Paediatric Procedural Sedation - Guide for Emergency Departments, Wards, Clinics and Imaging

**Summary**  This Guideline supports the use of safe care where children require procedural sedation outside of operating theatre and/or intensive care units.

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**Distributed to**  Divisions of General Practice, Ministry of Health, Private Hospitals and Day Procedure Centres, Tertiary Education Institutes

**Audience**  Emergency Departments, Medical, Clinicians, Nursing
PAEDIATRIC PROCEDURAL SEDATION - GUIDE FOR EMERGENCY DEPARTMENTS, WARDS, CLINICS AND IMAGING

PURPOSE
Paediatric Procedural Sedation - Guide for Emergency Departments, Wards, Clinics and Imaging provides direction to clinicians and is aimed at achieving the best possible paediatric care in all parts of the state. The guide was prepared for the NSW Ministry of Health by an expert clinical reference group.

KEY PRINCIPLES
This guide applies to all facilities where paediatric patients are managed. It requires the Chief Executives of all Local Health Districts and Speciality Health Networks to determine where local adaptions are required or whether it can be adopted in its current format in hospitals and facilities required to manage procedural sedation of paediatric patients.

This guide reflects what is currently regarded as a safe and appropriate approach to the management of procedural sedation for paediatric patients. However, as in any clinical situation there may be factors which cannot be covered by a single guide. This document should be used as a guide, rather than as a complete authoritative statement of procedures to be followed in respect of each individual presentation. It does not replace the need for the application of clinical judgement to each individual presentation.

USE OF THE GUIDELINE
Chief Executives must ensure:

- This guide is adopted or local procedures are developed based on the Paediatric Procedural Sedation Guide for Emergency Departments, Wards, Clinics and Imaging.
- Local protocols are in place in all hospitals and facilities likely to be required to manage paediatric patients requiring procedural sedation
- Ensure that all staff treating paediatric patients are educated in the use of the locally developed paediatric protocols.

Directors of Clinical Governance are required to inform relevant clinical staff treating paediatric patients of this revised guideline.

REVISION HISTORY

<table>
<thead>
<tr>
<th>Version</th>
<th>Approved by</th>
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1 INTRODUCTION

This Guide aims to support the best care for paediatric patients by providing a resource for the management of procedural pain and associated distress and anxiety. It is not intended to be used or interpreted as a training manual. The target audience is medical and nursing staff who provide care for paediatric patients requiring the use of procedural sedation. This guide should not be seen as a stringent set of rules to be applied without the clinical input and discretion of the managing professionals.

This guide focuses on the use of nitrous oxide and ketamine as sedatives of choice for paediatric procedural sedation, as both have a long history of safe use in paediatric patients.

Final responsibility for the safety of procedural sedation remains with the treating clinician. Each patient should be individually assessed with decision making centred around achieving the best clinical outcome. The focus of this Guide is on procedural sedation for paediatric patients in Emergency Departments (EDs) and other suitably designed, equipped and accredited areas.

Credentialing of practitioners, establishing and equipping safe sedation areas, determination of the scope of practice and other areas of clinical governance are the responsibility of each Local Health District (LHD) and/or Specialty Health Network (SHNs) and should comply with the Australia New Zealand College of Anaesthetists (ANZCA) PS09 Guidelines on Sedation and/or Analgesia for Diagnostic and Interventional Medical, Dental or Surgical Procedures.1

In 2011, the Victorian Emergency Care Improvement and Innovation Clinical Network (ECIICN) developed a program to standardise the approach for paediatric procedural sedation in Victorian EDs.2 Following permission from the Victorian Department of Health, the NSW Ministry of Health supported an expert group to adapt the information for use in NSW. This guide includes recommendations by experts from NSW in paediatrics, emergency medicine and anaesthesia. No conflict of interest has been identified.

2 CLINICAL GOVERNANCE

LHDs/SHNs determine the procedures that can be performed within their facilities and are responsible for staff credentialing, associated policies and procedures and medical gas supply. Paediatric procedural sedation should be supported by competencies, credentialing aligned with capability of the facility and appropriate recording and review of procedural sedation practices.

Procedural sedation should only be used by medical and nursing staff who have appropriate training and where adequate equipment, facilities and staff are available.

Successful sedation of paediatric patients requires recognition of potential issues associated with agent selection and safe administration. There should be an understanding of the nature of the procedure, the presence of co-morbidities and the impact of illness or injury. If managed well, procedural sedation of paediatric patients can be effective and safe.3,4,5 If not, there is a risk of adverse events such as airway obstruction or vomiting and...
aspiration due to depression of protective airway reflexes. Inadequate sedation can result in distress for the child and their parent/carer and may cause the procedure to have to be postponed.

The procedures described in this guide cannot be guaranteed to be safe and effective in every circumstance. Unexpected adverse events are possible in any clinical situation. Accurate and complete documentation should occur for any patient that receives procedural sedation. Episodes of procedural sedation should be audited as part of quality assurance activities and any adverse events should be reviewed to determine if remedial actions or changes to practice are required.

LHDs/SHNs should provide equipment to appropriately scavenge and reduce exposure of staff to medical gases such as nitrous oxide, see Section 6.1 Nitrous Oxide for more information.6

Suggested considerations for clinical governance units:

- Is procedural sedation of paediatric patients safe and appropriate in our department?
- Is the equipment described in the policies/procedures readily available?

Does the department/unit have written policies and/or procedures that address:

- The types of procedures that can be safely undertaken.
- Selection of suitable patients for procedural sedation.
- How informed consent is obtained and recorded.
- Where procedural sedation can be performed.
- Staff training and credentialing.
- Health and safety measures including safe supply and scavenging of medical gases.
- Pre-procedural assessment and preparation.
- Monitoring during and post-procedure.
- Procedures for management, recording and auditing of adverse events.
- Criteria for safe discharge post sedation.

2.1 Use of Off-Label Medications

Some of the medications recommended in this guide are considered ‘off-label’. This term refers to the use of medications in ways other than those approved by the Australian Therapeutic Goods Administration. It may include administration of a registered medication at a different dose, indication or route, or administration to a patient of an age outside the registered use. In patient groups such as paediatrics off-label use of medications is common and may be the only treatment option.7 More information about off-label medications can be found in the Australian Medicines Handbook and the complementary Australian Medicines Handbook Children’s Dosing Companion.

To support the safe use of medications recommended within this Guide the Working Party (see Appendix 8 for membership) considered the best available evidence and where necessary sought specialist advice.
3 STAFF CREDENTIALING

Clinicians who administer procedural sedation to patients must be competent in:

- Assessment of the child’s airway, breathing and circulation.
- Assessment of the child’s level of consciousness.
- Recognition and response to the deteriorating patient.
- Pain assessment and management.

There must be a thorough understanding of the actions of the medication being administered, including modifications for age, concurrent drug therapy and disease processes. Knowledge of the correct procedures is also required to safely administer sedation.

Clinicians who administer nitrous oxide must be formally credentialed or receive formal supervised training and have skills in basic airway management.

Clinicians must be formally trained or credentialed to use intravenous or intramuscular sedation and be trained in paediatric advanced life support. NSW Health Local Health Districts and Specialty Health Networks are responsible for credentialing of staff employed within their facilities. The Australian and New Zealand College of Anaesthetists (ANZCA) says that medical or dental practitioners wishing to provide procedural sedation and/or analgesia should have received a minimum of three months full time equivalent supervised training in procedural sedation and/or analgesia and anaesthesia or similar approved course. They should participate in a process of training and competency assessment. Training should include completion of a crisis resource management simulation centre course. More information about procedural sedation and the process of credentialing can be found in the ANZCA PS09 Guidelines on Sedation and/or Analgesia for Diagnostic and Interventional Medical, Dental or Surgical Procedures. This ANZCA guideline has also been endorsed by the Australasian College for Emergency Medicine (ACEM).

