Sedation for Paediatric Procedures - CED only - Full Paediatric Clinical Guideline – Derby only

Reference no.: CH CLIN C24

1. Introduction

To ensure a safe and consistent approach when considering procedural sedation of a child in the emergency department

IMPORTANT: Remember to titrate sedation to effect, AVOID Boluses *and aim for single Sedative agents only.*

2. Aim and Purpose

These guidelines are intended for use in patients who are generally healthy or have only mild systemic disease. The following patient groups should **not** be considered for sedation in the paediatric ED

- an abnormal airway (including large tonsils and anatomical abnormalities of upper or lower airway).
- raised intracranial pressure
- depressed conscious level
- history of sleep apnoea
- respiratory failure
- cardiac failure
- neuromuscular disease
- bowel obstruction
- active respiratory tract infection
- known allergy to sedative drug or past history of adverse reaction
- Children under the age of 1 year
- child too distressed despite adequate preparation
- older child with severe behaviour problems (likely to fail)
- informed refusal by the parent/ guardian or child.
- Ex premature infant up to one year
- ASA Categories III and IV (appendix 1)

3. Definitions

Sedation can be defined as a continuum from the awake state through to general anesthesia. The American Society of Anesthesiologists (ASA) uses the following definitions for levels of sedation (ASA 1999):

Minimal Sedation (anxiolysis) – a drug induced state in which patients respond normally to verbal commands. Although cognitive function and coordination may be impaired, ventilatory and cardiovascular functions are unaffected.

Moderate sedation/ analgesia (conscious sedation) – a drug-induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation (reflex withdrawal from a painful stimulus is not a purposeful response). No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained.

Deep sedation/ analgesia – a drug-induced depression of consciousness during which patients cannot be easily roused but respond purposefully following repeated or painful stimulation. The ability to maintain ventilatory function independently 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.

For the purposes of sedation in the emergency department (ED), and thus this guideline, we consider minimal and moderate sedation only.

4. Main body of Guidelines

Goals

The goals of procedural sedation are (American Academy of Paediatrics 2006): -

1) Guard the Patient's safety and welfare.
2) Minimise pain by giving appropriate analgesia as a complement to sedation.
3) Control anxiety, minimise psychological trauma, and maximise the potential for amnesia.
4) Control behaviour and/or movement to allow safe completion of the procedure
5) Return the patient to a state in which safe discharge from medical supervision, as determined by recognised criteria, is possible.

Indications

- Simple procedures lasting < 45 minutes
- Suturing
- Foreign body removal
- Fracture reduction/manipulation
- Joint relocation
- Abscess incision and drainage
- Burn management
- Tube thoracostomy placement
- Wound irrigation/exploration

Contraindications to ketamine

- Pulmonary hypertension
- Age <12months due to increased risk of laryngospasm and airway complications
- High risk of laryngospasm (active resp infection, active asthma)
- Unstable or abnormal airway
- Active upper or lower resp tract infection
- Proposed procedure within mouth or pharynx
- Patients with severe psychological problems such as cognitive, motor delay, or severe behavioural problems

- Significant cardiac disease (e.g. angina, heart failure, malignant hypertension)
- Intracranial hypertension with CSF obstruction
- Intra-ocular pathology (glaucoma, penetrating injury)
- Previous psycholtic illness
- Uncontrolled epilepsy
- Hyperthyroidism or thyroid medication
- Porphyria
- Prior adverse reaction to ketamine
- Altered conscious level due to acute illness or injury
- Drug/alcohol intoxication

Environment and Clinical Setting

An individual child's response to the administration of sedatives can be unpredictable (SIGN 2004). The risk of possible deeper sedation than intended must be anticipated and managed by appropriately trained staff (Pitetti 2003). This should therefore occur in the resuscitation area only.

The following age appropriate equipment should be prepared:

- Oxygen (via rebreathe mask)
- Suction equipment
- Tipping trolley
- Resuscitation masks and bags
- Guedel airway, Nasopharyngeal airways, Laryngeal Masks and endotracheal tubes of appropriate size
- Pulse Oximeter
- Non Invasive Blood Pressure Monitor
- Temperature monitoring for young children.
- End tidal CO2 monitor

The following equipment should be available:

- ECG machine
- Emergency drugs (including specific reversal agents for benzodiazepines (i.e. flumazenil) and opioids (i.e. naloxone).
- Defibrillator

Personnel Required

1) Specialist Registrar or above with the ability to rescue a child whose sedation level becomes deeper than planned, and deemed competent to do so by CED Consultants. They should have up to date APLS and ideally have achieved IAC (Initial Anaesthetic Competencies)
2) Staff nurse competent in basic life support of a child as a minimum to assist the monitoring of the sedated child.
3) The operator of the procedure – should be different to the person carrying out the sedation
4) Play specialist for support explaining procedure to child, if available, bleep 1420.

