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| CLINICAL GUIDELINE |  |
| Sedation guideline for children undergoing imaging  |

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| **For use in (clinical areas):** | *Paediatric Ward (F1), MRI, CT, Nuclear Medicine* |
| **For use by (staff groups):** | *Medical and nursing staff on F1, radiographers* |
| **For use for (patients):** | *Children undergoing imaging* |
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Purpose of the Guideline

The quality of imaging, and therefore the diagnostic accuracy, is dependant on keeping the child still during the procedure.

This guideline is meant for children admitted to ward F1 needing sedation for imaging only such as MRI, CT, Nuclear Medicine scans and Echocardiograms where there is a requirement for the child to remain still.

The purpose of this guideline is to use sedation appropriately i.e. where non-pharmacological means have failed or are deemed unsuitable, and use it to provide anxiolysis and control of movement. It aims to optimise safety and prevent common adverse events during sedation, ultimately to obtain high quality images for diagnostic purposes.

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**Introduction**

Sedation is a medically controlled state of depressed consciousness or unconsciousness. The levels of sedation based on those of the American Society of Anesthesiologists (ASA) are shown below. The important distinction between these states revolves around the ability to maintain their protective reflexes (Hatch et al 1999, Mandell et all 1997).



Awareness of adverse events that may occur with sedation is important. Such events in children can occur owing to a variety of reasons, such as inadequate monitoring, drug errors, inadequate skills of the personnel administering drugs and premature discharge. Commonly seen side-effects of sedation are mostly minor, such as vomiting and agitation. Up to 9% of children will have agitation but serious adverse events in this group is rare3. Two large database studies from the Pediatric Sedation Research Consortium, published in 2006, evaluated adverse events among 30,000 sedation encounters for procedures outside the operating room. They reported that there was no incidence of death, one cardiac arrest and one aspiration episode. One in every 200 sedations required airway and ventilation interventions, such as bag–mask ventilation, oral airway placement or emergency intubation3.

The failure rate to achieve goals of anxiolysis and control of excessive movement has been reported to be from as infrequent as 1–3%, to as frequent as 10–20%3.

**Pre-sedation assessment**

1. Once imaging has been approved by the radiology department and a form of sedation is considered necessary, the child will be reviewed in sedation clinic. If the child can remain still, avoiding the use of sedation, then the Children’s Play Specialist will assist with the process. She will psychologically prepare the child/ young person for sedation by offering information about the procedure, arranging a visit to MR scanner if needed.
2. For those children where sedation is felt to be necessary, the child will be seen in clinic by Dr Saraswatula or Gemma Dale to screen for suitability for imaging (MRI/CT/nuclear medicine scans). For urgent imaging, the assessment will be carried out by the consultant on-call.
3. Fitness for sedation (Table 1) is checked first. Use the proforma (Appendix 1) for this purpose and attach to the case notes. If found suitable, informed consent for the procedure and sedation is obtained on the Trust consent form 2. This should include a thorough explanation of the procedure, risks, and the plan of care in hospital and after discharge. Hand leaflets explaining sedation (page 6) to the family.
4. Ensure that fasting times are explained and understood by the family. Fasting time is 4 hrs for solids, milk and juice, and 2hrs for clear fluids & breast milk prior to sedation1,4.
5. Sedation is prescribed and the drug chart attached to the case notes. The prescriber should have a thorough understanding of the pharmacokinetics and phamacodynamics of the drugs prescribed1.

**Preparation on the ward before imaging**

1. The consultant on duty should be informed that a child is being sedated in the ward environment.
2. Ensure that there is systematic planning and preparation.
3. A transfer bag checked against the list (see Appendix 2) should be taken along
4. Familiarise yourself with the resuscitation bay in the MRI suite. This should include:

 Resuscitation Trolley

 Suction apparatus

 Oxygen piped oxygen

 Intra Osseous (IO) access and Advanced airway equipment – held in ITU, will arrive with ITU team in an emergency

 Monitors pulse oximeter (MR compatable) with size appropriate oximeter probes

1. Ensure that the child is fasted as per guideline.
2. Insert IV cannula for contrast where indicated, before giving sedation. IV contrast can be administered by a doctor or Advanced Nurse Practitioner (ANP).
3. Nurse/ ANP to administer the sedative drugs.

WARNING: Recommended doses must not be exceeded. If the child vomits, top up doses must not be given. No IV sedation to be used.

**During imaging**

1. Staff accompanying the child to the scanner or procedure must have paediatric life support skills, and be able to recognise the early symptoms of complications of sedation. Parents must accompany the child to the scanner whenever possible.
2. MR compatable sats monitors and ear defenders are placed before entry into the scanner. Safety checks should be carried out for all individuals entering the MRI room.
3. Suitably trained staff must monitor children in the scanner room. The airway and breathing should be observed, with continous oxygen saturation monitoring. Record observations on a PEWS chart.

CAUTION: For single agent sedation (chloral hydrate), the staff member accompanying the child to the scanner will be a registered nurse. For sedation using a combination of two agents (chloral hydrate, alimemazine), an experienced senior nurse or nurse practitioner will accompany the child to the scanner. The on-call paediatric team should be on standby, should they need to respond to any emergency whilst scanning.