Credentialing of clinical staff should include theoretical and practical components. LHDs/SHNs may develop credentialing processes for staff who perform procedural sedation. An example of a paediatric accreditation template based on the Emergency Care Institute’s Procedural Sedation Accreditation can be found in Appendix 2 Example of Credentialing for Paediatric Procedural Sedation.

4 GENERAL PRINCIPLES

4.1 Overview

The keys to safe and successful treatment are:

- Choosing when procedural sedation is appropriate.
- Choosing the type of sedation.
- Using procedures that maximise effectiveness.

The aim of providing procedural sedation to children is to:
• Allow the safe completion of painful procedures.
• Minimise pain, anxiety and psychological distress.
• Minimise movement which may jeopardise the procedure.
• Maximise the potential for amnesia.
• Allow return to the pre-sedated state as quickly as possible.

The possibility of excess sedation related to individual variations in response to medication is a risk in paediatric patients.

Deep sedation carries the potential for:
• Airway obstruction.
• Depression of protective airway reflexes.
• Depression of respiration.
• Depression of the cardiovascular system.
• Medication interactions.

Nonetheless, studies have shown that procedural sedation for paediatric patients can be performed safely.3,4,5

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

Patient selection is a major factor in achieving safe and successful procedural sedation. The approaches described in this Guide are intended for use with patients who are generally healthy or have only mild systemic disease.

More severely ill patients, those with complex medical problems and infants under 12 months of age or less than 10 kilograms should not be sedated outside of the operating theatre. General anaesthesia is usually more appropriate for prolonged procedures.

Proper preparation of the patient, the parent/carer, the environment and staff for a procedure using sedation is very important.

Children who are very anxious prior to the procedure need special consideration and may be more suitable for general anaesthesia in an operating theatre.

4.2 Safety

Before starting procedural sedation consider:
• Is sedation for the procedure is necessary?
• Does the procedure need to happen now?
• Is this patient a suitable candidate for procedural sedation?
• Would general anaesthesia in an operating theatre be a better option?
• Is the setting safe for the procedure?
• Are the necessary credentialed staff available?
• Are there adequate resources available to manage any unexpected events?

See Section 5.1 Pre-Procedure for more information about assessment of risk associated with procedural sedation.

4.3 Procedural Sedation for Paediatric Wards, Clinics and Imaging

Patients on paediatric wards, clinics or imaging areas should be fasted for elective sedation. Medications for procedural sedation in these areas are detailed in Section 6 Procedural Sedation for Emergency Departments, Wards, Clinics and Imaging. Each LHD/SHN should develop local policies and procedures to meet the standards outlined in this document. For more information see Appendix 6 Additional Resources, in particular Sydney Children’s Hospitals Network Procedural Sedation (Paediatric Ward, Clinic and Imaging Areas) Practice Guideline.

4.4 Pain Assessment and Management

There are many factors that may decrease the need for and/or amount of procedural sedation required. These include both non-pharmacological and pharmacological strategies. Please refer to NSW Health GL2016_009 Infants and Children: Management of Acute and Procedural Pain in the Emergency Department for information on assessment and management of pain in the paediatric patient.

4.4.1 Non-Pharmacological Strategies

With some children non-pharmacological strategies can reduce or even avoid the need for procedural sedation. In many instances it will make the procedure less distressing for the child, the parent/carer and staff.

The use of non-pharmacological techniques can also help by:

• Decreasing anticipatory anxiety before the procedure.
• Reducing pain and anxiety during the procedure.
• Promoting coping with future medical procedures.

For more information about the use of non-pharmacological strategies in the management of pain see NSW Health GL2016_009 Infants and Children: Management of Acute and Procedural Pain in the Emergency Department.

4.4.2 Pharmacological Strategies

Use of topical anaesthetics and systemic analgesia can decrease pain and anxiety and may decrease the amount of sedation required, however sedation should not be regarded as a substitute for analgesia.

Paracetamol, ibuprofen and oxycodone are the most commonly used oral medications for mild to moderate pain. For severe pain, intranasal fentanyl or intravenous morphine may be
required. Opioid analgesia should not be administered intramuscularly to paediatric patients where other options are available.

Topical anaesthetic cream such as AnGeL®️, EMLA®, or LMX4™️ can provide effective local anaesthesia. It is applied to the skin prior to intravenous cannula insertion, venepuncture or lumbar puncture.

For simple wound closure a solution of adrenaline, lignocaine and amethocaine (e.g. ALA or Laceraine™️) can be used. It is applied to sterile gauze or cotton wool which is placed into the wound for up to an hour. It has a similar efficacy to infiltrated lignocaine.⁸

For wound repair consider the use of tissue glues e.g. Dermabond or Steristrips®️ in place of sutures. This approach is often quick, painless and has similar cosmetic outcomes to suturing when used appropriately. Application of topical analgesic agents such as Laceraine™️ or ALA should be considered prior to use.⁹ As it dries tissue glue may cause a burning sensation, which some children find distressing. Prior application of ALA topically prior to use of the glue has been reported to reduce this sensation.

For more information about the use of pharmacological strategies in the management of pain see NSW Health GL2016_009 Infants and Children: Management of Acute and Procedural Pain in the Emergency Department.

5 PRINCIPLES OF PROCEDURAL SEDATION EPISODES

5.1 Pre-Procedure

The Paediatric Procedural Sedation Checklist for Emergency Departments, Wards, Clinics and Imaging (Appendix 1) should be completed for all episodes of procedural sedation and added to the healthcare record. The checklist has been designed to comply with NSW Health PD2017_032 Clinical Procedure Safety Policy and has been approved for use with the paediatric population. The ‘Before Sedation’ section of the checklist should be complete before procedural sedation begins.

5.1.1 Risk Assessment

Health assessment prior to procedural sedation includes a thorough medical history and physical examination. Airway assessment is necessary as airway obstruction associated with deeper than intended sedation is the most common difficulty encountered.

The Paediatric Procedural Sedation Checklist for Emergency Departments, Wards, Clinics and Imaging (Appendix 1) includes a risk assessment to assist with identification of patients at higher risk of complications. These patients may be more suitable for general anaesthesia in an operating theatre.

Components of risk assessment are listed below:

- Is there increased risk of airway compromise leading to obstruction?
  - Infants under 12 months of age or less than 10 kilograms.
  - Obesity.
  - Nocturnal loud snoring, stridor or history suggestive of sleep apnoea.
  - Large potentially obstructive tonsils (most common 2-6 years).
Paediatric Procedural Sedation - Guide for Emergency Departments, Wards, Clinics and Imaging

- Craniofacial abnormalities/cleft palate.
- History that may predict airway difficulties e.g. Macroglossia/Down syndrome.
- History of severe/recurrent croup, laryngomalacia or tracheomalacia.
- Medication that may decrease level of consciousness or respiratory effort such as opioids, anti-epileptics or benzodiazepines.

- **Is there increased risk of hypoventilation?**
  - Sedatives that may decrease level of consciousness or respiratory effort such as opioids, anti-epileptics or benzodiazepines.
  - Chronic lung disease e.g. ex-premature infants, cystic fibrosis.
  - Neuromuscular disorders e.g. cerebral palsy.
  - Central neurological abnormalities such as brainstem pathology.

- **Is there increased risk of aspiration?**
  - Recent ingestion of food or fluid.
  - Recent opioid administration.
  - Prior episodes of aspiration.
  - A procedure that involves oral or pharyngeal stimulation.
  - Bowel obstruction, gastro-oesophageal reflux or vomiting.
  - Decreased level of consciousness.
  - Cerebral palsy or bulbar dysfunction.

- **Is there increased risk of bronchospasm or laryngospasm?**
  - Asthma or a recent upper or lower respiratory tract infection.

- **Is there increased risk of cardiovascular compromise?**
  - Cardiac disease, hypovolaemia, sepsis.

- **Is there a history of adverse reactions to sedation or an anaesthetic?**

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

- **Is there a medication specific contraindication?**

The NSW Health PD2017_032 Clinical Procedure Safety Policy provides guidance on the management of safety risks associated with clinical procedures, in particular matching of the patient to the procedure, team time out and communication.

