Prince of Wales Hospital

Procedural Sedation Manual

June 2020

Learning Objectives

Pre procedure	• Non-pharmacological and pharmacological alternatives • Adjuncts to pharmacological sedation • Patient assessment • Consent and parent/patient information • Environment • Personnel required for procedural sedation including skill level • Equipment and drug preparation • Observation and monitoring
During procedure	• Drug administration • Monitoring of patient including sedation and pain scores • Ability to identify and respond to adverse events
Post procedure	• Monitoring of patient Discharge criteria Discharge advice and discharge check list
Documentation	• Legal and mandatory components of documentation

Special thanks to Caboolture Hospital who provided a template to prepare this manual

Principles of Procedural Sedation

Definitions

Procedural Sedation (PS) refers to a technique of administering sedatives or dissociative agents, with or without analgesics, to intentionally suppress a patient's level of consciousness. This is used to induce a state that allows the patient to tolerate unpleasant procedures while maintaining cardio respiratory function.

Ideally PS is intended to result in a depressed level of consciousness that allows the patient to maintain oxygenation and airway control independently, with no compromise to cardiovascular function.

It is important to recognize that procedural sedation is a continual spectrum from minimal sedation to general anaesthesia. All agents used for procedural sedation can potentially result in general anaesthesia if given in large enough doses.

As such, all practitioners administering PS should be competent to manage a patient at levels greater than the intended level of sedation including cardiovascular support and airway management as for general anaesthesia.

Minimal sedation (anxiolysis) is a drug-induced state during which patients respond normally to verbal commands. Cognitive function and coordination may be impaired but airway, ventilation and cardiovascular function are preserved.

Moderate Sedation previously referred to as 'conscious sedation' is defined as 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 defined as a drug induced depression of consciousness during which patients cannot be easily roused but respond purposefully after repeated or painful stimulation. These patients may require assistance in maintaining airway patency and respiratory effort. Cardiovascular function is usually maintained.

General anaesthesia is defined as a drug-induced loss of consciousness during which patients are not rousable and may have an impaired cardio-respiratory function requiring varying degrees of support. The patient under general anaesthesia is profoundly compromised and does not exhibit movement or autonomic nervous system responses to a standard surgical stimulus.

Dissociative sedation is a separate category of sedation which is used to better classify and describe the effects of agents such as ketamine. It is described as a ''trance-like cataleptic state characterized by profound analgesia and amnesia, with retention of protective airway reflexes, spontaneous respirations, and cardiopulmonary stability.'' The terms mild, moderate and deep sedation therefore do not apply to dissociative sedation.

Aims of procedural sedation

The aims for procedural sedation are to:-

- minimise physical discomfort or pain
- control behaviour and patient movement
- minimise psychological disturbance and distress
- maximise the potential for amnesia
- maximise patient safety.

These aims for safe and successful sedation can be maximised by:-

- correct patient selection (excluding patients at high risk for failure)
- ensuring that it is safe to perform PS
- preparing the patient and their family
- preparing the environment and staff
- ensuring adequate monitoring during the period of sedation
- ensuring discharge processes are safe

Prior to embarking on procedural sedation ask yourself 3 questions:-

1. Is this patient suitable for PS? (consider patient and procedure factors)
2. Is it safe to perform PS? (consider staff and environmental factors)
3. Is there a suitable alternative to PS?

Preparation for Procedural Sedation

1. Patient Selection

It is important that only suitable patients undergo PS and that those with a high chance of failure or anticipated difficulty are excluded.

Procedural Sedation may NOT be suitable for:-

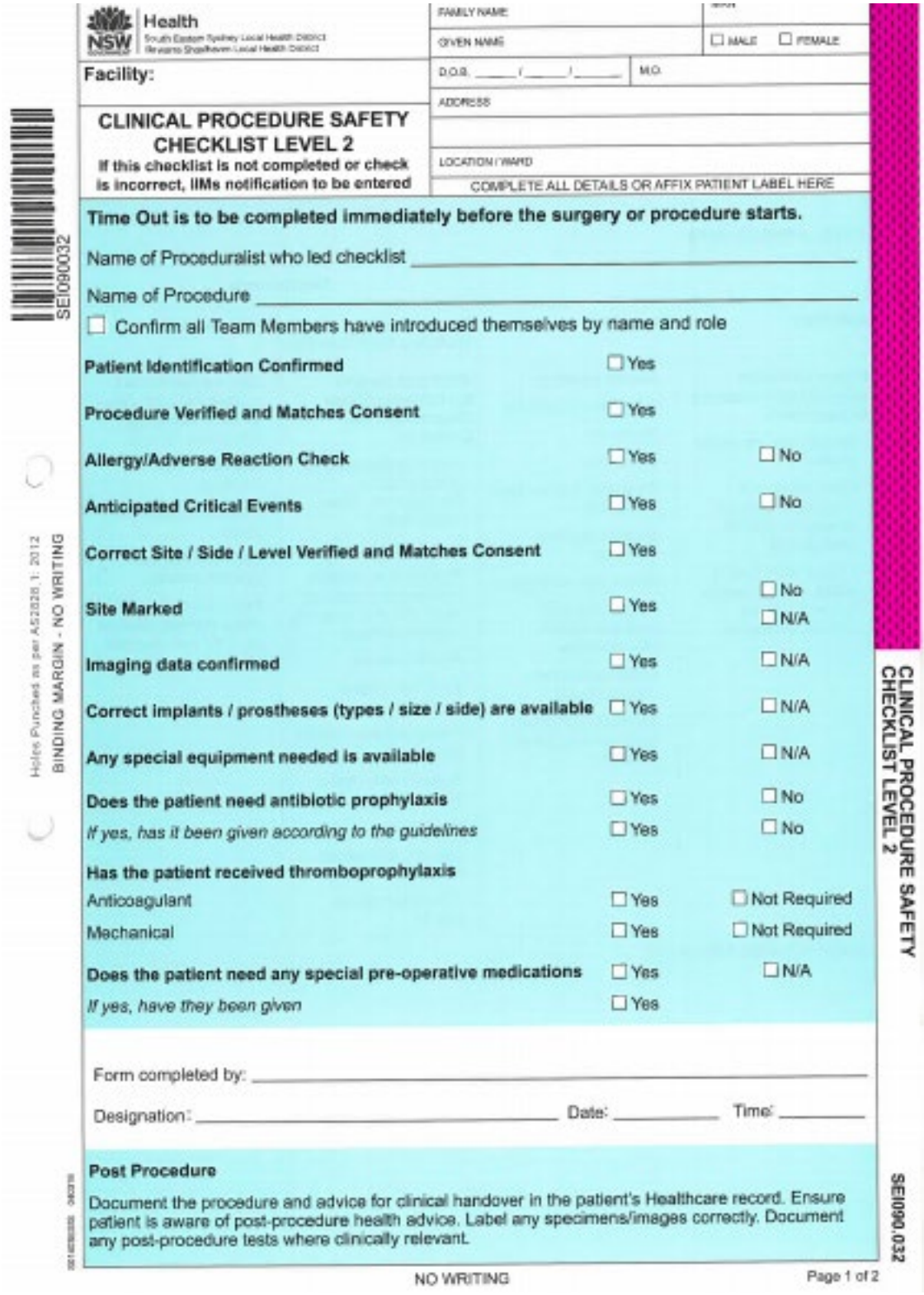
- Very young children and severely ill patients: these cases should only be sedated in ED in extenuating emergency circumstances and require ED consultant to be consulted and/or present during the sedation
- Very painful or prolonged procedures: these are unlikely to be managed successfully with PS; GA should be considered
- Very anxious patients: difficult to achieve adequate sedation, GA should be considered
- Patients unable to provide consent (unless in an emergency i.e. life or limb threatening)

2 Safety Issues

As a general rule, procedural sedation should **NOT** be provided in ED:-

- when the required number of appropriately skilled staff are not available
- when appropriate staff cannot be dedicated to their roles due to other demands in ED
- when an appropriate clinical area with resuscitation equipment cannot be dedicated for the procedure to take place

To minimise risk associated with incorrect patient identification and comply with mandatory national standards, the POWH standardised approach to patient identification should be followed. This ensures confirmation of the correct identity, correct procedure and correct site for patients receiving care.



Health
South Eastern Sydney Local Health District
Illawarra Shoalhaven Local Health District

Facility:

FAMILY NAME
GIVEN NAME ☐ MALE ☐ FEMALE
D.O.B. ____/____/____ M.O
ADDRESS
LOCATION / WARD
COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

CLINICAL PROCEDURE SAFETY CHECKLIST LEVEL 2

If this checklist is not completed or check is incorrect, IIMs notification to be entered

SEI090032

Time Out is to be completed immediately before the surgery or procedure starts.

Name of Proceduralist who led checklist _____

Name of Procedure _____

☐ Confirm all Team Members have introduced themselves by name and role

Patient Identification Confirmed	☐ Yes	
Procedure Verified and Matches Consent	☐ Yes	
Allergy/Adverse Reaction Check	☐ Yes	☐ No
Anticipated Critical Events	☐ Yes	☐ No
Correct Site / Side / Level Verified and Matches Consent	☐ Yes	
Site Marked	☐ Yes	☐ No ☐ N/A
Imaging data confirmed	☐ Yes	☐ N/A
Correct implants / prostheses (types / size / side) are available	☐ Yes	☐ N/A
Any special equipment needed is available	☐ Yes	☐ N/A
Does the patient need antibiotic prophylaxis	☐ Yes	☐ No
If yes, has it been given according to the guidelines	☐ Yes	☐ No
Has the patient received thromboprophylaxis		
Anticoagulant	☐ Yes	☐ Not Required
Mechanical	☐ Yes	☐ Not Required
Does the patient need any special pre-operative medications	☐ Yes	☐ N/A
If yes, have they been given	☐ Yes	

Form completed by: _____

Designation: _____ Date: _____ Time: _____

Post Procedure

Document the procedure and advice for clinical handover in the patient's Healthcare record. Ensure patient is aware of post-procedure health advice. Label any specimens/images correctly. Document any post-procedure tests where clinically relevant.

