Ketamine Sedation in the Children's Emergency Department

Ketamine is a unique dissociative drug introduced into clinical practice in 1970. It has anxiolytic, analgesic, amnesic and dissociative properties with a wide safety margin. It is most commonly used to induce analgesic sedation in children who will need a painful or frightening procedure during the course of their emergency care, such as suturing under local anaesthetic, removal of a foreign body or brief orthopaedic manipulations.

The doses advised for analgesic sedation are designed to leave the patient capable of protecting their airway. There is a significant risk of failure of sedation if the procedure is prolonged, and the clinician must recognise that the option of general anaesthesia may be preferred in these circumstances.

Prior to ketamine use, all management options should be fully considered (please see sedation guideline). These include reassurance, distraction, simple analgesia, inhaled nitrous oxide, oral sedation, intranasal diamorphine or fentanyl, and admission for general anaesthetic.

Ketamine should only be used by clinicians trained in its use, and capable of managing any complications.

The child should be managed in an area with immediate access to full resuscitation facilities. Monitoring should include ECG, blood pressure, respiratory rate and pulse oximetry. After the procedure, the child should recover in a quiet area, under the continuous observation of a member of staff.

This guideline covers the administration of ketamine, together with the important associated considerations.

Patient Selection> Pre Procedure preparation> Administration of ketamine> Post procedure.

Patient Selection

Indications

- **Children over 12 months of age** – there is an increased risk of airway complications in children less than 12 months
- **Short painful procedures** – such as wound closure, fracture manipulation, and reduction of joint dislocations.

All planned procedural sedation must be discussed with the Senior Doctor in the Children's ED. If there is no Consultant in CED at that time (e.g. overnight) then the EPIC should be informed

The doctor performing the sedation

Minimum requirements:

1. **ST4+ in the Emergency Department (ED)**

And

2. **Competent in paediatric airway management**, as evidenced by at least 2 of:
    a. Minimum 6 months training in anaesthetics or intensive care
    b. APLS provider
    c. Assessed as proficient in basic airway management by ED consultant

Sedation in the Emergency Department must be safe. There are both patient factors ***and*** wider Emergency Department factors that may contraindicate sedation:

Patient Factors that contraindicate the use of Ketamine Sedation

- **Age less than 12 months**. This is due to an increased risk of laryngospasm and airway complications. Children aged between 12 and 24 months should only receive ketamine sedation from expert staff.
- **Not adequately starved.** There is no evidence that complications are reduced if the child is fasted, however traditional anaesthetic practice favours a period of fasting prior to any sedative procedure. The fasting state of the child should be considered in relation to the urgency of the procedure, but recent food intake should not be considered as an absolute contraindication to ketamine use.
- **Proposed procedure in the mouth or pharynx**
- **Procedure likely to take longer than 20mins, or would be better done in theatre (e.g. with use of image intensifier)**
- **Prior adverse reaction to ketamine**
- **No guarantee of adequate supervision after discharge**

- Active respiratory infection (including URTI). These produce more secretions putting the child at a higher risk of laryngospasm.
- Severe asthma
- Unstable or abnormal airway, tracheal surgery or stenosis
- Significant cardiac disease
- Recent significant head injury or reduced level of consciousness
- Intracranial hypertension with CSF obstruction
- Intra-ocular pathology (e.g. glaucoma, penetrating eye injury)
- Previous psychotic illness
- Patients with severe neurodevelopmental problems such as developmental delay or severe behavioural problems.
- Uncontrolled epilepsy
- Hyperthyroidism
- Porphyria

Emergency Department Factors that contraindicate the use of Ketamine sedation

- Department unable to adequately supervise patient 1:1
- Appropriately qualified medical or nursing staff unavailable
- Resuscitation/HDU area or equipment not available

Pre-Procedure Preparation

During Covid-19 Pandemic there are further considerations to be made:

- ***Bagging a patient is an aerosol generating procedure, the sedationist should therefore be wearing PPE appropriate for aerosol generating procedures.***
- ***On preparation of equipment it must ensured that the bagging equipment has an HME filter attached***
- ***The location for providing sedation is a consultant led decision depending on acuity and activity in the department.***

Patient

- Check procedure appropriate for ketamine, recheck contra-indications.
- The procedure should be explained to the care givers and the child including an explanation of the effects of ketamine
- Written consent should be obtained and documented in the child's notes.
- Baseline observations and the child's weight should be recorded
- Encourage the child and parents to talk/dream about happy topics. This can help minimise unpleasant emergence phenomena.