5.1.2 Medication

Episodes of procedural sedation require completion of the Paediatric Procedural Sedation Checklist for Emergency Departments, Wards, Clinics and Imaging (Appendix 1). The checklist includes guidance for use of sedatives with paediatric patients. Consideration should be given to the use of combinations of opioids and benzodiazepines as well as any other medication the patient may be taking that has a sedative effect such as anti-epileptics. Staff who prescribe and administer procedural sedation should understand the actions and use of antagonists and know where they are located.
All medication should be prescribed, administered and recorded as per NSW Health PD2013_043 Medication Handling in NSW Public Health Facilities. Note for paediatric patients:

- The patient’s current weight must be recorded on the Paediatric National Inpatient Medication Chart (PNIMC) and/or the electronic medication administration record.
- Where the patient is overweight, medication calculations should be based on estimated lean body mass.
- All medications, including nitrous oxide, require prescription on a PNIMC/electronic medication administration record.

**Combinations of medications should only be administered under the direction of an appropriately credentialed medical officer.**

### 5.1.3 Fasting

The Australian and New Zealand College of Anaesthetists (ANZCA) PS15 Recommendations for the Perioperative Care of Patients Selected for Day Care Surgery recommends that children fasting for elective procedures may have clear fluids up to two hours, breast milk up to four hours and formula milk or solid food up to six hours before anaesthesia.

Fasting recommendations for children undergoing sedation for non-urgent procedures are listed in Table 2.

**Table 2: Recommended Fasting Times for Non-Urgent Procedures**

<table>
<thead>
<tr>
<th>Agent</th>
<th>Fasting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrous oxide*</td>
<td>2 hours for fluid/solids ¹¹</td>
</tr>
<tr>
<td>Nitrous oxide and additional analgesic or sedative*</td>
<td>2 hours for clear fluid</td>
</tr>
<tr>
<td></td>
<td>4 hours for milk/solids ¹¹</td>
</tr>
<tr>
<td>Ketamine*</td>
<td>2 hours for clear fluid</td>
</tr>
<tr>
<td></td>
<td>6 hours for milk/solids ¹⁰</td>
</tr>
<tr>
<td>Propofol</td>
<td>2 hours for clear fluid</td>
</tr>
<tr>
<td></td>
<td>6 hours for milk/solids ¹⁰</td>
</tr>
<tr>
<td></td>
<td>(Fasting times must not be compromised)</td>
</tr>
</tbody>
</table>

* Assess risk/benefit of fasting for urgent procedures

The decision to sedate an unfasted patient for an emergency procedure should be based on careful assessment of the urgency of the procedure, the desired sedation depth, the fasting status and individual patient risk factors. If the procedure is considered urgent and the patient is not fasted for the recommended time, consult the appropriate specialist.

The relationship between recommended fasting times and the risk of adverse outcomes in procedural sedation is the subject of some debate. Recent data indicates that fasting and adverse events in emergency department sedation in paediatric patients are not closely
Final decisions about fasting should be considered on a case by case basis by appropriately credentialed senior clinicians.

The American College of Emergency Physicians made the following Level B recommendations, based on moderate clinical certainty:

‘Do not delay procedural sedation in adults or paediatrics in the ED based on fasting time. Pre-procedural fasting for any duration has not demonstrated a reduction in the risk of emesis or aspiration when administering procedural sedation and analgesia.’

5.1.4 Staff

The level of sedation reached by any agent can be unpredictable. Careful consideration should be given to staff and training required for management of deeper levels of sedation or anaesthesia. Staff designated to undertake a procedure must be present before any medication is administered.
**Table 1: Recommended Staff**

### Nitrous oxide

- A clinician credentialed in use of nitrous oxide and basic airway management.
- A clinician to perform the procedure.

### Nitrous oxide and additional analgesic or sedative

- A clinician credentialed in the use of nitrous oxide and basic airway management.
- A clinician assistant.
- A clinician to perform the procedure.

Senior doctor available in the department, aware that the procedural sedation is occurring and able to respond immediately if required. If present may have sedationist or proceduralist role.

### Intravenous or intramuscular sedation

- A doctor credentialed to administer the sedation, assess airway patency and monitor the patient.
- A clinician to assist the sedationist and record the monitoring.
- A clinician to perform the procedure.

Senior doctor present during sedation and procedure. May have sedationist or proceduralist role.
5.1.5 Location

The areas in which procedural sedation can be administered should be defined in local policies/procedures. Nitrous oxide may be administered in a location such as a procedure room as long as a scavenging system is present and the equipment listed below is available. Paediatric resuscitation facilities and medications must be readily available.

Procedural sedation administered intravenously or intramuscularly should only be administered in a specifically designed procedural area with advanced paediatric monitoring equipment, resuscitation facilities and medications. Patients who are severely ill, have complex medical problems and infants under 12 months of age or less than 10 kilograms, should not be sedated outside the operating theatre. General anaesthesia is usually more appropriate for prolonged procedures.

5.1.6 Equipment

Equipment must be available and checked prior to the start of any procedural sedation, including oxygen and suction. A list of equipment required is included on the Paediatric Procedural Sedation Checklist for Emergency Departments, Wards, Clinics and Imaging (Appendix 1).

Equipment required includes:

- Paediatric resuscitation trolley, with a full set of intubation equipment.
- Oxygen (minimum 15 L flow meter).
- Bag-valve-mask.
- Suction with a rigid sucker.
- Oropharyngeal airway (+ 1 size above and below).
- Oxygen saturation monitor with appropriate audible alarm settings.

Additionally, for intravenous or intramuscular agents:

- Blood pressure measuring device.
- Access to electrocardiograph (ECG) monitoring.
- Expired carbon dioxide monitoring available.

Note: If the child is unsettled it may be necessary to apply the oxygen saturation probe, blood pressure cuff and attach ECG leads once sedation has taken effect.

5.1.7 Monitoring

Baseline observations must be taken and recorded on the age appropriate Between the Flags Observation Chart Paediatric Emergency Department Observation Chart/Standard Paediatric Observation Chart (PEDOC/SPOC) before administration of sedation. Observations required for various sedatives are outlined in Section 5.3.1 Monitoring below.
5.1.8 Preparing the Child and the Parent/Carer

In general, one parent/carer is encouraged to stay with their child where clinically appropriate and where the child is conscious, as agreed between the clinician and the parent/carer.

One team member should be allocated the role of providing explanations to the child and their parent/carer about what is happening before, during and after the procedure.

Consent must be obtained prior to the procedure as required by NSW Health PD2005_406 Consent to Medical Treatment - Patient Information and Consent and is required for all episodes of procedural sedation.

Factsheets about procedural sedation are available via the Sydney Children’s Hospitals Network or HNEkidshealth websites. Factsheets specifically on nitrous oxide administration are available via the Sydney Children’s Hospitals Network website.

For more information on the management of paediatric pain see NSW Health GL2016_009 Infants and Children: Management of Acute and Procedural Pain in the Emergency Department

5.2 During the Procedure

5.2.1 Monitoring

All patients undergoing procedural sedation must be observed and monitored continuously with pulse oximetry, this equipment must alarm when appropriate limits are transgressed. Observations are to be recorded on the age appropriate Between the Flags Observation Chart (PEDOC/SPOC). Depth of sedation may be assessed using a sedation scoring system such as the University of Michigan Sedation Scale (UMSS) (Appendix 5) or a level of consciousness score such as Alert, Voice, Pain, Unresponsive (AVPU). Levels of sedation are listed in Appendix 4: Levels of Sedation. In the event that the patient becomes more sedated than anticipated, staff are to be aware of available resources within their facility such as how to activate local emergency response systems and how to access senior emergency, anaesthetic and/or paediatric skilled staff.