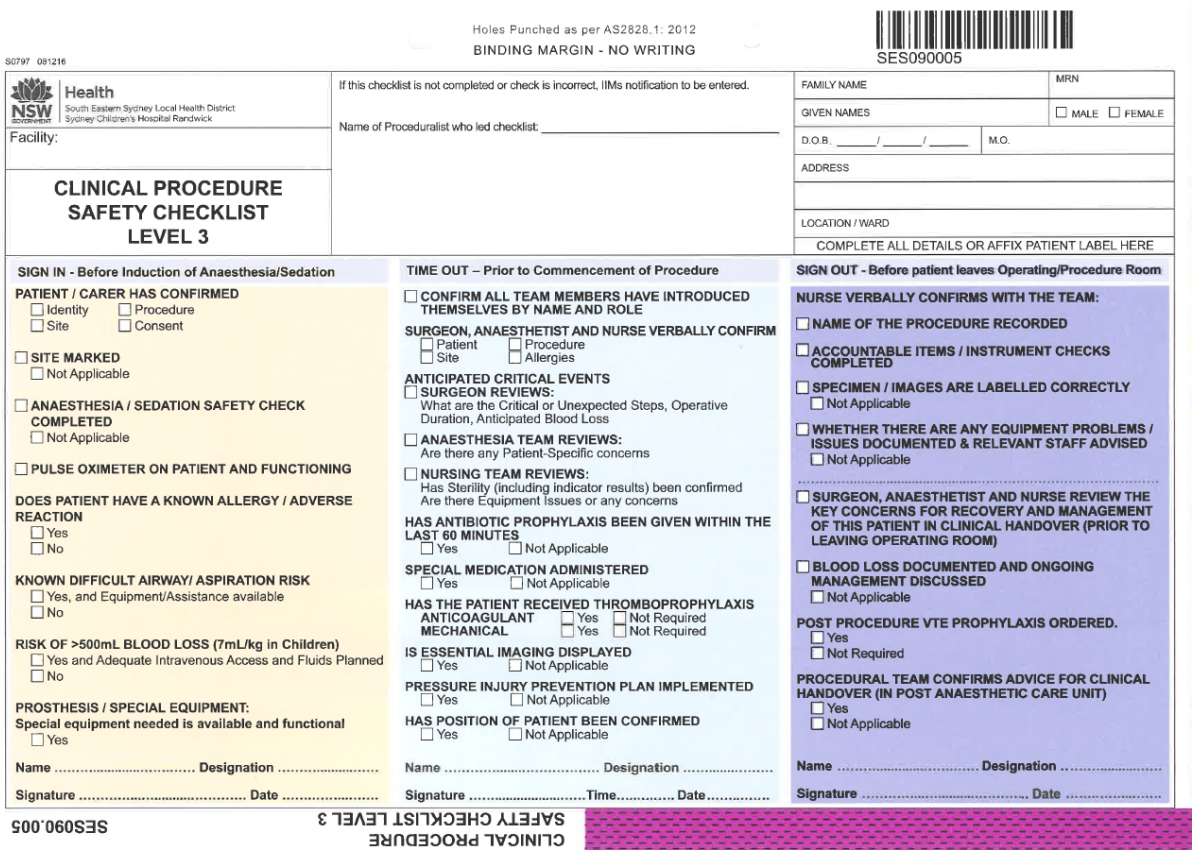
Holes Punched as per AS2828.1: 2012
BINDING MARGIN - NO WRITING

CLINICAL PROCEDURE SAFETY CHECKLIST LEVEL 2

SEI090.032

NO WRITING

Page 1 of 2



Holes Punched as per AS2828.1: 2012
BINDING MARGIN - NO WRITING
SES090005

S0797 081216

Health
South Eastern Sydney Local Health District
Sydney Children's Hospital Randwick

Facility:

CLINICAL PROCEDURE SAFETY CHECKLIST LEVEL 3

If this checklist is not completed or check is incorrect, IIMs notification to be entered.

Name of Proceduralist who led checklist: _____

FAMILY NAME | MRN
GIVEN NAMES | ☐ MALE ☐ FEMALE
D.O.B. ____/____/____ | M.O.
ADDRESS
LOCATION / WARD
COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

SIGN IN - Before Induction of Anaesthesia/Sedation

PATIENT / CARER HAS CONFIRMED
☐ Identity ☐ Procedure
☐ Site ☐ Consent

☐ SITE MARKED
☐ Not Applicable

☐ ANAESTHESIA / SEDATION SAFETY CHECK COMPLETED
☐ Not Applicable

☐ PULSE OXIMETER ON PATIENT AND FUNCTIONING

DOES PATIENT HAVE A KNOWN ALLERGY / ADVERSE REACTION
☐ Yes
☐ No

KNOWN DIFFICULT AIRWAY/ ASPIRATION RISK
☐ Yes, and Equipment/Assistance available
☐ No

RISK OF >500mL BLOOD LOSS (7mL/kg in Children)
☐ Yes and Adequate Intravenous Access and Fluids Planned
☐ No

PROSTHESIS / SPECIAL EQUIPMENT:
Special equipment needed is available and functional
☐ Yes

Name ..... Designation .....
Signature ..... Date .....

TIME OUT – Prior to Commencement of Procedure

☐ CONFIRM ALL TEAM MEMBERS HAVE INTRODUCED THEMSELVES BY NAME AND ROLE

SURGEON, ANAESTHETIST AND NURSE VERBALLY CONFIRM
☐ Patient ☐ Procedure
☐ Site ☐ Allergies

ANTICIPATED CRITICAL EVENTS
☐ SURGEON REVIEWS:
What are the Critical or Unexpected Steps, Operative Duration, Anticipated Blood Loss

☐ ANAESTHESIA TEAM REVIEWS:
Are there any Patient-Specific concerns

☐ NURSING TEAM REVIEWS:
Has Sterility (including indicator results) been confirmed
Are there Equipment Issues or any concerns

HAS ANTIBIOTIC PROPHYLAXIS BEEN GIVEN WITHIN THE LAST 60 MINUTES
☐ Yes ☐ Not Applicable

SPECIAL MEDICATION ADMINISTERED
☐ Yes ☐ Not Applicable

HAS THE PATIENT RECEIVED THROMBOPROPHYLAXIS
ANTICOAGULANT ☐ Yes ☐ Not Required
MECHANICAL ☐ Yes ☐ Not Required

IS ESSENTIAL IMAGING DISPLAYED
☐ Yes ☐ Not Applicable

PRESSURE INJURY PREVENTION PLAN IMPLEMENTED
☐ Yes ☐ Not Applicable

HAS POSITION OF PATIENT BEEN CONFIRMED
☐ Yes ☐ Not Applicable

Name ..... Designation .....
Signature .....Time..... Date.....

SIGN OUT - Before patient leaves Operating/Procedure Room

NURSE VERBALLY CONFIRMS WITH THE TEAM:

☐ NAME OF THE PROCEDURE RECORDED

☐ ACCOUNTABLE ITEMS / INSTRUMENT CHECKS COMPLETED

☐ SPECIMEN / IMAGES ARE LABELLED CORRECTLY
☐ Not Applicable

☐ WHETHER THERE ARE ANY EQUIPMENT PROBLEMS / ISSUES DOCUMENTED & RELEVANT STAFF ADVISED
☐ Not Applicable

☐ SURGEON, ANAESTHETIST AND NURSE REVIEW THE KEY CONCERNS FOR RECOVERY AND MANAGEMENT OF THIS PATIENT IN CLINICAL HANDOVER (PRIOR TO LEAVING OPERATING ROOM)

☐ BLOOD LOSS DOCUMENTED AND ONGOING MANAGEMENT DISCUSSED
☐ Not Applicable

POST PROCEDURE VTE PROPHYLAXIS ORDERED.
☐ Yes
☐ Not Required

PROCEDURAL TEAM CONFIRMS ADVICE FOR CLINICAL HANDOVER (IN POST ANAESTHETIC CARE UNIT)
☐ Yes
☐ Not Applicable

Name ..... Designation .....
Signature ..... Date .....

SES090.005
CLINICAL PROCEDURE SAFETY CHECKLIST LEVEL 3

3. Consider Alternatives to Procedural Sedation

Alternatives to PS include:-

- Non-pharmacological strategies
- Analgesia only: parenteral and/or oral
- Local anaesthesia (may be used as an adjunct)
- Regional anaesthesia (nerve blocks, Bier's block)
- Procedure performed under general anaesthesia

4. Non-pharmacological adjuncts/alternatives to PS

Using non-pharmacological techniques for both children and adults will make procedures less distressing for patients, family and staff. These are summarised in the table below.

