamine and IV midazolam • Resuscitation trolley with paediatric airway equipment in ED 				
5 Adequate staff available	<p>For nitrous oxide inhalation: two staff available (one credentialed)</p> <p>For parenteral sedation: three staff available plus senior doctor available; two credentialed for parenteral agents</p>				
6 Pre-procedure activities complete (time-out)	<p>Both staff involved in the procedure will confirm the following:</p> <ul style="list-style-type: none"> • The patient's identity checked by ID band or positive identification • Confirm or mark site (if applicable) • Procedure to be performed 				
7 Details of sedation score (UMSS)	<p>0 = Awake</p> <p>1 = Minimally sedated (may appear tired/sleepy, responds to verbal conversation and/or sound)</p> <p>2 = Moderately sedated (somnolent/sleeping, easily roused with light tactile stimulation or simple verbal command)</p> <p>3 = Deep sedation (deep sleep, rousable only with deep or significant physical stimulation)</p> <p>4 = Unrousable</p>				
8 Discharge criteria	<ul style="list-style-type: none"> • Resumption of pre-sedation level • Resumption of purposeful neuromuscular activity • Ability to ambulate (if appropriate) or able to sit without support • Ability to verbalise appropriate to age • Final set of vital signs are within normal limits for the child's age • Ability to tolerate oral fluids 				

This form or equivalent should be filed in the patient's medical record.

Appendix 2

Parent information sheet for children receiving procedural sedation in the emergency department

Parent information sheet for children receiving procedural sedation in the emergency department

This information sheet is for parents of children having sedation for a procedure while in the emergency department.

What is sedation?

Sedation is a medicine given to make children feel sleepy and relaxed. This medicine can be given by breathing in a gas or by an injection.

Why does your child need sedation?

Your child needs to have a procedure and may become distressed or have pain when this occurs. Procedural sedation (sedation for procedures) is intended to reduce your child's pain and anxiety. The sedation will make them feel sleepy and/or make them unable to remember the procedure. The procedure can then be completed without causing distress for your child or for you.

Permission to give sedation

As the parent or caregiver you must give us consent (permission) for sedation of your child and for the procedure. You need to understand the reasons for sedation and the procedure, and the gas or drugs to be used including any risks involved. This will be explained by the doctor.

Helping your child before the sedation and procedure

- Ask the doctor or nurse to explain the procedure to you and your child.
- Talk to your child about some ways to cope (for example – looking at an interactive book, using their imagination to be in a nice place, blowing bubbles).
- It helps not being too upset or nervous yourself – your child will notice this.

Helping your child during the sedation and procedure

- It is usually helpful to have a parent (or another adult who knows the child) stay with them.
- The level at which you will be able to engage with your child will depend on how sleepy your child becomes.
- Your child may need reminders of the coping methods you decided upon earlier. For example, 'Blow away the hurt.' This sort of distraction is very helpful.
- Giving your child a sense of control with some simple choices is helpful. We can allow them to choose things they may like such as music or video options, or which finger the oxygen probe may be placed on.

Helping your child after the sedation and procedure

- Remain with your child. They may not remember where they are or why they are in hospital.
- Focus on the good things your child did. For example 'You did a great job blowing away the hurt.'
- For your child's safety, do not take your child home until staff tell you it is safe to do so. Expect to wait for an hour or more after the procedure.

Home care

The delayed effects of the medicines may make your child a bit confused, sleepy or clumsy during the 24 hours after discharge. You need to take extra care in looking after and supervising your child during this time.

If your child falls asleep in the car seat, watch them to make sure that they do not have any difficulty breathing. **Do not** leave your child alone in a car seat or alone in the car.

Children may go to sleep again after getting home from the hospital. Children may want to sleep more because of the sedation medicine.

Check on your child's sleeping pattern the night after getting home. If their sleeping seems heavy or strange then wake them up gently. If you cannot wake them or something seems very wrong in their appearance or breathing, call an ambulance and return to the hospital immediately.

Sometimes children may feel sick or vomit if they eat a big meal too soon after sedation. Give your child clear liquids such as diluted fruit juice, icy poles, jelly or clear soup.

Supervise all playing and bathing for at least eight hours after getting home from the hospital.

Do not let your child swim or use play equipment, such as bikes or monkey bars, which might cause an accident, for 24 hours after discharge.

Reference: *Paediatric procedural sedation: Emergency department manual 2011*.

Key points to remember

- Sedation is commonly used in children for procedures in emergency departments.
- You need to give consent before your child has sedation and the procedure.
- Make sure you understand the reasons for and the risks of sedation.
- Be as open and honest as you can with your child about what is going to happen. It helps not to be too upset yourself.