Table 3: Observations

<table>
<thead>
<tr>
<th>Medication</th>
<th>Level of Sedation</th>
<th>Observations</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrous oxide</td>
<td>Minimal/moderate</td>
<td>Pulse rate, respiratory rate, oxygen saturation</td>
<td>Recorded every 15 minutes</td>
</tr>
<tr>
<td></td>
<td>sedation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrous oxide and additional</td>
<td>Minimal/moderate</td>
<td>Pulse rate, respiratory rate, oxygen saturation</td>
<td>Recorded every 15 minutes</td>
</tr>
<tr>
<td>analgesic or sedative</td>
<td>sedation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intravenous or intramuscular</td>
<td>Deep sedation</td>
<td>Pulse rate, respiratory rate, oxygen saturation, blood pressure, ECG and</td>
<td>Recorded every 5 minutes</td>
</tr>
<tr>
<td>agents</td>
<td></td>
<td>expired carbon dioxide monitoring available</td>
<td></td>
</tr>
</tbody>
</table>
5.3 Post-Procedure

5.3.1 Monitoring

Continuous monitoring and recording of observations, as per above Section 5.2.1 Monitoring should continue until after the procedure, when the patient is rousable.

Recovery from an episode of procedural sedation should mirror the usual post anaesthesia recovery standards and guidelines as per the ANZCA PS09 Guidelines on Sedation and/or Analgesia for Diagnostic and Interventional Medical, Dental or Surgical Procedures. ¹

The recovery area must have adequate staff, equipment and an appropriate environment for managing patients who have become unconscious or who have suffered complications during the procedure. Staff who are monitoring unconscious patients must be aware of resources available within their facility such as how to activate local emergency response systems and how to access senior emergency, anaesthetic and/or paediatric skilled staff. If the patient remains deeply sedated, observations and level of consciousness score should be monitored continuously until the patient is responsive and shows age-appropriate activity. Patients should not eat or drink until fully awake.

After the procedure is complete and there is less stimulus from pain, the child may become more sedated.

5.3.2 Discharge

As patients respond to sedation differently with differing rates of recovery, it is not possible to set a specific discharge time. A patient can be discharged after the following criteria are met:

- Resumption of pre-sedation level of consciousness.
- Resumption of purposeful neuromuscular activity.
- Able to move and talk as per pre-procedure.
- Observations have returned to what they were pre-procedure.
- Able to tolerate oral fluids.
- If required, post procedure analgesia has been arranged.

For small children or those who have physical or cognitive impairments, 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. The parent/carer can most often assist staff when making this judgement.

A responsible adult must accompany the child home and be available to supervise and care for the child’s ongoing needs. Discharge care should be explained to the parent/carer as well as providing written instructions.
5.3.3 Documentation

Complete the Paediatric Procedural Sedation Checklist for Emergency Departments, Wards, Clinics and Imaging (Appendix 1) as well as other relevant documentation. This includes recording the type of procedure and sedation used, medication administered, effectiveness of sedation and procedural sedation team members. All side effects or adverse events should also be recorded in the patient's healthcare record.

6 PROCEDURAL SEDATION APPLICABLE TO EMERGENCY DEPARTMENTS, WARDS, CLINICS AND IMAGING

Nitrous oxide and chloral hydrate are suitable for use in wards, clinics and imaging areas as well as Emergency Departments (EDs). Prior to any episode of paediatric procedural sedation a thorough risk assessment should be undertaken which includes location, equipment and staff training and credentialing as per the ANZCA PS09 Guidelines on Sedation and/or Analgesia for Diagnostic and Interventional Medical, Dental or Surgical Procedures. For more information on risk assessment see Section 5.1.1 Risk Assessment. The Paediatric Procedural Sedation Checklist for Emergency Departments, Wards, Clinics and Imaging (Appendix 1) should be completed for all episodes of procedural sedation and added to the healthcare record.

6.1 Nitrous Oxide

6.1.1 Background

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

Studies in children have shown nitrous oxide to be an effective and safe analgesic for use during painful procedures. 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 ED.

Nitrous oxide can be administered as a mixture up to 70% when blended with oxygen. It can also be administered as a premixed solution known as Entonox™ (50% nitrous oxide/50% oxygen). Both of these can be delivered via a free flow system or a demand system.

There are two types of nitrous oxide delivery systems, demand and free flow. The demand system is generally not suitable for children under eight years of age as they are unable to reliably create the necessary negative pressure to open the demand valve. The suitability of a child to use this system should be assessed including physical, cognitive and compliance. For more information see Appendix 6 Additional Resources and Sydney Children’s Hospitals Network Pain Management – CHW practice guideline.

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

Nitrous oxide is useful for procedures such as suturing, insertion of an intravenous cannula and burns dressings. Nitrous oxide is not effective for procedures such as incision and drainage of complex or deep abscesses. It is difficult to administer nitrous oxide for children with perioral lacerations.
6.1.2 Adverse Reactions

Nitrous oxide is usually well tolerated by children. In a recent study mild side effects occurred in 1.8% of cases.\(^8\)

*Mild side effects include:*

- Vomiting.
- Nausea.
- Dizziness.
- Light-headedness.

*Major side effects are rare and include:*

- Aspiration if vomiting occurs while the patient is deeply sedated.
- Airway obstruction.
- Diffusion hypoxia.

Diffusion hypoxia may occur when reversing a patient from nitrous oxide. It is due to a large amount of nitrous oxide re-entering alveoli from the blood and diluting the available amount of oxygen. Care should therefore be taken during the reversal phase of sedation with supplemental (100%) oxygen to limit this.

There is no data to guide the appropriate maximum duration or number of times a patient can be safely exposed to nitrous oxide. If nitrous oxide is to be used repeatedly it may be reasonable to administer methionine, vitamin B\(_{12}\) and possibly folic acid or calcium folinate.

*Risks to staff*

Nitrous oxide can have adverse effects on staff. Occupational exposure should be minimised by ensuring a suitable scavenging system is used. For more information see *Safe Work Australia Workforce Exposure Standards for Airborne Contaminants*\(^6\) Exposure to nitrous oxide should be avoided during pregnancy. The data on fertility risks of nitrous oxide are unclear, even in staff are exposed repeatedly.

6.1.3 Contraindications

Nitrous oxide should not be used in the following situations:

*Increased risk of airway loss:*

- Infants under 12 months of age (caution with 12-24 months old).
- Acute upper respiratory tract infection 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.

Increase in pulmonary vascular pressure:
• Pulmonary hypertension.

Risk of nitrous oxide induced bone marrow suppression, neurotoxicity or increased homocysteine levels:
• History of B12 or folate deficiency.
• Nutritionally compromised patients, patients on H2 antagonists 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).

6.1.4 Administration
Nitrous oxide administration requires:
• Risk assessment as per the Paediatric Procedural Sedation Checklist for Emergency Departments, Wards, Clinics and Imaging (Appendix 1).
• Fasting as per local guidelines.
• Parent information and consent see Section 5.1.8 Preparing the Child and Parent/Carer).

6.1.5 Staff
A minimum of two staff members should be present:

<table>
<thead>
<tr>
<th>Nitrous oxide</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔧 A clinician credentialed in use of nitrous oxide and basic airway management.</td>
</tr>
<tr>
<td>👨‍⚕️ A clinician to perform the procedure.</td>
</tr>
</tbody>
</table>

6.1.6 Location
Nitrous oxide may be administered in a location such as a procedure room as long as a scavenging system is present and the equipment listed below is available. Paediatric resuscitation facilities and medications must be readily available.

6.1.7 Equipment
Equipment must be available and checked prior to the start of any procedural sedation, including oxygen and suction, as described in Section 5.1.6 Equipment.
If possible, giving the child the opportunity to become familiar with the nitrous oxide mask may decrease any anxiety associated with its use. A child life therapist may be able to assist with preparation of the child, if available.

Equipment required includes:

- Paediatric resuscitation trolley with a full set of intubation equipment.
- Oxygen (minimum 15 L flow meter).
- Bag-valve-mask.
- Suction with a rigid sucker.
- Oropharyngeal airway (+ 1 size above and below).
- Oxygen saturation monitor with appropriate audible alarm settings.