Area

- All Ketamine sedation should be performed in HDU, resus or a closed cubicle with the facilities for airway monitoring and management.
- Doctor and Nurse in Charge both agree that performance of Ketamine Sedation is appropriate, consider the wider needs of the department at that time.

Equipment

The following should be identified and checked:

- Oxygen, suction, bag-valve-mask, oro and nasopharyngeal airways, laryngoscope, ET tubes, bougie, difficult airway trolley, resus trolley.

Monitoring should be attached:

- Pulse oximeter, ECG and BP monitoring. End-tidal CO_2 monitoring is also desirable.

Drugs

- Draw up Ketamine 1mg/kg aliquots (2 or 3)

Calculate doses of Midazolam (0.05mg/kg) and Atropine (10micrograms/kg – minimum 100mcg, maximum 500mcg), together with key resuscitation drugs and ensure they are readily available.

Staff

- Doctor in charge of Children's ED aware of procedure taking place.
- Minimum 2 doctors (1 suitably qualified senior doctor for sedation, 1 for procedure) and minimum of 1 nurse 1 (who must remain 1:1 until child speaking normally.

Time Out

Before proceeding, **ALL** staff involved in the procedure will confirm the following:
The patient's identity (ID band or positive identification)

- The planned procedure
- Confirm or mark the site (if applicable)
- An appropriate "plan B" should complications occur

Administration of Ketamine

Characteristics of Ketamine Dissociative State

- Dissociation – patient in a trance-like state with eyes open but not responding
- Catalepsy – normal or slightly increased muscle tone is maintained
- Analgesia – excellent analgesia is typical
- Amnesia – usually total
- Airway reflexes are maintained
- Cardiovascular state – blood pressure and heart rate increase slightly
- Nystagmus is typical

It is important to emphasise to the family that nystagmus, purposeless movements and some degree of dissociation are normal during ketamine sedation.

Adverse effects

- Unpleasant emergence phenomena (More common beyond mid-adolescence)
    - Mild agitation (20%)
    - Moderate/severe agitation (1.5%)
- Lacrimation, hypersalivation and increased bronchial secretions (10%)
- Transient rash (10%)
- Vomiting (7%)
- Transient clonic movements (<5%)
- Airway problems (1%)

Some (<1%) patients can have snoring respirations that improve with head positioning. Laryngospasm (stridor and airflow obstruction) requiring intubation occurs in <1:5000 cases and is more likely if there is airway manipulation (e.g. airway suctioning).

Although rare, it is vital that should laryngospasm occur, it is quickly recognised and managed:

- Apply continuous positive end-expiratory pressure (PEEP) with bag-valve-mask
- Call for help
- Prepare for Rapid Sequence Intubation (RSI)

Continuous PEEP is usually sufficient to break laryngospasm and if the patient does respond, no further action is required. If, however, laryngospasm fails to respond to PEEP, then RSI should be performed.

Roles

Sedationist:

- Insert IV cannula. This is best done in the patients bed space with distraction and topical analgesia. Ketamine can be safely administered by either the IV or IM route. The IV route is used in the department as it preferable in allows titration and is associated with shorter recovery times.
- Move child and parent round into the bay where the procedure will be performed.
- Give Ketamine 1mg/kg IV by slow bolus over 1-2 minutes (More rapid administration is associated with respiratory depression)