Coping promoting behaviours	• Non-procedural talk and distraction • Prompting children to use coping behaviours • Breathing techniques (eg slow deep breathing) • Humour
Distress promoting behaviours	• Making reassuring or empathetic statements (thought to be because it makes child focus on feelings rather than coping) • Apologising, criticising, bargaining with the child • Providing explanation during the procedure • Giving the child control over when to start the procedure • Becoming agitated

5. Pharmacological adjuncts to PS

Any factors that decrease sedation needs are beneficial in the short and long term and include:

Systemic pain relief:-

- Removal of pain will reduce anxiety and possibly the need for sedation.
- Simple and multimodal analgesia will help with the induction, maintenance and recovery phases of PS
- Administration of simple analgesia (eg paracetamol, ibuprofen, codeine) can compliment post procedural pain management.

Local pain relief:

- **Laceraine** (amethocaine 0.5%/lignocaine 4% /adrenaline 0.1%) applied to open wounds to provide local anaesthesia. This is particularly beneficial prior to suturing and may obviate the need for further local anaesthetic or may reduce the pain with subsequent injected local anaesthetic.
- **EMLA** (Eutectic Mixture of Local Anaesthesia = Prilocaine 2.5%/lignocaine 2.5%) cream applied to cutaneous areas prior to IV insertion or blood taking. Ensure the cream is covering the vein or area you wish to use. EMLA is applied onto intact skin.
- **Amethocaine 4% Topical gel** is a more rapidly acting topical anaesthetic than EMLA and causes venodilation.
- **Local anaesthetic infiltration**
- **Regional nerve blocks**

6. Patient assessment

Health evaluation prior to sedation includes:-

- Nature of the current condition
- General health
- Medications and allergies
- Past medical problems (esp. CVS, respiratory or CNS)
- Previous anaesthetics (and any problems)
- Family history of problems with anaesthesia
- Fasting status
- Baseline observations
- Patient weight (for dose calculations)
- Allergies

A risk assessment should be performed to identify patients at higher risk of complications who might be unsuitable for sedation in ED. This identifies features that may indicate a higher risk of airway complications and cardiovascular instability during sedations.

The **American Society of Anaesthetists (ASA)** classification of health parameters, whilst not directly applicable to procedural sedation, has been shown to correlate with morbidity and mortality of general anaesthesia and can assist in the performance of risk assessment. The classes are defined as:

Class 1: Normal healthy patient

Class 2: Patient with mild systemic disease with no functional limitation.

Class 3: Patient with severe systemic disease with definite functional limitation

Class 4: Patient with severe systemic disease that is a constant threat to life.

Class 5: Moribund patient who is not expected to survive without the operation

This is a commonly used and understood classification which may aid in communication between health professionals.

Other risk components are:

Increased risk of airway compromise leading to obstruction

- History of snoring, stridor, sleep apnoea
- Craniofacial abnormalities
- History of airway difficulties
- Children < 1 year

Increased risk of hypoventilation

- Patients with reduced sensitivity to CO_2 retention – chronic lung disease, neuromuscular disorders
- Abnormalities of the respiratory centre – brainstem tumours

Increased risk of aspiration

- Vomiting, bowel obstruction, history of aspiration previously
- History of gastro-oesophageal reflux, hiatus hernia, congenital abnormalities, Cerebral palsy, pregnancy, obesity
- Altered mental status

Increased risk of bronchospasm or laryngospasm

- Asthma, recent upper or lower respiratory tract infection

Increased risk of cardiovascular compromise

- Cardiac disease, hypovolemia, sepsis

Drug specific contraindications need to be considered as part of a sedation plan. For more details on different drugs used refer to the appendix.

7. Fasting status

Current literature fails to support an association between fasting status and adverse events during procedural sedation in children or adults.

The ASA guidelines for fasting in relation to elective general anaesthesia are not applicable to patients requiring procedural sedation in the ED.

The American College of Emergency Physicians (2014) states, “Do not delay procedural sedation in adults or paediatrics in the ED based on fasting time. Preprocedural fasting for any duration has not demonstrated a reduction in the risk of emesis or aspiration when administering procedural sedation and analgesia.

Step 1: Patient risk of aspiration (higher or standard risk)

Higher-risk patients are those with one or more of the following present to a degree individually or cumulatively judged clinically important by the treating physician:-

- Potential for difficult or prolonged assisted ventilation should an airway complication occur (e.g., short neck, small mandible, large tongue, tracheomalacia, laryngomalacia, history of difficult intubation, congenital anomalies of the airway and neck, sleep apnoea)
- Conditions predisposing to oesophageal reflux (e.g. oesophageal disease, hiatus hernia, bowel obstruction, ileus, tracheoesophageal fistula, raised ICP, pregnancy, obesity)
- Extremes of age (eg, >70 years or <6 months)
- Severe systemic disease with definite functional limitation (i.e. ASA physical status 3 or greater)
- Other clinical findings leading the emergency physician to judge the patient to be at higher than standard risk (eg, altered level of consciousness, frail appearance)

Step 2: Nature and timing of recent oral intake (within last 4 hours)

- Nothing
- Clear liquids only
- Light snack (includes breast milk and cow's milk)
- Heavier snack or meal

Step 3: Urgency of the Procedure

- **Emergent** eg, cardioversion for life-threatening dysrhythmia, reduction of markedly angulated fracture or dislocation with soft tissue or vascular compromise, intractable pain or suffering.
- **Urgent** e.g., care of dirty wounds and lacerations, animal and human bites, abscess incision and drainage, fracture reduction, hip reduction, lumbar puncture for suspected meningitis, arthrocentesis, neuroimaging for trauma
- **Semi-urgent** e.g., care of clean wounds and lacerations, shoulder reduction, neuroimaging for new-onset seizure, foreign body removal, sexual assault examination
- **Non-urgent or elective** eg, non-vegetable foreign body in external auditory canal, chronic embedded soft tissue foreign body, ingrown toenail

Step 4: Determine the Prudent Limit of Targeted Depth and Length of PS

The following sedation levels and durations are listed in the order representing the lowest to highest potential aspiration risk.

1. Minimal sedation
2. Dissociative sedation or brief/intermediate length moderate sedation
3. Extended moderate sedation
4. Brief deep sedation
5. Intermediate or extended length deep sedation

Duration of sedation

- **Brief** <10 minutes
- **Intermediate** 10-20mins

- **Extended** > 20mins

By considering the elements described in Steps 1 – 4, a reasonable assessment of the risk of aspiration during PS for the individual patient may be made, which can then be balanced against the urgency of the procedure.

8. Consent and patient/parent information

It is essential to give patients and carers information and discuss the procedure and risks of the procedure prior to starting. The information may be in verbal, written or audio visual form.

Informed consent must be obtained from the patient or their carers prior to any procedural sedation. Written informed consent is recommended and the most important part of this process is the dissemination and comprehension of the information prior to the signature on the dotted line. The “procedural consent form” may be used for this purpose.

9. Environment

Sedation with ketamine, propofol, midazolam and nitrous oxide can be performed in the resuscitation area or in a specifically equipped procedural sedation area with resuscitation equipment immediately available.

Sedation with inhalational agents or oral/IN midazolam can be performed in the procedure room or cubicles provided that equipment to provide ventilatory support, oxygen and suctioning and clearance of the airway is checked and immediately available.

10. Staff requirements for procedural sedation

MEDICATION	Minimum STAFF NEEDED	
	Sedation	**Procedure**
Ketamine Propofol IV Midazolam	• 1 Doctor • 1 RN (PS credentialed and orientated to resus/procedural sedation area) **Also Senior Emergency Doctor on shift notified and available**	• One Doctor • Any other staff required e.g. physio

However, in situations where a single Dr and RN ONLY are available, the following applies:

- Consider the urgency of the procedure and patient risk assessment.
- Consider deferring the procedure until 2 doctors are present.
- Consider using nitrous + / - opiates only.
- Consider whether there is another Dr on site who may be able to perform the procedure, leaving the credentialed Dr to provide the sedation and careful monitoring

11. Equipment and drug preparation

Equipment and drugs for the management of any adverse events must be prepared prior to intravenous procedural sedation, including:-

Airway and ventilation equipment

- Oxygen source
- Suction working
- Airway adjuncts (OP and NP airways) of appropriate sizes
- BVM with appropriate mask size
- Intubation Equipment: ET tubes (not opened), introducers, working laryngoscopes, lubricating gel, syringe, tube tie.