Pre-Procedure Preparation

1) Written consent must be obtained from someone with Parental responsibility

Discussion should include: -

a) Sedation may fail resulting in abandonment of the procedure and child may need a general anaesthetic and admission (at a later date)
b) Risk and benefits of procedural sedation vs. elective admission and GA.

2) History and examination of the child paying particular attention to: -

a) Age and Weight of Child
b) Consideration of airway – history of snoring/ obstructive sleep apnoea, tonsillar hypertrophy, mandibular hypoplasia
c) Consideration of risk of Gastric Aspiration – duration of fast, presence of gastro-oesophageal reflux. *The child should be fasted as for a general anaesthetic (6 hours for solids or bottle milk, 4 hours for breast milk, 2 hours for clear fluids).* This is the ideal situation but risk : benefit has to be considered.
d) Systems review – co-existing renal, cardiac or liver disease that may alter child's responses to sedating medications
e) Previous sedation history (or adverse family sedation history) – failures and adverse events make a GA a safer option.
f) Baseline observations – Heart rate, oxygen saturations, blood pressure, respiratory rate.

3) Access

All patients needing moderate sedation need to have IV access prior to commencing sedation. This should be performed with minimal distress to the child, utilising local anaesthetic cream, spray and play specialists where appropriate.

Drugs

Sedative agents need to be titrated slowly and **NEVER** be given in large boluses. The use of multiple drugs increases the risk of complications hence the use of a single sedative agent is recommended (Cote 2000, Cravero 2006). If pain is anticipated appropriate analgesia should also be given and the added sedative effect of this accounted for in the sedative dose. Ketamine should only be used by staff who are experienced with its use and have been deemed competent by a consultant experienced in its use.

Drugs to be prescribed on procedural sedation pathway proforma.

Drug	Pharmacokinetics	Common Side Effects/ Adverse Reactions	Dose Range

Midazolam	IV onset of action within 1-5 minutes Need to titrate dose »Short acting »Anxiolytic/Sedative »CNS depressant »No analgesic properties	»Cardiac depression »Apnoea and respiratory depression »Paradoxical Reaction »Emergence delirium »Midazolam will potentiate the effects of other sedative drugs e.g. Opioids.	Initially 25-50micrograms/kg over 2-3min, 5-10mins prior to procedure Maximum dose 6mg (1month-5yrs) or 7.5mg (age 6+) Do not exceed maximum dose.
Morphine	Iv peak onset of action 15-30 minutes Need to titrate dose »Analgesic »Mild sedative »No amnesic properties	»Nausea »Respiratory Depression »Bronchospasm due to Histamine release	IV dose 0.1mg/kg/dose (maximum dose 10mg)
Ketamine	Iv onset of action in 1 minute, duration of action 10-15 minutes. »Analgesic »Dissociative agent »Sedative »Preserves airway reflexes »Minimal effect on respiratory drive	»Emergence phenomena (1.6% if age <10yrs; affects 1in3 adults) »Hypersalivation and lacrimation (<10%) (co-administration with anticholinergics are not necessary) »Laryngospasm (0.3%) »Nystagmus »Ataxia (5%) »Mild agitation (20%) »Vomiting (5-10%) »Transient rash (10%)	IV dose 1mg/kg as a single dose by slow injection Supplemental doses of 0.5mg/kg by slow IV injection as recommended in CEM guidance Max 2mg/kg IV
Reversal Agents	**Pharmacokinetics**	**Common Side Effects/ Adverse Reactions**	**Dose Range**
Flumazenil	Benzodiazepine antagonist Onset of action 2 minutes Short acting may need repeat dose		Child 1 month–12 years 10 micrograms/kg (max. single dose 200 micrograms), repeated at 1 minute intervals if required; max. total dose of 50 micrograms/kg (1mg) Child 12–18 years 200 micrograms, repeated at 1 minute intervals if required; max. total dose 1 mg
Naloxone	Onset of action 2 minutes		Child 1 month–11 years

	Short acting may need repeat dose		5–10 micrograms/kg; if response inadequate, give a subsequent dose of 100 micrograms/kg (max. 2 mg) Child 12–18 years 1.5–3 micrograms/kg; if response inadequate, give subsequent doses of 100 micrograms every 2 minutes