6.1.8 Monitoring

Monitoring should continue and be recorded on the age appropriate Between the Flags Observation Chart (PEDOC/SPOC) until the patient returns to a normal conscious state. For more information see Section 5.2.1 Monitoring.

6.1.9 Pre, During and Post-Procedure

See Section 5 Principles of Procedural Sedation Episodes.

6.2 Chlortal Hydrate

Chlortal hydrate is a sedative useful for painless procedures especially for children under two years of age. For more information see Sydney Children’s Hospitals Network Procedural Sedation (Paediatric Ward Clinic and Imaging Areas) Practice Guideline.
Table 4: Nitrous Oxide Procedure

<table>
<thead>
<tr>
<th>Pre-procedure</th>
<th>During procedure</th>
<th>After procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Check oxygen and nitrous oxide hoses are connected to the correct wall outlets or that cylinder gauges have adequate supply available</td>
<td>1. Commence flow as per medication order and local policy for type of system used</td>
<td>1. Administer 100% oxygen for 2 minutes after the procedure is finished to avoid diffusion hypoxia</td>
</tr>
<tr>
<td>2. Check circuit is correctly connected and functioning as per local policy</td>
<td>2. Apply the face mask or mouth piece ensuring adequate seal</td>
<td>2. Turn off suction scavenger</td>
</tr>
<tr>
<td>3. Select the appropriate face mask or mouth piece</td>
<td>3. Monitor flow as per local policy for type of system used</td>
<td>3. Discard bacterial filter or disposable tubing set</td>
</tr>
<tr>
<td>4. Ensure the scavenging system is used as per local policy</td>
<td>4. Nitrous oxide/oxygen mix should be applied for three to five minutes prior to the procedure to ensure maximum analgesic effect</td>
<td>4. Place face mask in box for sterilisation or discard as per hospital policy</td>
</tr>
<tr>
<td>5. Familiarise the child and parent/carer with the environment and equipment and choose distraction strategy</td>
<td>5. The child should continue to breathe nitrous oxide/oxygen mix throughout the procedure</td>
<td>5. Monitor the child until their conscious state returns to baseline</td>
</tr>
<tr>
<td>6. Attach the oxygen saturation probe.</td>
<td>6. Monitor sedation levels and adjust percentage of nitrous oxide/oxygen concentration as required</td>
<td>6. Complete all documentation.</td>
</tr>
</tbody>
</table>
7 PROCEDURAL SEDATION APPLICABLE TO EMERGENCY DEPARTMENTS

Medications that can cause deeper levels of sedation include:

- Nitrous oxide and intranasal fentanyl
- Nitrous oxide and oral opioids.
- Nitrous oxide and midazolam.
- Ketamine.
- Propofol.

These sedatives should only be used in Emergency Departments (EDs). Other circumstances may be considered by local clinical governance following a thorough assessment of risk including staff training and credentialing, location and equipment as per ANZCA PS09 Guidelines on Sedation and/or Analgesia for Diagnostic and Interventional Medical, Dental or Surgical Procedures.¹

For more information on risk assessment of individual patients see Section 5.1.1 Risk Assessment. The Paediatric Procedural Sedation Checklist for Emergency Departments, Wards, Clinics and Imaging (Appendix 1) should be completed for all episodes of procedural sedation and added to the healthcare record.

7.1 Nitrous Oxide and Additional Sedative or Analgesic

7.1.1 Intranasal Fentanyl

The following information specifically refers to intranasal fentanyl as an adjunct to other agents that may be used in procedural sedation, not as an analgesic on its own. Intranasal fentanyl is a rapid acting, non-invasive, painless and reliable method of giving an opioid to patients who have moderate to severe pain but do not have intravenous (IV) access. It is primarily an analgesic and like all opioids has sedation as a side effect.¹ ¹ It is important for clinicians to check for fentanyl doses given before administering any procedural sedation. Naloxone must be available in departments or wards during administration for use as a reversal agent if required.

Adverse reactions

Possible adverse reactions include:

- Respiratory depression.
- Airway obstruction due to poor position.
- Hypotension.
- Allergic reactions.
- Nausea and vomiting.

Contraindications

- Infants under 12 months of age or less than 10 kilograms.
- Known fentanyl hypersensitivity.
- Altered level of consciousness.
- Patients presenting with a head injury.
- Epistaxis or facial trauma.\textsuperscript{21,22}

**Dose**

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dose</th>
<th>Route</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intranasal fentanyl (child over 1 year)</td>
<td>1 - 2 micrograms/kg/dose\textsuperscript{20} (max 100 micrograms/dose)</td>
<td>Intranasal</td>
<td>Every 5 minutes if needed up to a total of 3 micrograms/kg.\textsuperscript{20}</td>
</tr>
<tr>
<td>Naloxone</td>
<td>10 micrograms/kg (max 400 micrograms)\textsuperscript{20}</td>
<td>IV/IM/SC</td>
<td>Repeat as necessary to a total of 2 mg.\textsuperscript{20}</td>
</tr>
</tbody>
</table>

**Administration**

The correct intranasal administration technique is by use of a specially adapted syringe attached to an atomiser device, e.g. a Mucosal Atomisation Device. Intranasal fentanyl is rapidly absorbed with therapeutic levels attained after about two minutes with a duration of 30-60 minutes. The bioavailability of intranasal fentanyl is around 70%. Maximising bioavailability should be achieved by ensuring the nasal passage is not obstructed (see also contraindications) and that only a small volume is delivered to each nostril to minimise swallowing and side effects such as sneezing.\textsuperscript{22} Draw up the required volume into a syringe allowing for priming of the atomising device:

- Position the patient at a 45 degree angle or with their head to one side.
- Administer dose in small aliquots using a push pause technique.

Fentanyl administration requirements if used in conjunction with a sedative:

- Risk assessment, see Section 5.1.1 Risk assessment and the Paediatric Procedural Sedation Checklist for Emergency Departments, Wards, Clinics and Imaging (Appendix 1).
- Fasting, see Section 5.1.3 Fasting.
- Parent information and consent, see Section 5.1.8 Preparing the Child and the Parent/Carer.

During administration the syringe needs to be pushed using a push/pause technique to ensure an atomising effect is achieved. If pushed too slowly the medication is not atomised and is less effective.

*The combination of nitrous oxide and intranasal fentanyl leads to deeper levels of sedation and increases the rate of vomiting.*
7.1.2 Oral Opiates

Oral oxycodone or morphine may be used as an adjunct to nitrous oxide. For more details see Sydney Children’s Hospitals Network Procedural Sedation (Paediatric Ward Clinic and Imaging Areas) Practice Guideline.

7.1.3 Midazolam

Midazolam is a useful agent as a premedication prior to general anaesthesia, as an anxiolytic or for adjunctive sedation of fasted patients for brief elective procedures. For more information see the Sydney Children’s Hospitals Network Procedural Sedation (Paediatric Ward, Clinic and Imaging Areas) Practice Guideline. Midazolam has no analgesic properties and has a long duration of effect and so it is therefore not commonly used for procedural sedation of children in the ED. The addition of an analgesic then increases the potential for airway compromise or hypoventilation. Some children given midazolam become paradoxically agitated. There have been reports of unpredictable sedation and an unpleasant taste.

When midazolam is used, flumazenil should be readily available for use as a reversal agent.

7.1.4 Staff

A minimum of three staff members should be present.

<table>
<thead>
<tr>
<th>Nitrous oxide and additional analgesic or sedative</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="https://via.placeholder.com/150" alt="Clinician.png" /> A clinician credentialed in the use of nitrous oxide and basic airway management.</td>
</tr>
<tr>
<td><img src="https://via.placeholder.com/150" alt="Clinician.png" /> A clinician assistant.</td>
</tr>
<tr>
<td><img src="https://via.placeholder.com/150" alt="Clinician.png" /> A clinician to perform the procedure.</td>
</tr>
</tbody>
</table>

Senior doctor available in the department, aware that the procedural sedation is occurring and able to respond immediately if required. If present may have sedationist or proceduralist role.