Drugs

- cardiac arrest drugs available in minijet form
- reversal agents as appropriate
- paediatric drug doses calculated and written on the white board
- drugs for the procedure including adjuncts drawn up and doses double checked

IV access

- checked and flushing adequately
- IV crystalloids available (consider using as flush for titrated medications)

12. Drugs for Procedural sedation

Drugs	Dose	Onset	Clinical Offset	Physiology	Sedation	Analgesia
Entonox	50% N_2O /50% oxygen	1-3min	5 min	Stable	+	++
Quantiflex	Up to 70% N_2O /30% oxygen	1-3 min	5 min	Stable	++	++
Morphine	0.05 – 0.1 mg/kg IV	5mins	3 hours	↓ RR, HR and BP, histamine release, N & V	+	++
Fentanyl	1-3 mcg/kg IV 1.5 mcg/kg IN	2 min	60min	↓ RR and chest wall rigidity	+	++
Midazolam	0.1mg/kg IV 0.4mg/kg IN	1-5 mins	1-2hrs	↓ RR, HR and BP	++	none
Propofol	0.5 - 3mg/kg IV	30sec	4-8min	↓ RR and BP	+++	none
Ketamine	1-2mg/kg IV 2-4mg/kg IM	1min IV 5minIM	5-10min IV 20-25 min IM	↑BP, HR laryngospasm myoclonic jerks and nystagmus	+++ dissociative	+++

13. Guidelines for Procedural Sedation using Intravenous Medication

- Examination by MO
- Inform senior medical officer on shift that a patient is going to be sedated
- 2 doctors one with skills to PS
- RN
- Parents/patients informed consent
- Medication prescribed on medication chart (dose to be filled in later)
- Medication prepared (consider continuous IV infusion of saline)
- O2, suction, bag valve mask and airway equipment checked and in working order
- IVC in place – secured and patent
- Emergency and intubation drugs immediately available
- Oximetry monitoring and capnography in place
- Cardiac monitoring in place if applicable
- Baseline observations documented especially BP
- Supplemental oxygen should be applied for all procedures
- Titrated boluses of sedation medication during procedure
- Constant monitoring of blood pressure, heart rate, SPO2 and level of consciousness (sedation score)
- Provide airway support when required
- Definitive care
- Continue monitoring until fully awake and continue recording on the PSR 3 minutely during the procedure, 5 minutely until fully awake and then 15 minutely for up to 1 hour post procedure
- Documentation throughout

Do not leave patient unattended at any time until GCS returns to pre-sedation score.

14. Observations and monitoring

A set of observations must be obtained immediately prior to the administration of the sedation and should be documented. If the patient is agitated and unsettled prior to the procedure, consider the accuracy of observations due to distress.

Observations include but are not limited to:

- Weight – mandatory for children
- Temperature, Pulse, Respiratory rate, Oxygen saturation,
- Blood pressure (in children only with IV sedation)
- Capnography
- Pain Score.
- Conscious state (AVPU or sedation score)

Monitoring must be applied prior to any IV medications being administered. This includes a minimum of:-

- Continuous O_2 saturation and heart rate monitoring
- NIV blood pressure monitoring (every 3-5 mins).
- Continuous nasal capnography
- Continuous ECG monitoring (if any history of CVS disease or compromise)

DURING PROCEDURE

1. Drug administration

All medications must be recorded. This does not require a specific dose prior to the procedure as the medication will be titrated and then totalled for recording but a record must be kept

Titrated medications should be entered at the time given

All drugs are to be administered in accordance with the Medication Act. Nitrous can be administered by credentialed nurses.

Oxygen should be administered in all intravenous sedation

2. Monitoring of the patient

As noted previously, all patients are to have a complete set of relevant observations recorded immediately prior to the procedure, including pain score.

- Pulse oximetry should be continuously monitored with IV sedation until 1 hour after the procedure has finished and for 15 min after IN or inhaled sedation has finished
- Cardiac monitoring is required if any history of heart disease or arrhythmia or in patients >50 years
- NIBP monitoring should be performed every 3 minutes during sedation

- NIBP, Oxygen saturations, capnography, HR and RR should be recorded for IV sedation
    - Every 3 mins post the administration of IV medication until the end of the procedure
    - After the end of the procedure 5 minutely until the patient has regained pre sedation consciousness.
    - Once regained pre sedation consciousness recorded every 15mins for up to the next hour
    - Sedation score or AVPU– should be documented at these intervals also to obtain a rapid determination of conscious level

Sedation score (Wisconsin score)

This scoring system is often used to document level of sedation. Deeper sedation has been shown to carry a higher risk of adverse events than lighter sedations.

Ketamine, as a dissociative agent, does not fit into this schema and is addressed separately in the ketamine module.

Inadequate	6	Anxious, agitated, or in pain
Minimal-conscious	5	Spontaneously awake without stimulus
Conscious-moderate	4	Drowsy, eyes open or closed, but easily arouses to consciousness with verbal stimulus
Moderate-deep	3	Arouses to consciousness with moderate tactile or loud verbal stimulus
Deep	2	Arouses slowly to consciousness with sustained painful stimulus
	1	Arouses, but not to consciousness, with painful stimulus
Anaesthesia	0	Unresponsive to painful stimulus

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 variances in vital signs and observations to ensure appropriate interventions.

ADVERSE EVENTS

Adverse events are associated with procedural sedation and can be classified into:-

Major: laryngospasm, hypoxia, apnoea, pulmonary aspiration, hypotension, severe emergence agitation, seizures, arrhythmias, emesis during sedation.

Minor: transient rash, post procedure emesis, nausea, dizziness, hypertonicity, minor airway obstruction, salivation.

The actual incidence varies considerably in reported studies from 2% up to 17% in some studies. The incidence of adverse events highlights the need to ensure PS must only be administered and monitored by staff knowledgeable in the identification and management of adverse events and who possess the requisite skills to manage these.

Adverse events should be recorded in the patient medical notes.

Management of Adverse Events

Airway and Breathing

1. Airway obstruction

- Complete obstruction: cessation of airflow, no respirations and marked paradoxical rocking of the chest (chest descends as the abdomen rises)
- Partial obstruction – sonorous breathing,

Management

1. Call for help
2. Basic manoeuvres (head tilt/chin lift or jaw thrust)
3. Supplemental O_2 (maximal FiO_2)
4. Clear airway using suction if required
5. Try airway adjuncts: oropharyngeal or nasopharyngeal airway
6. Consider adrenaline if thought to be allergic reaction
7. If still no clear airway proceed to advanced airway management: laryngeal mask (LMA) or endotracheal tube (ETT)
8. Last resort surgical airway management

2. Hypersalivation

- Suction – with care (deep suction may trigger laryngospasm)
- Positioning manoeuvres e.g. lateral position /head down
- Atropine 20mcg/kg (0.02mg/kg) to maximum dose of 0.6mg

3. Laryngospasm

Laryngospasm is spasm of the vocal cords secondary to airway trauma, instrumentation or secretions in the airway.

- Complete: silent, paradoxical movement of chest
- Partial: stridor (high-pitched crowing noise)

Management

1. Cease procedure
2. Call for help
3. Clear airway/suction hypopharyngeal secretions
4. Give Supplemental O_2 (maximal FiO_2)
5. Jaw thrust with BVM held on firmly, give gentle breaths if required
6. Pressure on Larsons point (laryngospasm notch)
7. Prepare for emergency drug assisted intubation
8. Deepen sedation eg with low dose propofol
9. If no response consider administering suxamethonium. A dose of only 0.1-0.5 mg/kg may be sufficient, but in severe laryngospasm administer a full dose (1-2 mg/kg IV) and perform intubation.

4. Hypoventilation/apnoea

Signs may include slowed respirations, shallow or irregular respirations or cessation of respirations. Detected much earlier by use of nasal capnography, and identified by rising level of $ETCO_2$ or decreased breathing rate (hypoventilation) or complete loss of CO_2 trace (apnoea)

Most commonly due to over sedation but may be secondary to airway obstruction (see above).

Management

1. Call for help
2. Try to rouse patient
3. Ensure adequate clear airway(as above)
4. Supplemental O_2 (maximal FiO_2)
5. Assist ventilation with BVM few small breaths if other measures fail
6. If prolonged consider chemically reversing sedatives
7. If still hypo-ventilating despite above measures proceed to advanced airway and ventilation measures

5. Aspiration of stomach contents

Usually identified easily with the presence of vomiting and coughing during sedation.

Management

- Stop the procedure
- Head down/ lateral position to potentiate drainage
- Suction and clear airway
- Give Supplemental O_2 (maximal FiO_2)
- Assist ventilation with BVM after airway toilet if inadequate ventilation
- May need NIV BIPAP/IPPV and PEEP
- After the procedure is finished may need admission for further management.

Desaturation (SaO2 < 94%)

1. Ensure adequate wave form on monitor, move probe if required.
2. Ensure adequate and clear airway (as above)
3. Give supplemental O_2 (maximal FiO_2)
4. Assist ventilation with BVM if required
5. Identify and treat potential causes:-

    - airway obstruction `or` laryngospasm
    - aspiration
    - anaphylaxis

6. Ensure adequate circulation-check pulse, BP and capillary refill and manage if inadequate
7. Reverse sedatives if necessary

6. Allergy and anaphylaxis

Allergy and anaphylaxis are part of the same spectrum. Manifestations may include

- Skin – generalised erythematous or macular rash, itchy and warm
- Airway – swelling of lips/tongue, evidence of angioedema of the floor of the mouth and pharynx and plate, stridor
- Bronchospasm (greater if patient is asthmatic)
- CVS – hypotension
- ENT – rhinitis
- Eyes – conjunctivitis
- GIT – nausea, vomiting and diarrhoea

Management

1. Stop procedure
2. Assess and resuscitate using ABCDE approach
3. Specific treatment depends on what is manifesting

- Rash only: may be just histamine release e.g. with morphine or propofol. Consider adopting “wait and see” approach. May require an anitihistamine
- Wheeze only: nebulised salbutamol and hydrocortisone
- Angio-oedema or stridor
    - Consider nebulised adrenaline if isolated angio-oedema
    - IM adrenaline 0.5mg (adult) or 0.01mg/kg (child)
    - IV adrenaline 1mg in 100ml of Normal saline titrated to effect
    - IV hydrocortisone
- Hypotension:
    - IM adrenaline 0.5mg (adult) or 0.01mg/kg (child)
    - IV fluid bolus (up to 50ml/kg)
    - IV Adrenaline as above
    - IV Hydrocortisone
    - Consider H1 and H2 Blockers