Management of severe ketamine complications

- Severe emergence phenomena, significantly distressed – midazolam doses 0.05-0.1mg/kg
- Intractable vomiting – ondansetron 0.1mg/kg (max 4mg)
- Laryngospasm –
    - If stridor develops try gentle airway re-positioning, suction secretions and apply high flow oxygen via non-rebreathe mask
    - If saturating appropriately can continue the procedure
    - If desaturating <92% start gentle bag-valve-mask ventilation, apply PEEP, prepare for RSI
    - If worsens seek help, proceed to RSI

During Procedure

1) Sedationist must remain with the patient
2) Child to have continuous pulse oximetry and ECG monitoring whilst sedated.
3) Observation of HR, Oxygen Saturations, RR, End Tidal CO2 and Blood pressure to be recorded during procedure on Procedural sedation pathway every 10 minutes till sedation score is >0.

Post Procedure

Once stable post procedure can move to the paediatric observation unit till meets discharge criteria or be discharged if meets criteria in department.

Discharge Criteria

1. Airway patent and stable unsupported
2. Easily rousable
3. Oxygen saturation >95% in air
4. Haemodynamically stable
5. Hydration adequate, no bleeding, passed urine
6. Returned to normal level of responsiveness and orientation for age and mental status, can walk unaided (if appropriate)
7. No nausea or vomiting
8. Pain controlled
9. Nystagmus resolved

5. References (including any links to NICE Guidance etc.)

Adams (2008) Standards of practice in UK emergency departments before, during and after conscious sedation. EMJ;25:728–731

ASA (1999) Continuum of depth of sedation. Definition of general anaesthesia and levels of sedation/analgesia. Park Ridge (IL): The Society. Available from url: http://www.asahq.org/publicationsANDservices/standards/20.html
American Academy of Pediatrics (2002). Guidelines for monitoring and management of pediatric patients during and after sedation for diagnostic and therapeutic procedures: addendum. Pediatrics. 2002;114 :836 –838
American Academy of Paediatrics (2006). Guidelines for monitoring and management of paediatric patients during and after sedation for diagnostic and therapeutic procedures: An update. Paediatrics 118(6); 2587-2599.
Babl (2008) High-Concentration Nitrous Oxide for Procedural Sedation in Children: Adverse Events and Depth of Sedation. Pediatrics; 121: e528 - e532.
College of Emergency Medicine (2004) Clinical Effectiveness Committee. Guideline for Ketamine Sedation in Emergency Departments. CEM4192-CEC-Ketamine-sedation.pdf available from http://www.collemergencymed.ac.uk
Coté (2000) Adverse Sedation Events in Pediatrics: Analysis of Medications Used for Sedation. Pediatrics,; 106: 633 - 644.
Cravero (2006) and the Pediatric Sedation Research Consortium. Incidence and Nature of Adverse Events During Pediatric Sedation/Anesthesia for Procedures Outside the Operating Room: Report From the Pediatric Sedation Research Consortium. Pediatrics; 118: 1087 - 1096.
Heinz (2006) Is atropine needed with ketamine sedation? A prospective, randomised, double blind study. EMJ;23:206–209
Howes (2004) Ketamine for paediatric sedation/analgesia in the emergency department EMJ 2004;21:275–280.
McCarty (2000) Ketamine Sedation for the Reduction of Children's Fractures in the Emergency Department J. Bone Joint Surg. Am; 82(7): 912 - 912.
Munro (2007) Midazolam or ketamine for procedural sedation of children in the paediatric emergency department. EMJ;24;579-580
McGlone (2008) BET 3: Does the time of fasting affect complication rates during ketamine sedation? EMJ;25;367-369

NICE (2010) CG112. Sedation in children and young people: Sedation for diagnostic and therapeutic procedures in children and young people.
Pitetti (2003) Safe and Efficacious Use of Procedural Sedation and Analgesia by Nonanesthesiologists in a Pediatric Emergency Department. Arch Pediatr Adolesc Med.3; 157: 1090 - 1096.
Scottish Intercollegiate Guidelines Network (2004). Guideline 58. Safe sedation of children undergoing diagnostic and therapeutic procedures. A national and clinical guideline. Available from http://www.sign.ac.uk
Varela (1995)Intravenous sedation for the closed reduction of fractures in children. J. Bone Joint Surg. Am., Mar 1995; 77: 340 - 345.
Weisman (2002) Academy of Pediatrics/American Society of Anesthesiologists Process Model Risk Reduction in Pediatric Procedural Sedation by Application of an American. Paediatrics;109;236-243
Ketamine Procedural sedation for children in the emergency department, Royal College of Emergency Medicine (RCEM), February 2020