Seeking help

Please call the emergency department if:

- your child vomits more than twice
- your child has strange or unusual behaviour
- you have any questions.

The contact number for the emergency department is:

Appendix 3

Ketamine dosage for paediatric procedural sedation in the emergency department

Ketamine IV dosage for paediatric procedural sedation in the emergency department

Note: Doses must be calculated and prepared prior to the commencement of the procedure.

Weight of child Kg	INITIAL DOSE: 1.0 mg/kg		SUBSEQUENT DOSE: 0.5mg/kg	
	IV Ketamine (200 mg/2 ml vial)		IV Ketamine (200 mg/2 ml vial)	
	Dose (mg)	Volume (ml)	Dose (mg)	Volume (ml)
10	10	0.10	5.0	0.05
11	11	0.11	5.5	0.06
12	12	0.12	6.0	0.06
13	13	0.13	6.5	0.07
14	14	0.14	7.0	0.07
15	15	0.15	7.5	0.08
16	16	0.16	8.0	0.08
17	17	0.17	8.5	0.09
18	18	0.18	9.0	0.09
19	19	0.19	9.5	0.10
20	20	0.20	10.0	0.10
21	21	0.21	10.5	0.11
22	22	0.22	11.0	0.11
23	23	0.23	11.5	0.12
24	24	0.24	12.0	0.12
25	25	0.25	12.5	0.13
26	26	0.26	13.0	0.13
27	27	0.27	13.5	0.14
28	28	0.28	14.0	0.14
29	29	0.29	14.5	0.15
30	30	0.30	15.0	0.15
35	35	0.35	17.5	0.18
40	40	0.40	20.0	0.20
45	45	0.45	22.5	0.23
50	50	0.50	25.0	0.25
55	55	0.52	27.5	0.28
60	60	0.60	30.0	0.30

IV administration	Subsequent doses
<ol style="list-style-type: none"> 1 Calculate the initial dose 2 Draw up into a 1 ml syringe 3 Transfer this (using the drawing up needle) into an appropriate size syringe and dilute with normal saline to a final concentration of 10mg/ml 4 Administer slowly over 1 minute <p>e.g. 20 kg child, add 0.2 ml of ketamine to 1.8 ml normal saline = 20 mg/2 ml (10 mg/ml)</p>	<ol style="list-style-type: none"> 1 Use the same method as the initial dose (using table above) or 2 Make up 20 mg ketamine to 20 ml with normal saline (1 mg/ml) and administer the pre-calculated number of mg (ml), rounded down to the nearest ml.

Note: Ensure ALL syringes are accurately labelled with drug and dosage in accordance with the National Recommendations for User-applied Labelling of Injectible Medicines, Fluids and Lines (August 2010) www.safetyandquality.gov.au

Reference: Paediatric procedural sedation: Emergency department manual 2011.

Ketamine IM dosage for paediatric procedural sedation in the emergency department

Note: Doses must be calculated and prepared prior to the commencement of the procedure.

IM: 4 mg/kg		
IM Ketamine (200 mg/2 ml vial)		
Weight of child	Dose (mg)	Volume (ml)
Kg		
10	40	0.40
11	44	0.44
12	48	0.48
13	52	0.52
14	56	0.56
15	60	0.60
16	64	0.64
17	68	0.68
18	72	0.72
19	76	0.76
20	80	0.80
21	84	0.84
22	88	0.88
23	92	0.92
24	96	0.96
25	100	1.00
26	104	1.04
27	108	1.08
28	112	1.12
29	116	1.16
30	120	1.20
35	140	1.40
40	160	1.60
45	180	1.80
50	200	2.00
55	220	2.20
60	240	2.40

IM administration	Subsequent doses
1 Calculate initial dose	Insert IV
2 Draw up calculated ketamine volume plus 0.1 ml in a 1 ml syringe	Administer subsequent doses IV at a dose of 0.5 mg/kg.
3 Change to injecting needle, prime needle (discarding drug if necessary) leaving only calculated ketamine volume in syringe	See the Ketamine IV dosage chart for calculation and preparation of subsequent IV doses.
4 Administer into a large muscle such as the thigh.	

Note: Ensure ALL syringes are accurately labelled with drug and dosage in accordance with the National Recommendations for User-applied Labelling of Injectable Medicines, Fluids and Lines (August 2010) www.safetyandquality.gov.au

Reference: *Paediatric procedural sedation: Emergency department manual 2011.*

8 References

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