Circulation

1. Cardiac Arrest (Asystole/pulseless VT/VF):Follow usual protocols

2. Bradycardia

- Treat underlying cause – may do nothing more
- Drugs - atropine (use ARC guidelines)
- Pacing and dopamine, isoprenaline if resistant

3. Tachycardia

- Usually due to pain resulting from inadequate sedation: manage by increasing sedation and analgesia
- Maybe iatrogenic secondary to medication e.g. ketamine
- Primary arrhythmias rarer: manage as per usual protocols

4. Hypotension

- Fluid challenge
- Treat underlying cause:-

    - Iatrogenic secondary to sedation medication: allow sedation to wear off
    - Consider bleeding or other fluid loss: give further fluid
    - Anaphylaxis: IM or IV adrenaline (as above)

5. Hypertension

Treat the cause

- Commonly pain secondary to inadequate sedation: increase sedation and analgesia
- May be iatrogenic e.g. ketamine
-
- Monitor patient - usually doesn't require further management

Neurological

1. Pain, distress and agitation

- Pause procedure
- Ensure adequate ABC
- Psychological support: distraction and reassurance
- Drugs: consider increasing analgesia and sedation
- Gentle but firm physical restraint

2. Emergence reaction

Ketamine can stimulate hallucinatory reactions during recovery, which may be either pleasant or unpleasant. Although these so-called ‘‘emergence reactions’’ are rarely unpleasant in children (1.6% incidence of reactions judged more than ‘‘mild’’) their incidence in adults is highly variable, with reported incidences ranging from 0% to 30%. When Ketamine is administered in adults, clinicians should be aware of the potential for pronounced reactions, including nightmares, delirium, excitation, and physical combativeness.

Management

- Low noise, dimmed lights may lessen chance of reaction
- Reassure patient
- Talk them through it
- Allow patient to fuss with mask etc
- Consider small dose of midazolam if patient is otherwise unmanageable

3. Paradoxical reactions

Instead of acting as a sedative medication in about 10% of cases patients will become paradoxically excited. This is not uncommon with midazolam and occasionally occurs with N_2O

Management

1. Opioid prior to sedation often prevents
   2. Ensure adequate analgesia
   3. Firm “gentle” restraint
   4. If due to midazolam–consider reversal with flumazenil IV – consider contraindications- eg benzodiazepine dependence, seizure disorder

4. Vomiting

1. Lateral position/suction

2. Drugs

- First line metoclopramide 0.2-0.5 mg/kg (not in patients <20yrs)
- Second line ondansetron 0.1 mg/kg
- Third line dexamethasone 0.15 mg/kg
- Use all 3 for severe nausea and vomiting
- If still refractory can trial droperidol 10mcg/kg or Promethazine 0.5 mg/kg
- Manage aspiration see above

5. Drug induced muscle rigidity

Identify cause and treat accordingly:

- Secondary to tramadol, fentanyl, morphine: treat with naloxone
- Secondary to extrapyramidal effects of drugs (dystonia, akathisia: treat with benztropine 0.01-0.02 mg/kg
- Neuroleptic malignant syndrome(NMS) IV fluids +/- bromocriptine
- Malignant hyperthermia(MH): treat with IV fluids and dantrolene

6. Seizures

- Position on side
- Ensure adequate brain perfusion: check and manage ABC, give oxygen, check BSL
- Medications if doesn't resolve spontaneously
    1. IV Midazolam
    2. IV propofol (unless secondary to this)
    3. IV Levetiracetam
- If prolonged and resistant–rapid sequence induction and intubate

7. Myoclonus

Mild and brief – no specific management needed

POST PROCEDURE

The patient must be observed by a member of nursing staff until full recovery to pre sedation state.

Following the procedure observations should be recorded every 5 -15 minutes depending on how much the patient has recovered from sedation. If patients remain difficult to rouse then close visual observation should be maintained and observations recorded every 5 minutes. As the patient recovers the frequency of observations can be reduced to 15 minutely.

Keep the patient nil by mouth until fully alert then offer clear fluids prior to discharge.

DISCHARGE CRITERIA

The patient cannot be discharged until discharge criteria are met. It is essential to assess each patient individually by using the following 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 age
- Final set of vital signs are returned to pre procedure status.
- Ability to tolerate oral fluids - initial fluids offered can include water, cordial, juice, tea, coffee or ice block
- Pain score less than 4

For a very young or intellectually disabled child or adult, the aim is to achieve the pre-sedation level of responsiveness or as close as possible to the normal level of functioning for the particular patient. This should be achieved by communicating with the parent/guardian/carer to establish what is normal for the patient.

In addition, a responsible adult needs to be available to accompany the patient home.

DOCUMENTATION

All notes relating to the procedure performed, procedural sedation technique, adverse events and management and discharge / follow-up plans must be recorded in the patient's medical records.

APPENDICES

Appendix A: Drugs Used in Procedural Sedation

NITROUS OXIDE

Background

Nitrous oxide is an anaesthetic gas, which provides analgesia and sedation and is delivered in variable concentration with oxygen. The exact mechanism of action of nitrous oxide is unknown however it is thought to work by stabilising neuronal as well as other membranes and therefore causing general depression of the whole CNS. The gas is non allergenic and not flammable or explosive.

1. Entonox: a 50-50 premix nitrous oxide and oxygen.
2. Quantiflex: a device allowing delivery of a variable quantity of nitrous mixed with Oxygen up to 70% Nitrous concentration

Indications

N_2O has both analgesic and sedative properties. Its quick onset of action and recovery makes it ideal for use in the emergency department.

It is useful in such interventions as:

- Suturing and wound management
- IV insertion – particularly in acutely painful conditions e.g. burns
- Removal of foreign bodies from ear/soft tissue
- Fracture manipulation
- Reduction of digit dislocations
- Simple moulding of plaster of Paris casts to fractures
- Burns dressings
- Injection of local anaesthetic
- Abscess incision and drainage
- Other painful/uncomfortable procedures

It is less useful for:

- Very painful or prolonged procedures
- Facial (perioral) lacerations
- Procedures requiring immobility

Pharmacology

Nitrous oxide has a short duration of action. It takes approximately 1-3 minutes to induce these effects with a nitrous oxide-oxygen mixture and about 4-5 minutes for them to wear off. There are no drug interactions – nitrous is eliminated unchanged from the lungs.

Adverse events and Contraindications

Nitrous oxide is usually well tolerated by patients in the emergency department. Most patients only have mild side effects such as vomiting, nausea, dizziness, light-headedness and occasionally nightmares and some patients will not be able to tolerate the mask. Some side effects are further outlined below.

Vomiting: Patients should be warned that vomiting may occur both during and after the procedure and even after arrival home. Post procedure nausea and vomiting has recently been cited as a reason for decreasing or stopping the use of nitrous oxide. Although vomiting is unpleasant it is not usually dangerous as cough and gag reflexes are maintained. The exception to this is if patients have had previous or simultaneously administered opiates or benzodiazepines. Because the combination will result in deeper sedation there is a potential for aspiration if vomiting occurs.

Over sedation: The precautions of **mandatory** co-administration of oxygen and self-administration prevent over sedation. If a mask or mouthpiece is held on by another person there is a possibility of over-sedation so this should be avoided unless the patient has monitoring and staffing requirements as per intravenous sedation and if the operator feels that the patient is becoming too sedated then they should remove the mask

Desaturation with respiratory difficulties. This is rare. In patients with concurrent URTI or history or airways disease or asthma there is an increase risk therefore care should be taken with these patients

Increased pressure – intracranial, intraocular and Pulmonary vascular Pressure: Nitrous oxide is therefore contraindicated in patients with pulmonary hypertension, glaucoma or anyone with known increased ICP or with ALOC after head injury

Increased volume in closed air spaces: Nitrous oxide is 35 times more soluble in blood than nitrogen causing it to diffuse into a closed air-containing cavity faster than nitrogen diffuses out. If the cavity does not have rigid walls, the volume increases. It should not be used in patients in whom there is a the possibility of closed air spaces such as pneumothorax , bowel obstruction, middle ear infection, or after SCUBA diving (12hours of a normal dive or 24hours of repeated or deep dives) or if any signs of decompression sickness.

History of Malignant hyperthermia: Nitrous oxide is possibly associated with malignant hyperthermia and should not be used in patients who are susceptible to this.

Fasting state prior to procedure

There is no evidence that fasting state is related to adverse events – in particular there is no reported difference in vomiting or aspiration rates in patients given N_20 whether they have fasted or not.

Equipment

Nitrous Oxide administration requires the preparation of the following equipment:

Separate oxygen source with mask other than the nitrous oxygen source and also Bag valve mask available

Observations

- Documentation of vital signs and findings throughout the administration of nitrous oxide
- Oxygen saturation needs to be monitored constantly and for five minutes post procedure
- Respiratory rate needs to be constantly monitored
- Conscious state must be constantly monitored by the administrator
- On completion of the procedure and administration of nitrous the patient needs to be monitored until their conscious state returns to the baseline. (if developmentally delayed, carers can aid in the assessment of baseline)

Administration

Trained nursing or medical staff are required to supervise the administration of nitrous oxide.