7.1.5 Location

Sedation with nitrous oxide and an additional sedative or analgesic should only be performed in a treatment room or specifically designed procedural area such as a resuscitation room with paediatric equipment for continuous monitoring and resuscitation.

7.1.6 Equipment

Equipment must be available and checked prior to the start of any procedural sedation, including oxygen and suction, as described in Section 5.1.6 Equipment.

Equipment required includes:

- Paediatric resuscitation trolley with a full set of intubation equipment.
- Oxygen (minimum 15 L flow meter).
- Bag/valve/mask.
- Suction with a rigid sucker.
- Oropharyngeal airway (+1 size above and below).
- Oxygen saturation monitor with appropriate audible alarm settings.

### 7.1.7 Monitoring

Monitoring should continue and be recorded on the age appropriate Between the Flags Observation Chart (PEDOC/SPOC) until the patient returns to a normal conscious state, including sedation score. For more information see Section 5.2.1 Monitoring and Appendix 5 University of Michigan Sedation Scale (UMSS) for an example of a sedation scoring system. The administering clinician should monitor airway and breathing. Desaturation is usually due to partial airway obstruction and therefore vigilant observation of the patient during the procedure is essential. Senior medical support must be immediately available throughout the procedure to assist with management of any adverse effects.

### 7.1.8 Pre, During and Post-Procedure

See Section 5 Principles of Procedural Sedation Episodes.

### 7.2 Ketamine

Ketamine can cause deeper levels of sedation and anaesthesia. Additional staff with specific training and credentialing in its use and a higher level of monitoring is required. Ketamine should be used in accordance with the ANZCA PS09 Guidelines on Sedation and/or Analgesia for Diagnostic and Interventional Medical, Dental or Surgical Procedures.\(^1\)

#### 7.2.1 Background

Ketamine is a dissociative anaesthetic agent. This dissociative state is characterised by profound analgesia, sedation, amnesia and immobilisation.\(^{25}\) Protective airway reflexes and spontaneous respiration as well as cardiovascular stability are relatively maintained, although aspiration could potentially still occur. The eyes commonly remain open with a disconnected stare or nystagmus, which can be alarming to parents, who should be forewarned about this.

The depth of sedation is dose related. Lower ketamine doses such as 0.25 mg/kg intravenously are sedative, and purposeful responses may be maintained. Higher doses such as 1 mg/kg intravenously will possibly result in general anaesthesia but will allow very painful procedures to be undertaken.

Ketamine is a valuable agent for short painful procedures. General anaesthesia is preferable for prolonged or complex procedures.

The safety of ketamine use in children has been documented in a number of studies.\(^3,4,26\)

In the ED setting, ketamine can be administered by intravenous (IV) or intramuscular (IM) or injection. Both routes are safe and effective.
Time to discharge from medication administration is shorter with IV ketamine. Sedation with IM ketamine lasts longer and the likelihood of vomiting is higher.

If IM Ketamine is used consider inserting an IV cannula once the child is sedated.

Generally, IV administration should be used if an IV cannula is already in situ and/or if an IV cannula can be inserted quickly with minimal distress to the child. If IM ketamine is used, a cannula would usually be inserted once the child is sedated.

### 7.2.2 Indications

Indications for use of ketamine:

- Very painful procedures.
- Laceration repair in small 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.

### 7.2.3 Adverse Reactions

Possible adverse reactions include:

- Airway obstruction.
- Respiratory depression.
- Hyper-salivation.
- Laryngospasm.
- Cardiovascular stimulation.
- Musculoskeletal effects/movements.
- Seizures.
- Ataxia.
- Emergence reaction.
- Vomiting.

**Airway obstruction**

Upper airway obstruction may occur, especially if higher doses are used, unless careful attention is given to maintaining the airway in the correct position. It is important to pay attention to airway patency; reposition the head or jaw if signs of airway obstruction such as snoring, stertor, stridor or increased work of breathing develop.
Respiratory depression
Severe respiratory depression is relatively rare. It is more likely if ketamine is administered as a rapid IV bolus, when central nervous system abnormalities are present or in infants.

Hyper-salivation
Ketamine stimulates salivary and tracheobronchial secretions. Atropine or glycopyrrolate have in the past been recommended as adjunctive agents to be co-administered with IV or IM ketamine. Current data do not support their use and there is some indication that these medications increase airway and respiratory adverse events.25

Laryngospasm
Laryngospasm is infrequent but clinicians need to be prepared to manage this complication at any time. Laryngospasm appears to develop idiosyncratically and does not seem related to specific risk factors.27 Slow administration of ketamine may decrease occurrence of laryngospasm. Most cases of laryngospasm can be managed with airway optimisation and 100% oxygen, plus continuous positive airway pressure or assisted ventilation.

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 heart failure or hypertension.25 In patients with maximal sympathetic drive (for example, severe hypovolaemia, pericardial tamponade), the intrinsic cardiac depressant effects of ketamine may become clinically apparent.

Musculoskeletal effects
Skeletal muscle hypertonicity and random movement of head and extremities are often observed. The parent/carer might interpret this as lack of sedation and need to be forewarned. The movements limit the use of ketamine for imaging procedures such as Magnetic Resonance Imaging where strict and prolonged immobilisation is required.

Intracranial pressure elevation
There is no evidence that ketamine causes clinically significant raised intracranial pressure.25

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

Seizures
Ketamine has anticonvulsant properties, however there are case reports of brief seizures related to ketamine in patients with underlying seizure disorders.25
Emergence reactions
Ketamine often stimulates hallucinations and dreaming during recovery. Emergence reactions are more frequent in adults than adolescents and relatively rare in children under 10 years of age.26 Although evidence is limited, strategies such as maintaining a quiet environment in the recovery phase have been used to reduce emergence reactions.25 Patients with psychosis or behavioural abnormalities should be given ketamine with caution.
In the past, co-administration of benzodiazepines given at induction was used to decrease ketamine emergence reactions. Studies have shown this does not reduce the frequency of emergence reactions and the practice is not recommended. A small dose of benzodiazepines can be used to treat severe emergence reactions if they do occur and are problematic.29,30

Vomiting
Vomiting may occur, especially during recovery. There are no documented reports of clinically significant ketamine associated aspiration syndrome.25

7.2.4 Contraindications
Contraindications are summarised below:
- Infants under 12 months of age or less than 10 kilograms due to increased risk of airway complications.
- Previous adverse reaction to ketamine.
- Active respiratory tract infection or disease.
- Procedures involving the lower airway or pharynx.
- Cardiovascular disease including hypertension.
- Bowel obstruction.
- Central nervous system masses.
- Neurologic impairment with limited respiratory reserve or abnormal bulbar function.
- Glaucoma.
- Psychosis.
- Porphyria.
- Thyrotoxicosis.

7.2.5 Dose
The following table explains the differences between administration of IV and IM ketamine.20,26,30 Ketamine IV should be given as slow push over one minute. There is no reversal agent for ketamine.
Table 5: Comparison of IV and IM Ketamine

<table>
<thead>
<tr>
<th>Route</th>
<th>Intravenous</th>
<th>Intramuscular</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial dose</td>
<td>1 mg/kg*</td>
<td>3 - 4 mg/kg</td>
</tr>
<tr>
<td>Subsequent dose</td>
<td>0.5 mg/kg</td>
<td>After 10 minutes, if needed, repeat IM 1.5 - 2 mg/kg OR: Insert IV and give further doses IV 0.5 mg/kg</td>
</tr>
<tr>
<td>Advantages</td>
<td>Ease of repeat dosing</td>
<td>Slightly faster recovery</td>
</tr>
<tr>
<td>Clinical onset</td>
<td>One minute</td>
<td>Five minutes</td>
</tr>
<tr>
<td>Effective sedation</td>
<td>15 - 20 minutes</td>
<td>15 - 30 minutes</td>
</tr>
<tr>
<td>Recovery (approx.)</td>
<td>100 - 140 minutes</td>
<td>90 - 120 minutes</td>
</tr>
</tbody>
</table>

* Based on expert opinion

7.2.6 Administration

Refer to local policies for fasting protocols for ketamine. The most senior medical officer available should assess individual patient fasting requirements.