  Clinical onset: 1 minute

  Effective sedation duration: 10-20 minutes
- Further incremental doses of 0.5mg/kg may be given if sedation is inadequate or longer sedation is necessary, to a maximum of 3mg/kg.
- If an upsetting degree of agitation occurs during recovery that is unresponsive to calm reassurance etc., then consider Midazolam. There is no evidence of improved emergence phenomena if midazolam is routinely used as a supplement.
- If hypersalivation occurs despite gentle suctioning, consider Atropine. There is no evidence of reduced airway problems if atropine is routinely used as a supplement
- If laryngospasm occurs (As evidenced by stridor and airflow obstruction):
  - **Call for help**
  - Apply PEEP using bag-valve mask
  - Prepare for RSI
  - If PEEP is inadequate, proceed with RSI procedures

- Once procedure completed, and patient begins to wake you may leave patient's side as long as nursing staff remain at bedside
- Review every 10-15 minutes until discharge

Nursing Staff:

- Watch for adverse reaction especially airway and breathing
- Record observations (heart rate, Respiratory rate, saturations, BP) every 5 minutes
- Do not leave bedside

Post-procedure

Recovery

- Continue monitoring until fully awake
- Place patient in appropriate recovery position
- Watch for adverse reaction, especially agitation
- Minimise stimulation – dim lights, close doors and keep noise levels to a minimum

Following sedation, once the doctor performing the sedation is happy that the child no longer needs to be in ER/HDU, they may be moved to CSSU to complete their recovery.

- A CSSU admission proforma should be completed
- Recovery from sedation should be complete between 60 and 120 minutes, depending on the dose used.
- Half-hourly observations should be performed until the child reaches discharge criteria

Documentation and Disposition

- A Procedural Sedation Record Form must be completed for all children receiving Ketamine sedation in the ED. This will be kept with the child's medical notes.
- Details of the procedure and sedation must be recorded in the patients' medical notes, together with the parent's consent.

Discharge

The following criteria must *all* be met

- At least 60 minutes have passed since sedation
- The child's conscious level has returned to baseline, with appropriate responses
- Resolution of nystagmus

- Ability to walk unassisted
- Vital signs within normal limits for child
- Respiratory status not compromised
- Pain and discomfort have been addressed
- Adequate supervision can be assured

Caregivers should be given written (see Ketamine advice leaflet) and verbal advice prior to discharge

- Advise rest, quiet, and supervised activity for the rest of the day
- The child should not eat or drink for 2 hours due to the risk of nausea and vomiting
- Warn about the risk of falls for 6-12 hours following sedation
- Warn about the risk of vivid dreams for a night or two

References

RCEM Clinical Effectiveness Committee Guideline for ketamine sedation of children in Emergency Departments
https://www.secure.rcem.ac.uk/code/document.asp?id=4880

Paediatric Emergency Department- Sedation Checklist

(To be used in conjunction with Procedural Sedation PED Guideline)

Affix Sticker

Consultant:……

Weight: ……(Kg)

Sedationist:	**Grade**	**Procedure:**
Assistant:	**Grade**	
Procedurist:	**Grade**	
Supervisor:	**Grade**	**Date: / /**

Contraindications:

Parent Refusal	Y / N	Proposed procedure in mouth/pharynx	Y / N
Age <12 months	Y / N	Active respiratory infection	Y / N
Proposed procedure likely to take longer than 20 minutes	Y / N	Severe asthma	Y / N
No guarantee of adequate supervision post discharge	Y / N	Severe neurodevelopmental disorder	Y / N
Past adverse reaction to Ketamine	Y / N	Abnormal or unstable airway	Y / N

Fasting State

Food:

Time:……..

Clear Fluids:

Time:……

Sedation Appropriate **Y / N**

(Likely to be painful, short duration & alternative methods considered)

Risks Explained:

Apnoea	Y / N	Pain	Y / N
Hypotension	Y / N	Awareness	Y / N
Allergy	Y / N	Other:	

Procedural Checks:

Monitoring attached & functional	Y / N
Airway Rescue present & available (NPA/OPA/BVM/Bougie/LMA/ETT/O_2)	Y / N
Procedurist present & ready	Y / N
Procedural Equipment available	Y / N

Allergies:

Signature: ……

Name & Grade:……

Paediatric Emergency Department- Sedation Checklist

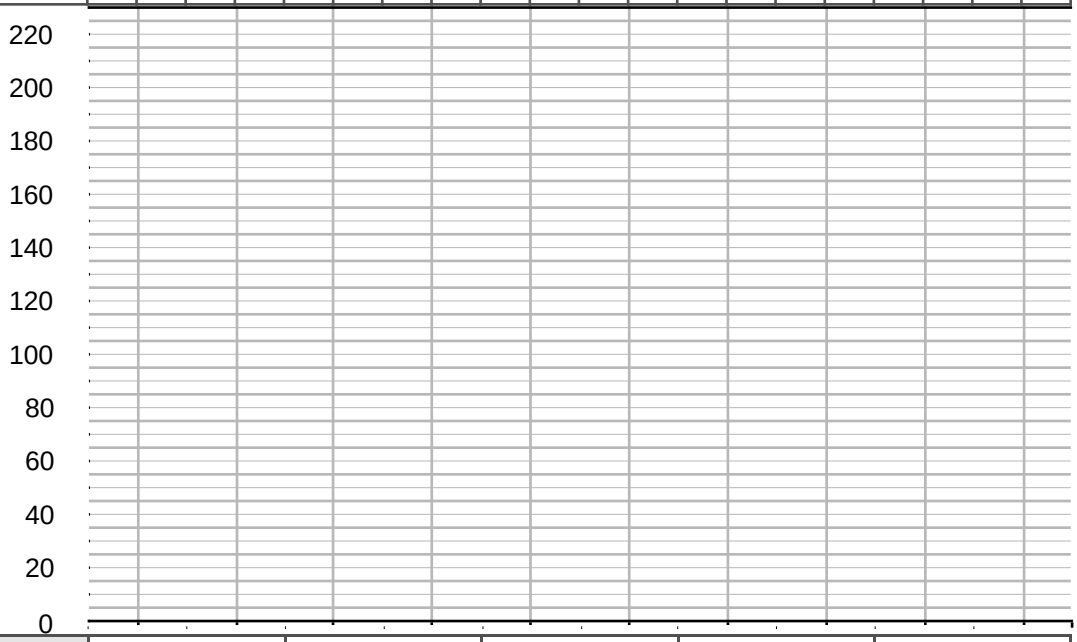
(To be used in conjunction with Procedural Sedation PED Guideline)

Monitoring (All must be present)	
Pulse Oximetry	
ECG	
End Tidal CO2	
Non-invasive BP	

Technique + Adjuncts	
Intravenous	
Entanox / Gas + Air	
Nerve Block	

IV Access	**Position**
Cannula 1:	
Cannula 2:	

Drug, Units, Dose																			



Time										
Spo2										
ETCO2										
Sedation Score										
Location <->										

Key:

BP: V Λ

Pulse: ●

Resp Rate: X

University of Michigan Sedation Scale

0. Awake & Alert
1. Minimally sedated: tired sleepy, appropriate response to verbal conversation or sound
2. Moderately Sedated: Somnolent/sleeping, easily aroused with light tactile stimulation or verbal command
3. Deeply sedated: Deep sleep,aroused only with significant physical stimulation
4. Unrousable

Paediatric Emergency Department- Sedation Checklist

(To be used in conjunction with Procedural Sedation PED Guideline)

Serious Adverse Event (Requires DATIX completion)	**Tick**	**Minor Adverse Event**	**Tick**
Airway Problems		Agitation	
Cardiac arrest		Hypotension	
Hypoxia		Nausea/Vomiting	
Apnoea		Respiratory Depression	
Cardiovascular collapse		Allergy without anaphylaxis	
Anaphylaxis		Other	

Interventions	**Tick**	**Notes**
None		
Airway manouvres		
Bag valve mask ventilation		
ETT / LMA / NPA / OPA		
Admit for adverse event		
Other (please specify in notes box)		

Post Sedation Pre Discharge Checklist	**Tick**
Child's conscious level returned to baseline	
Vital signs within normal limits for child	
Resolution of nystagmus	
Able to walk unassisted	
No respiratory compromise	
Absence of significant pain and discomfort	
Adequate supervision can be assured	
Information leaflet for discharge provided	
Name…… **Signature……**	