Guidelines for administration of Nitrous Oxide

- Familiarise patient especially children with the equipment prior to the procedure – this increases effectiveness and compliance
- Appropriate mask to be attached to the circuit or mouthpiece if older
- Filter is needed in the Entonox circuit
- Use a new mouthpiece and filter for each administration
- Check level in the bottle – if less than 1⁄4 then must be replaced
- Turn on the cylinder
- Allow patient to self-administer Entonox – a “Darth Vader” or hissing sound indicates the patient is activating the valve
- Administration should start 3 minutes prior to the procedure
- Sedation score of 4 is the aim – if the patient becomes excessively drowsy, remove the mask if it doesn’t automatically fall away.
- At the end of the procedure 100% oxygen should be delivered for 3 minutes and the cylinder turned off and mouthpiece and filter discarded
- Continue observations 15 minutely until the patient meets discharge criteria

Equipment assembly and check prior to procedure

- Check that the O2 and N2O hoses are connected to the cylinders and both cylinders are turned on
- Check the gauges to ensure that there is an adequate supply of oxygen and nitrous oxide (1⁄4 % full minimum)
- Check the reservoir bag inflates with no leak
- Select the appropriate size face mask.
- Check the scavenging device is connected
- Prescribe on medication chart

During procedure

- Set the flow of O2/ N2O to desired concentration (usually 50-70% N2O)
- Apply face mask ensuring adequate seal
- Observe the reservoir to ensure there is a supply of nitrous oxide for the patient to breathe and to ensure that the bag does not overextend
- Nitrous oxide/oxygen mix should be applied for 3 minutes PRIOR to procedure to ensure sufficient analgesic effect is present.
- The patient should continue to breathe nitrous/oxygen mix for the duration of the procedure.
- The dose may be titrated upwards by increasing the nitrous flow by 1 l/min. - or by 10 % increase in nitrous to a maximum of 70% N2O
- Administration should be temporarily discontinued if the patient becomes excessively drowsy. Frequent communication with the patient allows titration of the N2O dose for effect.
- Monitor sedation levels and adjust % of N2O versus O2 as required
- Continuous monitoring and assessment of vital signs throughout the procedure (see observation recommendations)
- Administer 100% oxygen for 4-5 minutes after the procedure is finished to avoid diffusion hypoxia

Post Procedure

- Turn off nitrous machine
- Discard face mask and tubing
- Monitor patient until their conscious state returns to baseline

BENZODIAZEPINES

Benzodiazepines have been used in children and adults as adjuncts in procedural sedation. They are anxiolytic, sedative and result in amnesia for the procedure. They have no analgesic effects therefore for painful procedures they should only be used in conjunction with an opiate for analgesia.

Benzodiazepines act at the gamma amino butyric acid receptor (GABA). GABA receptor stimulators such as benzodiazepines potentiate the GABA effects of calming the patient, relaxing smooth muscle and producing sleep.

The prototypical benzodiazepine, diazepam, has been replaced in procedural sedation by midazolam due to its shorter half-life and water solubility.

Midazolam can be administered IV, IM, orally, rectally and nasally. Absorption varies with route of administration. In addition oral dosages are in part metabolised by the liver (first pass effect).

Effects of benzodiazepines can be reversed by Flumazenil, a benzodiazepine antagonist although this should not be administered to patients who have a history of chronic benzodiazepine use as they are at risk of seizures with reversal

Formulation of Midazolam

- **ORAL/BUCCAL:** The oral route is the most convenient and easiest route of administration. However, the IV preparation used is bitter and children sometimes refuse it or spit it out. The taste can be disguised by using 5-15mls of undiluted cordial/other flavouring.
- **INTRAVENOUS:** The advantage of IV midazolam is ease of administration and titration. Disadvantage is insertion of an IV line.
- **INTRANASAL**: IN midazolam has a rapid onset and may be used however children may become upset because the formulation stings the mucosa. One drop of 5mg/ml solution contains about 0.3mg of midazolam – one drop per nostril over 15sec until full dose applied. A single spray of Intranasal lignocaine spray per nostril administered immediately prior to the IN midazolam solution has been found to reduce the discomfort.
- **RECTAL and INTRAMUSCULAR**: Rectal and IM administration of midazolam are generally not recommended for procedural sedation in the emergency department. Blood levels after rectal administration are variable. The onset is slower than with intranasal route.

    - The main problem with IM midazolam is the pain associated with injection.

Indications for use

Relieve anxiety regarding procedures and in conjunction with opiates to achieve sedation for procedures

Benzodiazepines have no analgesic effect

Adverse reactions

Major side effects are:

1. Cardiorespiratory depression (hypotension, bradycardia and respiratory depression)

2. Paradoxical excitement (10-15%)

3. Emergence delirium

Side effects are dose related and vary with route of administration.

- The highest risk of major side effects is IV administration. [13] Rapid IV administration simultaneously with opioids increases the risk of respiratory depression.
- Higher doses of intranasal midazolam can lead to prolonged elimination, delayed recovery and respiratory depression. All patients receiving this sedative intra-nasally must be monitored closely.
- No serious respiratory depression has been reported in oral administration at 0.5mg/kg except if other sedative drugs are co-administered.

Considerations for use

- Patients with previous adverse events to midazolam sedation – this is the only true contraindication. Also should not be used in children aged less than 1 year due to increased risk of airway complications.
- Patients with swallowing difficulties, airway difficulties or sleep disorders can develop airway obstruction and hypoxemia from relaxation of upper airway muscles
- Consider reduced doses in renal hepatic and cardiac impairment
- Consider reduced doses in the elderly
- Myasthenia gravis.
- Acute glaucoma

Equipment, staffing and set up are as per general module see previous

Doses

- **Oral midazolam:** 0.5mg/kg with sedation in 30-45 minutes (max 15mg).

  Higher doses of 0.75-1mg/kg are associated with increased side effects.

- **Buccal Midazolam:** 0.3mg/kg of IV formulation – onset 10-15mins but may be earlier.
- **IV Midazolam:** 0.05-0.1mg/kg with onset 1 minute. IV midazolam should be given slowly and titrated to effect in adults <5mg is recommended regardless of weight dosing.
- **IN Midazolam**: 0.2-0.4mg/kg of IV formulation (max 10mg) intra-nasally sedation is usually within 10-15 minutes but may be earlier and may last up to 2 hours

Reversal agent Flumazenil

Overdose symptoms of midazolam can be reversed by flumazenil, a benzodiazepine antagonist. Flumazenil is administered IV. It has a short duration of action and might require several doses or an infusion. It should never be required if careful titrated sedation is undertaken.

- Children: 5mcg/kg every 60 seconds to a total dose of 40mcg/kg (max 1mg)
- Adult dose: 300-600mcg repeat as necessary up to a total of 2mg
  Maintenance dose if indicated – half the dose required to waken the patient given every hour by continuous infusion

KETAMINE

Background

Ketamine is an analgesic and a dissociative anaesthetic agent. It is fundamentally different from other procedural sedation and analgesia agents. Ketamine exerts its effect by ‘‘disconnecting’’ the thalamo-neocortical and limbic systems (through simultaneous depression of the cortex and stimulation of the limbic system), effectively dissociating the central nervous system from outside stimuli (e.g., pain, sight, sound). The resulting ‘‘sensory isolation’’ of this trance like cataleptic state is characterized by potent analgesia, sedation, and amnesia while cardiovascular stability is maintained and spontaneous respirations and protective airway reflexes are usually preserved.

The complete analgesia typical of the dissociative state permits extremely painful procedures to be performed that would otherwise be difficult using traditional moderate or deep sedation with benzodiazepines and opioids. Rather than displaying the dose-response continuum observed with all other procedural sedation and analgesia agents, Ketamine dissociation is either present or absent with a narrow transition zone. This dissociative state, once achieved, has no observable progressive depth or level, and administration of additional Ketamine to an already dissociated patient does not enhance or deepen sedation, as would be the case with opioids, sedative-hypnotics, or inhalational agents. For non-dissociative agents, the more drug given, the more the patient progresses along the sedation continuum, with increasing probability of impaired independent airway function and respiratory control. In contrast, the absolute amount of Ketamine given has no clinically

important impact on respirations and airway integrity within the range of clinically administered doses and using standard administration methods. Accordingly, dissociative sedation can be readily begun by administration of a single intravenous or intramuscular loading dose, and the only need for titration, in marked contrast to other sedatives, is to maintain the dissociative state over time.

Ketamine is an ideal agent to facilitate short painful procedures, especially in children, which might otherwise require general anaesthesia. It has many features that are attractive in the outpatient setting: rapid onset (less than 5 minutes IM or IV and up to 25min Oral or IN), consistently effective analgesia and amnesia, airway stability and acceptable recovery duration (70 –140 minutes depending on route of administration).

Its safe use in children has been documented in numerous series[14,15,16] and the literature supports the safety and efficacy of ketamine for a large variety of brief, painful or emotionally disturbing procedures – most typically fracture reduction and laceration repair in children. Its use in adults has been increasing in recent years and evidence is appearing that it is safe and effective in this age group also.

It is also used extensively in developing countries for major and minor surgery and in disaster and battlefield settings where no anaesthetist or facilities are available.

Adverse Reactions and Contraindications

Previous allergy or anaphylaxis to ketamine

Ketamine use is obviously contraindicated in this case

Respiratory depression

Ketamine uncommonly causes respiratory depression. Severe respiratory depression is rare but is increased in frequency if ketamine is pushed by rapid IV bolus achieving rapid peak CNS levels, or when CNS abnormalities are present or in young infants. Neonates and small infants have greater difficulty maintaining a patent airway with any sedative agent. Therefore, in the Emergency Department, ketamine is contraindicated in infants less than 3 months of age and relatively contraindicated between 3-12 months of age.