Ketamine administration considerations:

- Risk assessment see Section 5.1.1 Risk Assessment and the Paediatric Procedural Sedation Checklist for Emergency Departments, Wards, Clinics and Imaging (Appendix 1).
- Fasting see Section 5.1.3 Fasting
- Parent information and consent see Section 5.1.8 Preparing the Child and the Parent/Carer

The 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. Factsheets about procedural sedation for children are available via the Sydney Children’s Hospitals Network or HNEkidshealth websites.
7.2.7 Staff
A minimum of three staff members should be present for administration of ketamine. The most senior available medical officer must approve the sedation and be available immediately during the procedure to assist if required. Allocation and delegation of roles by team briefing prior to the procedure is essential. All required staff must be present with equipment checked and available prior to the administration of ketamine.

### Intravenous or intramuscular ketamine

- A doctor credentialed to administer the ketamine, assess airway patency and monitor the patient.
- A clinician to assist the sedationist and record the monitoring.
- A clinician to perform the procedure.

Senior doctor present during sedation and procedure. May have sedationist or proceduralist role

7.2.8 Location
Sedation with ketamine can only be performed in a specifically designed procedural area such as a resuscitation room, where advanced paediatric monitoring, equipment and medications are available.

7.2.9 Equipment
Equipment must be available and checked prior to the start of any procedural sedation, including oxygen and suction, as described in Section 5.1.6 Equipment.

Equipment required includes:
- Paediatric resuscitation trolley with a full set of intubation equipment.
- Oxygen (minimum 15 L flow meter).
- Bag/valve/mask.
- Suction with a rigid sucker.
- Oropharyngeal airway (+ 1 size above and below).
- Oxygen saturation monitor with appropriate audible alarm settings.
- Blood pressure measuring device
- Access to electrocardiograph (ECG) monitoring.
- Expired carbon dioxide monitoring available.
7.2.10 Monitoring

Monitoring should continue and be recorded on the age appropriate Between the Flags Observation Chart (PEDOC/SPOC) until the patient returns to a normal conscious state, including sedation score. For more information see Section 5.2.1 Monitoring. The administering clinician should monitor airway and breathing. Use of a monitor that records respiratory and ECG traces is recommended as well as pulse oximetry that will alarm when limits are transgressed. Desaturation is usually due to partial airway obstruction therefore vigilant observation of the patient during the procedure is essential.

7.2.11 Pre, During and Post-Procedure

See Section 5 Principles of Procedural Sedation Episodes.

7.3 Propofol

7.3.1 Background

Propofol is a general anaesthetic which should only be administered by medical officers with proficiency in its use, who have undergone formal training and have been credentialed by their LHD, consistent with the ANZCA PS09 Guidelines on Sedation and/or Analgesia for Diagnostic and Interventional Medical, Dental or Surgical Procedures. Propofol can be used safely with children in ED’s however ketamine is generally a better agent. Propofol provides no analgesia but the state of deep sedation/general anaesthesia allows tolerance of painful procedures. Propofol also has muscle relaxant properties that can be useful in some clinical situations such as reducing joint dislocations in older adolescents.

As propofol can produce rapid deep sedation, recommended fasting times should not be reduced.

Note the product information contraindicates propofol use in children under the age of 17 years for procedural sedation. It should therefore only be used after careful risk assessment.

Advantages of propofol:

- Rapid onset (1 minute), recovery (5-15 minutes).
- Substantial potency that reliably produces effective conditions for procedural sedation.
- Low incidence of vomiting and other undesirable after effects.

Disadvantages of propofol:

- A higher risk of airway compromise, respiratory depression and hypotension.
• Painful injection: propofol tends to cause a burning pain when administered as a bolus or ‘push’ dose.

### 7.3.2 Adverse Reactions

**Airway complications**

Patients frequently need airway support.

**Allergy**

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.

**Respiratory depression**

The most significant and common adverse effect of propofol is potent respiratory depression. Transient hypoxia is common (5-20% of patients). Medical officers using propofol must be competent in advanced airway and respiratory support, and have all required equipment available to manage respiratory depression.

**Cardiovascular effects**

Propofol lowers mean blood pressure by 10-25%, which is significant in haemodynamically unstable patients.

---

*The combination of propofol with an opiate increases the risk of respiratory depression and apnoea.*

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### 7.3.3 Indications and Contraindications

Propofol may be indicated for brief procedures. It has no analgesic effect. Propofol should not be used in patients:

- With a potentially difficult airway.
- With egg or soy allergy.
- That are haemodynamically unstable.

### 7.3.4 Dose

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dose</th>
<th>Route</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propofol (1 month – 18 years)</td>
<td>Usual range 1 - 2 mg/kg ³¹</td>
<td>IV</td>
<td>Usual range 1 - 2 mg/kg; titrate to response ³¹</td>
</tr>
</tbody>
</table>

### 7.3.5 Administration

Propofol can only be administered intravenously. IV cannulas should be flushed with 0.9% sodium chloride following administration to avoid further sedation from residual amounts of propofol.

Propofol administration requirements:
• Risk assessment see Section 5.1.1 Risk Assessment and the Paediatric Procedural Sedation Checklist for Emergency Departments, Wards, Clinics and Imaging (Appendix 1).

• Fasting status should be carefully considered. Ketamine is safer in the non-fasted patient, for more information see Section 5.1.3 Fasting

• Parent information and consent see Section 5.1.8 Preparing the Child and the Parent/Carer.

7.3.6 Staff
A minimum of three staff members, including the senior doctor, should be present for administration of propofol. Allocation and delegation of roles by team briefing, prior to the procedure is essential. All required staff must be present with equipment checked and available prior to the administration of propofol.

### Intravenous propofol

<table>
<thead>
<tr>
<th>Role</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>🚑</td>
<td>A doctor credentialed to administer propofol, assess airway patency and monitor the patient.</td>
</tr>
<tr>
<td>🧔</td>
<td>A clinician to assist the sedationist and record the monitoring.</td>
</tr>
<tr>
<td>🧔</td>
<td>A clinician to perform the procedure.</td>
</tr>
</tbody>
</table>

Senior doctor present during sedation and procedure. May have sedationist or proceduralist role.

7.3.7 Location
Sedation with propofol can only be performed in a specifically designed procedural area such as a resuscitation room where advanced paediatric monitoring, equipment and medications are available.

7.3.8 Equipment
Equipment must be available and checked prior to the start of any procedural sedation, including oxygen and suction, as described in Section 5.1.6 Equipment.

Equipment required includes:

- Paediatric resuscitation trolley with a full set of intubation equipment.
- Oxygen (minimum 15 L flow meter).
- Bag/valve/mask.
- Suction with a rigid sucker.
- Oropharyngeal airway (+ 1 size above and below).
- Oxygen saturation monitor with appropriate audible alarm settings.
- Blood pressure measuring device.
- Electrocardiograph (ECG) monitoring.
- Expired carbon dioxide monitoring available.

7.3.9 Monitoring

Monitoring should continue and be recorded on the age appropriate Between the Flags Observation Chart (PEDOC/SPOC) until the patient returns to a normal conscious state, including sedation score. For more information see Section 5.2.1 Monitoring. The administering clinician should monitor airway and breathing. Use of a monitor that records respiratory and ECG traces is recommended as well as pulse oximetry that will alarm when limits are transgressed. Desaturation is usually due to partial airway obstruction therefore vigilant observation of the patient during the procedure is essential.