6. Documentation Controls

<table>
<tr><td>Reference Number

CH CLIN C24</td><td colspan="2">Version:

5.0.0</td><td colspan="2">Status

Final</td><td>Author: Dr G Robinson, Dr HWilkin-Crowe
Job Title: Paediatric consultants</td></tr>
<tr><td rowspan="2">Version / Amendment History</td><td>Version</td><td>Date</td><td>Author</td><td colspan="2">Reason</td></tr>
<tr><td>5</td><td>May 2023</td><td>Dr G Robinson</td><td colspan="2">Routine Review & update</td></tr>
<tr><td colspan="6">Intended Recipients: Paediatric CED clinical staff at RDH</td></tr>
<tr><td colspan="6">Training and Dissemination: Cascade the information via BU newsletter and address training</td></tr>
<tr><td colspan="6">Development of Guideline: Dr Gis Robinson
Job Title: Paediatric Consultant</td></tr>
<tr><td colspan="6">In Consultation with: Consultant Paediatricians in CED</td></tr>
<tr><td colspan="6">Linked Documents: (Nice guidance/Current national guidelines)</td></tr>
<tr><td colspan="6">Keywords: (Search term for KOHA) Sedation, procedures</td></tr>
<tr><td colspan="3">Business Unit Sign Off</td><td colspan="3">Group: Paediatric Guidelines Group
Date: 22nd November 2023</td></tr>
<tr><td colspan="3">Divisional Sign Off</td><td colspan="3">Group: Women’s and Children’s Clinical Governance Group
Date: 23rd November 2023</td></tr>
<tr><td colspan="3">Date of Upload</td><td colspan="3">24/11/2023</td></tr>
<tr><td colspan="3">Review Date</td><td colspan="3">May 2028, every 5 years</td></tr>
<tr><td colspan="3">Contact for Review</td><td colspan="3">Dr G Robinson</td></tr>
</table>

7. Appendices

Appendix 1: CED Procedural Sedation Pathway

Date	
Time	

Patient name affix Date of birth label Hospital number

Planned procedure:

Planned sedation level:	minimal	
	moderate sedation	
	deep sedation	
	dissociative sedation	

Patient factors:

Age:		yrs		Weight	Kg
Pregnant:	Yes		No		
Relevant co-morbidities	IHD	COPD/asthma	Obese		
	Schizophrenia	other:			
Allergies					
Normal Medications					
Acute Medications					
Recreational drugs or alcohol					
Previous anaesthetic	Yes		No		
Anaesthetic complications					
Date and time of last food					
Date and time of last oral fluid intake					

ASA grade (please circle)

ASA I	A normal healthy patient
ASA II	A patient with mild systemic disease
ASA III	A patient with severe systemic disease
ASA IV	A patient with severe systemic disease that is a constant threat to life
ASA V	A moribund patient who is not expected to survive without the operation

Difficult Airway? **no concern/ mild concern/significant concern**

Features to consider:

BMV ventilation: beard, no teeth, obesity, trauma, cachexia

LMA: Look for characteristics of difficult intubation, Evaluate mouth opening and thyromental distance, assess Mallampati score, look for Obstruction, assess Neck mobility. (LEMON) Check front of neck.

Laryngoscopy:

Crithyroidotomy:

Consent:	sedation	verbal		written		lacks capacity	
	procedure	verbal		written		lacks capacity	

Preprocedural ECG:	Y	N

Pain before procedure	mild (0-3)	moderate (4-6)	severe (7-10)
Pain post-procedure	mild (0-3)	moderate (4-6)	severe (7-10)

Patient Information

Name:

Hosp No: Affix patient label:

	Name	Grade	Speciality
Sedating Practitioner			
Procedural Assistant			
Nursing staff			

Location for procedure Resus Y [ ] N [ ] Other (details) [ ]

Date:																
Time:																
Respiratory rate (bpm)																
SpO2 %																
Oxygen delivered (l/min or %)																
Blood pressure: Systolic/ Diastolic (mmHg)	240															
	230															
	220															
	210															
	200															
	190															
	180															
	170															
	160															
	150															
	140															
	130															
Heart Rate (bpm)	120															
	110															
	100															
	90															
	80															
	70															
	60															
	50															
	40															
	30															
Drugs	Units															