Airway malposition

Occasional malposition of the airway can occur especially if the patient exhibits random purposeless motion. It is critical to continuously pay attention to airway patency and reposition head or jaw if snoring respirations or stridor develop.

Hypersalivation

Ketamine stimulates salivary and tracheobronchial secretions. Some experts recommend concurrent use of an anticholinergic such as atropine (0.01-0.02/kg, max

dose 0.6mg) to inhibit these secretions, particularly when the procedure may involve the mouth and airway. Newer studies have failed to show a benefit from co administered atropine and its use in combination with ketamine is dropping. Can be used if developed excessive secretions.

Laryngospasm

Generally with anaesthesia young age and respiratory infections increase the risk of laryngospasm. Clinicians need to be prepared to treat laryngospasm with oxygen and assisted ventilation until the episode subsides.

Ketamine is relatively contraindicated for use in conditions with increased risk of laryngospasm. These include

- Procedures involving laryngeal stimulation
- History of Airway instability, stenosis, tracheomalacia, trachea surgery
- Active asthma, current upper respiratory tract infection

Cardiovascular stimulation

Ketamine is sympathomimetic and can produce mild to moderate increases of blood pressure, heart rate, cardiac output and oxygen consumption. Therefore it is relatively contraindicated in patients with significant cardiovascular disease.

Musculoskeletal effects and Ataxia

Skeletal muscle hypertonicity and random movement of head and extremities are often observed. Ataxia can be pronounced during recovery. Ambulation must be avoided until full equilibrium is restored. Also need to be aware if need full muscle relaxation eg for joint relocations it may not be the agent of choice

Intracranial pressure elevation

Ketamine may increase intracranial pressure especially in patients with pre-existing neurological conditions such as hydrocephalus and CNS lesions.

Whilst ketamine had previously been contraindicated in head trauma, a recent review has challenged the basis for this. Recent studies have shown it to be safe prehospital. ICU studies have found it to be a safe sedative agent in already intubated patients with head injury.

Intraocular pressure elevation

Ketamine may increase intraocular pressure so is contraindicated in cases of glaucoma or penetrating eye injury

Recovery reactions

Emergence Reactions and issues

Ketamine can stimulate hallucinatory reactions during recovery, which may be either pleasant or unpleasant. Although these so-called ‘‘emergence reactions’’ are rarely unpleasant in children their incidence in adults is highly variable, with reported incidences ranging from 0% to 30%. When Ketamine is administered in adults, clinicians should be aware of the rare potential for pronounced reactions, including nightmares, delirium, excitation, and physical combativeness. Titrated benzodiazepines appear to consistently and rapidly pacify such reaction.

Recovery agitation without an apparent hallucinatory component is not uncommon after dissociative sedation. It appears to be a separate entity from the Ketamine specific hallucinatory reactions and is also associated with Midazolam administration. Mild recovery agitation occurs more frequently in children aged less than 5 years of age and in patients with underlying medical problems.

Also, in contrast to all other sedative drugs, when a patient who is agitated prior to the drug has a sedated CNS and awakes gradually, ketamine is a dissociative drug and when the dissociative effect wears off the patient awakes as agitated as before the sedation. It is therefore essential to ensure the patient is calm and relaxed, thinking pleasant thoughts and to focus on what vivid dreams they would like to have before administering ketamine.

Although evidence is insufficient to mandate it, whenever possible provide a well monitored location with muted lighting, noise, and physical contact until wakefulness is well established.

When Ketamine is administered without prophylactic benzodiazepines and rare unpleasant recovery reactions do occur, titrated benzodiazepines appear rapidly and consistently effective in alleviating or substantially mitigating such reactions.

Vomiting

When vomiting occurs, it is typically late during the recovery phase when the patient is alert and can clear the airway without assistance. It occurs more frequently in older children, compared with younger children and may also be dose related as it has recently been reported to occur more frequently following IM administration – which is typically a higher dose of 4 mg/kg compared with an IV dose of 1.5 mg/kg.

Length of sedation

Length of sedation is significantly longer in IM group compared to the IV group.

The trance like state, open eyes and occasional random movements seen during ketamine administration can be frightening for parents. Therefore it is important to explain the effects of ketamine to the parent. The sedation handout provides good talking points in the discussion with parents about the expected events during the sedation and possible sequelae after the procedure.

Ketamine Doses and routes of Administration

Ketamine may be safely and effectively administered by either the intramuscular or intravenous route, and the choice should be based on practical considerations. The following table summarises the main features of the two methods of administration. Note that if IM ketamine is to be used then expertise to promptly achieve IV access must be present until full recovery of the patient**. There is no reversal agent for ketamine.**

Route of Administration	**Intramuscular (IM)**	**Intravenous (IV)**
Advantages	No IV necessary	Ease of repeat dosing, faster recovery
Clinical onset	5 minutes	1-2 minutes
Duration of effective dissociative sedation	20-25 minutes	5-10 -minutes
Recovery time	100 – 140 minutes	70 – 100 - minutes
Initial dose	2-4mg/kg	0.5 - 1mg/kg
Subsequent dose	Insert IV and give further doses 0.25 – 0.50 mg/kg IV	0.25 – 0.50 mg/kg
Maximum dose	5 mg/kg	2 mg/kg

Warning

IV administration must always be given over a period of greater than 60 seconds. Rapid IV administration is associated with transient respiratory depression including apnoea

PROPOFOL

Background

Propofol is an intravenous ultra-short acting sedative/hypnotic agent used for the induction and maintenance of sedation and anaesthesia. The amassed emergency medical experience using Propofol to induce deep sedation has shown this agent to be relatively safe and without serious sequelae. This ultra-short agent can occasionally transiently overshoot deep sedation but this appears to lack clinical significance. Adverse reactions can be reduced by slower induction titrating to the lowest dose producing optimal sedation. Transient cardio-respiratory depression can be safely managed in clinical practice.

It has no analgesic action thus mandating co-administration of opioid analgesics for painful procedures. It has the advantage of being a known antiemetic with minimum emergence reactions.

Propofol use for procedural sedation in paediatrics has been increasing in recent years with a number of published studies indicating its safety and efficacy in this age group.

Combination of propofol with ketamine in a 1:1 mix “ketafol” or as combination therapy can be used in procedural sedation in emergency. Preliminary studies appear to show reduction of overall dose required when the drugs are used in combination with minimal adverse events.

Pharmacology

A therapeutic dose of Propofol produces hypnosis with minimal excitation in approximately forty seconds from the start of the injection. As with other rapidly acting IV anaesthetic agents, the half time blood-brain equilibration is approximately 1 to 3 minutes, this accounts for the rapid induction of sedation/anaesthesia. Elimination can be 2 – 24 hours.

Indications for use

Short term for moderate and deep procedural sedation e.g.

- Removal of foreign bodies
- Cardioversion
- Relocation of joint e.g. shoulder or hip
- Fracture manipulation
- Short laceration repair

Adverse Reactions

Possible adverse events outlined below

Bradycardia/asystole

Propofol has been associated with reports of bradycardia (occasionally profound) and asystole. Atropine must be rapidly available to treat these adverse effects.

Hypotension

Cardiovascular effects range from minimal reduction in blood pressure to significant arterial hypotension. Slow induction and minimising dose requirements reduces the incidence of these untoward side effects. IV fluids should be available for management. Inotropes are not usually required as propofol is short acting and hypotension usually resolves with ceasing of further infusion of propofol however they should be available. Metaraminol should be available at the beside to manage this complication if required.

Pain on injection / thrombophlebitis

Often pain on injection. Good practive to warn the patient. Pain on injection can be reduced by adding lignocaine to the Propofol. The addition of lignocaine significantly decreases the incidence of excitatory side-effects. This is an OFF LABEL use of lignocaine but is a widespread practice in emergency departments and by anaesthetists.

Excitatory side-effects

Epileptiform movements, including convulsions & opisthotonos can occur.

Anaphylactoid reactions

Propofol has been reported to occasionally cause severe allergic reactions with angioedema, bronchospasm, erythema and hypotension. These reactions respond to adrenaline.

Flushing / rash

This is a not uncommon reaction and is due to histamine release. It is usually self limiting.

Contraindications

Propofol has been found to be relatively safe however the following contraindications should be noted.

- Anaphylaxis is rare but should not be used in patients with propofol, egg, lecithin, glycerol, and soya oil allergies.
- Pregnancy (no direct harm to foetus but increased rate of maternal death)

- CVS instability – other agents are more CVS stable
- Relative contraindications

  ○ Epilepsy : the following details should be considered prior to using propofol for epileptic patients

  - Epileptic patients were thought to have had an increased risk of seizure in the recovery phase. This is currently being challenged in the literature.
  - There may be some increase in seizures in the subsequent weeks which is thought to be due to a proconvulsant metabolite.
  - Status epilepticus is treated with propofol.

  Propofol dose

  - **Adults Induction for deep sedation** 0.5-1.0 mg/kg bolus (titrate slowly) and 0.5 mg/kg subsequent boluses. Suggested dose up to 3mg/kg and should be titrated to effect.
  - **Children >2 Induction for deep sedation** NB An emergency consultant must be present for any sedation of children with propofol
  - Initial dose IV Propofol 0.5- 1mg/kg (max 40mg) over 1 min

OPIOIDS

Introduction

Opioid analgesics are excellent agents for procedural sedation especially for patients who have significant pain before, during and after a procedure e.g. relocation of a dislocated shoulder. Analgesics are often given in the pre-hospital environment prior to presentation to the ED and the sedationist needs to consider this when giving other subsequent sedating medications. Morphine and fentanyl are used in combination with N_2O, benzodiazepines and Propofol. Multimodal use of procedural sedation and analgesic (PSA) agents allows creation of a better sedation experience while reducing the dose of each agent.