7.3.10 Pre, During and Post-Procedure

See Section 5 Principles of Procedural Sedation Episodes.
8 APPENDIXES

8.1 Appendix 1: Paediatric Procedural Sedation Checklist for Emergency Departments, Wards, Clinics and Imaging

Note this is an example of the Checklist only. The Checklist is available via print publications: http://www.health.nsw.gov.au/kidsfamilies/youth/Pages/YH-publications.aspx
<table>
<thead>
<tr>
<th>1. Staff</th>
<th>Nitrous oxide</th>
<th>Nitrous + analgesic or sedative</th>
<th>Ketamine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two staff:</td>
<td>Sedationist (credentialed)</td>
<td>Three staff:</td>
<td>Sedationist (credentialed)</td>
</tr>
<tr>
<td>• Sedationist (credentialed)</td>
<td>Proceduralist</td>
<td>• Proceduralist</td>
<td></td>
</tr>
<tr>
<td>• Assistant</td>
<td>Senior doctor on site and available to respond</td>
<td>• Assistant</td>
<td></td>
</tr>
<tr>
<td>• Senior doctor present</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 2. Location | Emergency departments, wards, clinics and imaging | Emergency departments, wards, clinics and imaging | Emergency department procedural area with advanced pediatric monitoring, resuscitation equipment and medications available |

| 3. Fasting (For non-urgent procedures) | 2 hours for fluid and solids | 2 hours for clear fluid | 2 hours for clear fluid |
| For urgent procedures | 4 hours for milk/solids | 6 hours for milk/solids | |

| 4. Observations | Baseline observations then recorded every 15 minutes | Baseline observations then recorded every 15 minutes | Baseline observations then recorded every 5 minutes |

| 5. Consent | Documented verbal consent | Documented verbal consent for minor procedures e.g. sutures, closed reduction of fracture | Written consent |

| 6. Medication | 30 - 70% | Fentanyl Intranasal (child over 1 year) | Ketamine Intravenous |
| | | 1 - 2 micrograms/kg/dose (max. 100 micrograms/dose) | 1 mg/kg titrated slowly |
| | | Given every 5 minutes if needed | Then 0.5 mg/kg every 10 minutes if needed |
| | | Up to total dose of 3 micrograms/kg (max 300 micrograms) | Intramuscular (if no IV access) |
| | | | 3 - 4 mg/kg |
| | | | After 10 minutes if needed give: |
| | | | IM 1.5 - 2 mg/kg |
| | | | OR |
| | | | Obtain IV access and give further 0.5 mg/kg dose |

7. Risk factors for procedural sedation:
- Under 12 months of age or less than 10 kg
- Airway obstruction e.g. sleep apnoea, anti-epileptics
- Hypoventilation e.g. neuromuscular disorders
- Aspiration e.g. propranolol, bowel obstruction
- Lamotrigine e.g. history, URTI with ketamine
- Bronchospasm e.g. asthma
- Cardiorespiratory compromise e.g. sapsic, hypovolaemia
- History of adverse reactions to sedation or analgesia
- Moderate or severe systemic disease
- Medication contraindications

For more information please see NSW Health clinical practice guideline: Paediatric Procedural Sedation Guide for Emergency Departments, Wards, Clinics and Imaging
8.1 Appendix 2: Example of Credentialing for Paediatric Procedural Sedation

Responsibility and accountability for the determination of the approved status of clinicians to perform procedural sedation rests with medical and nursing leaders of the emergency department, ward/service or their nominated delegate. This sedation accreditation is suggested for all clinicians engaged in procedural sedation of paediatric patients.

### Tier 1

**Requirements:**
- Knowledge of sedation policy
- Ability to perform basic airway manoeuvres (airway suction/chin lift/jaw thrust/bag valve mask/ventilation)

**Privileges:** Nitrous oxide

### Tier 2

**Requirements:**
- As in Tier 1
- Has undertaken advanced airway training
- Has completed an APLS course or equivalent
- Has formal qualification in emergency medicine, anaesthesia or paediatrics or is at an advanced stage of training
- Has been assessed as competent by consultant ED Staff Specialist (SS), Anaesthetist or Paediatrician

**Privileges:** May perform procedural sedation using ketamine but only with accredited specialist on site and aware of procedure

### Tier 3

**Requirements:**
- As in Tier 2
- Has performed five procedural sedation procedures with ketamine and demonstrated competency under direct supervision of accredited specialist.
- Has formal qualification in emergency medicine, anaesthesia or paediatrics or is at an advanced stage of training
- Has undergone and passed a simulated manikin run through of errors and complications associated with procedural sedation.
- Written approval to perform Tier 3 by DEMT/ED Director/Director of Medical Services/Director of Paediatrics

**Privileges:** Able to administer ketamine for procedural sedation without accredited specialist on site
8.2 Appendix 3: Definitions

Adolescent – young person between the age of 12-18 years

Adult – person over the age of 18 years

Nurse – registered nurse with the Australian Health Practitioner Regulation Agency

Paediatric patient – following discharge from maternity services up to the patient’s 16th birthday

Parent/carer – parent or person living with the infant, child or adolescent and assuming legal responsibility for, and providing direct care. This includes birth parents, step-parent, foster parent, legal guardian, custodial or safe and appropriate primary care giver.

PEDOC – Paediatric Emergency Department Observation Chart

PNIMC – Paediatric National Inpatient Medication Chart

SPOC – Standard Paediatric Observation Chart
8.3 Appendix 4: Levels of Sedation

The definitions of minimal, moderate and deep sedation used in this guide are based on those of the American Society of Anaesthesiologists.\(^{36}\)

Minimal sedation
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
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
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
A drug-induced loss of consciousness during which patients are not rousable, 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.
8.4 Appendix 5: University of Michigan Sedation Scale (UMSS)

Depth of sedation as measured using the University of Michigan Sedation Scale (UMSS)\(^\text{37}\)

<table>
<thead>
<tr>
<th>University of Michigan Sedation Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = Awake and alert</td>
</tr>
<tr>
<td>1 = Minimally sedated (may appear tired/sleepy, responds to verbal conversation and/or sound)</td>
</tr>
<tr>
<td>2 = Moderately sedated (somnolent/sleeping, easily roused with light tactile stimulation or simple verbal command)</td>
</tr>
<tr>
<td>3 = Deep sedation (deep sleep, rousable only with deep or significant physical stimuli)</td>
</tr>
<tr>
<td>4 = Unrousable</td>
</tr>
</tbody>
</table>

8.5 Appendix 6: Additional Resources

- NSW Health GL2016_009 Infants and Children: Management of Acute and Procedural Pain in the Emergency Department
- NSW Health PD2013_049 Recognition And Management of Patients Who Are Clinically Deteriorating
- NSW Health CEC Between the Flags
- NSW Health ACI Safe Sedation Resources 2015
- NSW Health ECI Procedural Sedation in the Emergency Department
- NSW Health GL2015_007 Management of Patients with Acute Severe Behavioural Disturbance in Emergency Departments
- NSW Health PD2005_406 Consent to Medical Treatment – Patient Information
- NSW Health PD2017_032 Clinical Procedure Safety
- Royal Children’s Hospital, Melbourne, Comfort Kids Program [www.rch.org.au/comfortkids](http://www.rch.org.au/comfortkids)
- Sydney Children’s Hospitals Network Procedural Sedation (Paediatric Ward Clinic and Imaging Areas) Practice Guideline
- Sydney Children’s Hospitals Network Pain Management – CHW Practice Guideline
- Australian Medicine’s Handbook
- Australian Medicine’s Handbook Children’s Dosing Companion
- Australia New Zealand College of Anaesthetists (ANZCA) PS09 Guidelines on Sedation and/or Analgesia for Diagnostic and Interventional Medical, Dental or Surgical Procedures
8.6 Appendix 7: References

1. Australian and New Zealand College of Anaesthetists. Guidelines on Sedation and/or Analgesia for Diagnostic and Interventional Medical, Dental or Surgical Procedures. PS09. 2014.


10. Australian and New Zealand College of Anaesthetists PS15 Recommendations for the Perioperative Care of Patients Selected for Day Care Surgery


8.7 Appendix 8: Subject Matter Expert Group

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Dr Jacqui Weeden, Emergency Physician, St George Hospital/Emergency Care Institute

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