Capnography used:	Y		N	
Level of sedation achieved:	minimal sedation			
	moderate sedation		dissociative sedation	
	deep sedation		anaesthesia	
Interventions needed:	none		ETT	
	hypotension rx		reversal agent	
	BMV		other	
	LMA			
Adverse events:	none		vomiting	
	hypoxia		cardiac arrest	
	hypotension		aspiration	
	adverse reaction		death	
Procedure Successful:	yes		no	Sedating Practitioner signature:
Discharge Advice given:	verbal		written	
Patient satisfaction with procedure:		/10		

Suitable for transfer from ED to Obs unit once

- » GCS > 12
- » Age appropriate respiratory rate
- » Additional analgesia prescribed and TT0's done
- » Documentation completed.

Exclusion criteria for Obs unit

- » Haemodynamic Instability
- » Respiratory distress or RR below normal range for age
- » GCS <12
- » Failure of Procedure

Management Plan for Obs unit

If following criteria are met child is suitable for nurse led discharge from the observation unit

	✓
Alert and Orientated	
Able to tolerate fluids	
Not vomiting or in severe pain	

Appropriate written instructions/ advice	
Take home analgesia if required	
Follow up arranged If required	
Time discharged : -- / -- hrs	
Nurse signature: ……..	

Appendix 2: ASA Classification of Physical Status

Class I	Normally Healthy Patient
Class II	A patient with mild systemic disease »Mild asthma »Acyanotic CHD »Controlled Epilepsy »Controlled IDDM
Class III	A patient with severe systemic disease
Class IV	A patient with severe systemic disease that is a constant threat to life
Class V	A moribund patient who is not expected to survive without an operation.

Consider upgrading children under the age of 5 by one ASA category to take into account the unpredictability of sedative agents in this age group.

CHILDREN'S SERVICES

Derby Hospitals NHS
NHS Foundation Trust

Parent/care-giver information about Procedural sedation using Ketamine

ABOUT KETAMINE:

Ketamine is a medication used for sedating patients who require a brief painful or unpleasant procedure. It lasts for about half an hour.

Ketamine is injected into a vein via a drip.

Under sedation, patients can appear awake but they are unaware of their surroundings. They may drool saliva, have watering of the eyes and may breathe loudly. Occasionally they can make random, purposeless movements or have twitching movements of the eyes, but they are unaware of what's going on.

SAFETY AND SIDE EFFECTS

Ketamine is very safe when used appropriately. Less than 1 in 100 children will experience a serious side-effect. Rarely, some patients will require help with their breathing while sedated. In 0.02% of cases your child may need to be given a general anaesthetic with a breathing tube placed in their windpipe to help their breathing.

Occasionally some patients will experience bad dreams either during the sedation or afterwards. This is transient and has no lasting effects on the patient. For children, it is particularly helpful to encourage them to imagine positive things before the injection. A calm manner and distraction with music, bubbles, toys etc. can also be helpful.

- One in ten children develop a rash
- One in ten children vomit
- One in ten children will have some eye watering, or may drool
- One in twenty children have some twitching movements
- Rarely (0.3% of cases) there can be laryngospasm (vocal cords close)
- Rarely (0.02% of cases) your child may need to be given a general anesthetic with a breathing tube placed in their windpipe.

AFTER THE PROCEDURE

Patients can generally go home 90 minutes following the sedation. This is when they are alert, talking and walking unaided. Vomiting may occur, but again this will resolve quickly.

Patients may remain mildly sleepy or clumsy afterwards. They should be closely supervised for the first 8 hours following discharge, and (if applicable) for the next 24 hours **should not**:

- Get involved in strenuous or sporting activities.
- Use play equipment such as monkey bars, climbing frames etc.

Do let the patient sleep and eat and drink only small amounts to minimise the risk of vomiting.

Sometimes children may feel sick or vomit if they eat a big meal too soon after sedation. Give your child small amounts of clear liquids such as diluted fruit juice, ice lollies, jelly, clear soup etc. and wait two hours before giving them a meal.

Let your child sleep. Children may go to sleep again after getting home from the hospital. Sometimes children may sleep more because of the sedation medicine; this is normal.

If you have any concerns that your child may be experiencing problems relating to the sedation that they have received, please contact us on 01332 786808 to discuss the issues with a senior doctor or nurse.

Ketamine Procedural Sedation for Children in The Emergency Department by the Royal College of Emergency Medicine (Feb 2020)