Indications

Analgesia for any painful procedure especially where the sedative agent has no analgesic properties

Considerations

- Myasthenia gravis
- Opioid hypersensitivity usually alternative opioid is available.

Precautions

Using combinations of opioid and other agents have accumulative effects on the depth of sedation and care must be taken to avoid adverse side effects.

Reduced doses are needed with the elderly, debilitated & patients with renal & hepatic dysfunction. Atopic patients may have increase histamine release.

Adverse Reactions

- Respiratory depression
- Histamine release
- Local rash
- Urticaria/wheeze
- Nausea/vomiting
- Muscle rigidity (High dose fentanyl in infants)

Dosage of Common agents

- Panadeine forte (codeine is a pro-drug of morphine) 30mg codeine with 500mg paracetamol usual dose for adult is 2 tablets
- Morphine 0.05-0.15 mg/kg IV
- Fentanyl 1-2 mcg/kg IV
- Fentanyl 1.5 mcg/kg Intra nasal (IN) (see protocol for subsequent doses)

Reversal Agent
Naloxone is a pure antagonist. This agent should not be needed if appropriate dose regimens are used. Abrupt reversal can cause sudden emergence with severe pain and massive catecholamine output which can precipitate ischaemic chest pain, arrhythmias and acute heart failure in the elderly. It can also cause seizures in patients who take regular doses of opiates including codeine and may cause pulmonary oedema in larger doses.

Dosage of Naloxone ADULTS:

Aliquots of 0.1-0.2mg should be given IV every 2-3 minutes until rousable with an adequate respiration rate.

An infusion at 2/3 the initial resuscitation dose / hour should then be implemented of more than 2 bolus's are required

CHILDREN

- Initial dose of 0.01mg/kg IV
- Repeat every 2-3 minutes

REFERENCES

- Burnett, A. M., Salzman, J. G., Griffith, K. R., Kroeger, B., & Frascone, R. J. (2012). *The Emergency Department Experience with Prehospital Ketamine: A Case Series of 13 Patients. Prehospital Emergency Care, 16*(4), 553-559 7p. doi:10.3109/10903127.2012.695434
- Caricato, A., Tersali, A., Pitoni, S., De Waure, C., Sandroni, C., Bocci, M. G., & ... Antonelli, M. (2013). Racemic ketamine in adult head injury patients: use in endotracheal suctioning. *Critical Care (London, England), 17*(6), R267. doi:10.1186/cc1309
- *Challenging Concepts in Emergency Medicine: Cases with Expert Commentary*. (2015). Oxford: Oxford University Press. doi:10.1093/med/9780199654093.001.0001
- Chong, J. H., Chew, S., & Ang, A. Y. (2013). Is prophylactic atropine necessary during ketamine sedation in children?. *Journal Of Paediatrics And Child Health, 49*(4), 309-312. doi:10.1111/jpc.12149
- Couloures KG, Beach M, Cravero JP et al (2011) Impact of provider specialty on pediatric procedural sedation complication rates. *Pediatrics 127*:e1154–e1160
- Doctor, K., Roback, M. G., & Teach, S. J. (2013). An update on pediatric hospital- based sedation. *Current Opinion In Pediatrics, 25*(3), 310-316 7p. doi:10.1097/MOP .0b013e328360bb92
- Grace, R. F., Tang, D. W., & Namel, E. (2015). An audit of the haemodynamic and emergence characteristics of single-shot 'ketofol'. *Anaesthesia And Intensive Care, 43*(4), 503-505.
- Godwin, S. A., Burton, J. H., Gerardo, C. J., Hatten, B. W., Mace, S. E., Silvers, S. M., & Fesmire, F. M. (2014). Clinical policy: procedural sedation and analgesia in the emergency department. *Annals Of Emergency Medicine, 63*(2), 247-58.e18. doi:10.1016/j.annemergmed.2013.10.015
- Green, S. M., Roback, M. G., Kennedy, R. M., & Krauss, B. (2011). Pain management and sedation/concept: Clinical Practice Guideline for Emergency Department Ketamine Dissociative Sedation: 2011 Update. *Annals Of Emergency Medicine, 57*449-461. doi:10.1016/j.annemergmed.2010.11.030
- Ho, J. D., Smith, S. W., Nystrom, P. C., Dawes, D. M., Orozco, B. S., Cole, J. B., & Heegaard, W. G. (2013). *Successful Management of Excited Delirium Syndrome with Prehospital Ketamine: Two Case Examples. Prehospital Emergency Care, 17*(2), 274-279 6p. doi:10.3109/10903127.2012.729129
- Hoffman, G. J. (2002). Risk Reduction in Pediatric Procedural Sedation by Application of an American Academy of Pediatrics/American Society of Anesthesiologists Process Model. *Pediatrics, 109*(2), 236.
- Husum, B., Stenqvist, O., Alahuhta, S., Sigurdsson, G. H., & Dale, O. (2013). Current use of nitrous oxide in public hospitals in Scandinavian countries. *Acta Anaesthesiologica Scandinavica, 57*(9), 1131-1137. doi:10.1111/aas.12165

- Jalili, M., Bahreini, M., Doosti-Irani, A., Masoomi, R., Arbab, M., & Mirfazaelian, H. (2016). Original Contribution: Ketamine-propofol combination (ketofol) vs propofol for procedural sedation and analgesia: systematic review and meta-analysis. *American Journal Of Emergency Medicine*, *34*558-569. doi:10.1016/j.ajem.2015.12.074
- Kim, D. H., Chae, Y. J., Chang, H. S., Kim, J. A., & Joe, H. B. (2014). Intravenous lidocaine pretreatment with venous occlusion for reducing microemulsion propofol induced pain: comparison of three doses of lidocaine. *The Journal Of International Medical Research*, *42*(2), 368-375. doi:10.1177/0300060513507391
- Krauss, B. S., Krauss, B. A., & Green, S. M. (2014). Procedural sedation and analgesia in children. *The New England Journal Of Medicine, 370*(15), 1-6. doi:10.1056/NEJMvcm1108559

- Lee, J. S., Jeon, W. C., Park, E. J., Min, Y. G., Jung, Y. S., Kim, G. W., & Choi, S. C. (2012). Adjunctive Atropine Versus Metoclopramide: Can We Reduce Ketamine- associated Vomiting in Young Children? A Prospective, Randomized, Open, Controlled Study. *Academic Emergency Medicine, 19*(10), 1128-1133 6p. doi:10.1111/j.1553-2712.2012.01457.x
- Lee, J. S, Jeon, W. C, Park, E. J, Min, Y. G. (2014). Does ondansetron have an effect on intramuscular ketamine-associated vomiting in children? A prospective,randomised, open, controlled study. *Journal of Paediatrics and Child Health, 50*(7). Doi:10.1111/jpc. 12515
- McDermott, P., & Sebastian, J. (2013). Should ketamine be used as an induction agent in traumatic brain injury?. *British Journal Of Hospital Medicine (London, England: 2005), 74(*9), 538
- MIMS Online. Ketamine hydrochloride. Retrieved March 23rd, 2016, from https://www.mimsonline.com.au/Search/FullPI.aspx?ModuleName=Product%20Info&searchKeyword=Ketamine+hydrochloride&PreviousPage=~/Search/QuickSearch.aspx&SearchType=&ID=19050001_2
- MIMS Online. Propofol. Retrieved March 23rd, 2016, from https://www.mimsonline.com.au/Search/FullPI.aspx?ModuleName=Product%20Info&searchKeyword=Propofol&PreviousPage=~/Search/QuickSearch.aspx&SearchType=&ID=19000001_2#an-AdverseReactions1018
- Miner, J. R., Moore, J. C., Austad, E. J., Plummer, D., Hubbard, L., & Gray, R. O. (2015). Pain management and sedation/original research: Randomized, Double- Blinded, Clinical Trial of Propofol, 1:1 Propofol/Ketamine, and 4:1 Propofol/Ketamine for Deep Procedural Sedation in the Emergency Department. *Annals Of Emergency Medicine*, *65*479-488.e2. doi:10.1016/j.annemergmed.2014.08.046
- Molina, J., Lobo, C., Goh, H., Seow, E., & Heng, B. (2010). Review of studies and guidelines on fasting and procedural sedation at the emergency department. *International Journal Of Evidence-Based Healthcare (Wiley-Blackwell), 8*(2), 75-78 4p. doi:10.1111/j.1744-1609.2010.0016
- Pasarón, R., Burnweit, C., Zerpa, J., Malvezzi, L., Knight, C., Shapiro, T., & ... Velis, E. (2015). Nitrous oxide procedural sedation in non-fasting pediatric patients undergoing minor surgery: a 12-year experience with 1,058 patients. *Pediatric Surgery International, 31*(2), 173-180. doi:10.1007/s00383-014-3608-5
- Treston, G., Bell, A., Cardwell, R., Fincher, G., Chand, D., & Cashion, G. (2009). What is the nature of the emergence phenomenon when using intravenous or intramuscular ketamine for paediatric procedural sedation?. *Emergency Medicine Australasia, 21*(4), 315-322 8p. doi:10.1111/j.1742-6723.2009.01203.x