**Post-imaging**

1. The child should have continuous oxygen saturation monitoring until full recovery3. Following return from the scan, the consultant on duty must be informed if:
	* + The oxygen saturation falls below 93%
		+ There is tachycardia or bradycardia
		+ Unresponsive on the AVPU scale (level of consciousness)
2. Do not feed the child till fully awake. Introduce clear fluids and then progress to solids when tolerating fluids well. Children should be discharged only when the vital signs have returned to the baseline, and able to tolerate oral fluids.
3. Families should be given written post-sedation instructions, and telephone numbers to contact if they have questions or emergencies.
4. Document adverse events on proforma.
5. Document failed sedation stating the reason(s). Please discuss with the on-call consultant. A second attempt may be decided for another date, or recommended for the imaging to be done under GA.

**Drugs used for sedation**

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| Infants < 5 kg | No sedation required usually, ‘feed and wrap’ |
| Children 5 -15 kg1 | Chloral Hydrate 100 mg/Kg oral/rectal (max 2gm), 45-60 min prior to the procedure. Oral route preferred over rectal route, although both permitted. |
| Children 12 - 40 kg4 | Alimemazine 1-2 mg/kg (max 60 mg) oral to be given 1.5 hours prior to the procedure PLUS Chloral Hydrate 50 - 100 mg/kg oral/rectal (max 2gm) 45-60 min prior to the procedure. |

**Notes on Choral Hydrate**

Side-effects include: unpleasant taste, respiratory complications, vomiting and paradoxical reactions, deaths have occurred in unattended children.

Chloral hydrate is an oral drug and unfortunately causes nausea and vomiting when large volumes of the drug are used. chloral hydrate is therefore likely to be less successful in larger children. Doses of more than 1g of chloral hydrate may be vomited and hence be unsuccessful. This may explain why choral hydrate is thought to be more effective in smaller children. The guideline development group concluded that uncooperative children needed to be asleep for imaging and that high doses of chloral hydrate were successful in approximately 90% of children under 15kg1.

**Notes on Alimemazine (trimeprazine)**

Potential side-effects include: dry mouth, constipation, urinary retention, blurred vision, paradoxical excitement

**Training**

Nursing staff involved in sedation should have:

1. Undertaken EPLS or APLS training
2. Read and understood the paediatric sedation guideline
3. Completed a record of competencies, and successfully completed work-based assessments. This includes transfer training and the use of MR compatible equipment.

**Audit**

Annual audit of adverse events, critical incidents, success/failure rates, referrals for GA and cost-benefit analysis to be undertaken.

**Parent information leaflets**

Always go through the leaflet with the family when handing it out.

1. Royal College of anaesthetists. Sedation for children leaflet series <http://www.rcoa.ac.uk/system/files/PI-Sedation-parents.pdf>
2. Royal Children’s Hospital, Melbourne. <http://www.rch.org.au/kidsinfo/handout/index.php?doc_id=11362>

<http://www.rch.org.au/kidsinfo/factsheets.cfm?doc_id=8627>

1. Information for parents of children having an MRI scan under sedation – West Suffolk Hospital

**Table 1**

**Contraindications to sedation2**

* Abnormal airway including adenotonsillar hypertrophy causing obstruction to breathing when asleep (Obstructive Sleep Apnoea, or OSA), or any other anatomical abnormality of upper and lower airway.
* Raised intracranial pressure
* Depressed conscious level.
* History of sleep apnoea
* Respiratory failure
* Cardiac failure
* Neuromuscular disease
* Bowel obstruction
* Active respiratory tract infection
* Acute porphyria
* Known allergy to sedative drug / previous adverse reaction
* Child too distressed despite adequate preparation
* Older child with severe behavioural problems
* Refusal by the parent / guardian / child.

**Extra caution should be exercised when sedating children who have any of the following conditions3:**

* Neonates, especially if premature or ex-premature
* Children with cardiovascular instability or impaired cardiac function
* Renal impairment
* Hepatic impairment
* Severe respiratory disease
* Gastro-oesophageal reflux
* Impaired bulbar reflexes
* Emergency cases who are not adequately starved
* Anticonvulsant therapy
* Children receiving opioids and other sedatives
* Children receiving drugs that potentiate the action of sedatives

Refer to [www.medicines.org.uk](http://www.medicines.org.uk) for full information on interactions and contraindications.

#####   Appendix 2: Transfer bag – List of contents

***Appendix 1***

**Front pocket**

1x transfer checklist (blank)

1x Nursing transfer letter (blank)

1x List of contents for paediatric transfer bag

1x pen

**Bag 1 – Dark Blue**

1x oral airways for each size (000, 00, 0, 1, 2, 3)

1x paediatric bag and mask (this may be outside of bag 1)

1x oxygen tubing

1x adult Yankauer sucker

1x paediatric Yankauer sucker

1x adult non-rebreathing oxygen mask

1x sucktion catheters for size 6fr, 8fr, 10fr and 12fr

**Bag 2 – Red**

4x neoflon 24G cannulae

2x venflon 22G cannulae

2x paediatric cannula dressings

2x single lumen extensions

2x double lumen extensions

3x sani-cloth wipes

2x 150cm infusion sets

2x gravity infusion sets

2x infusion pump giving sets

1x hand splint neonatal

1x hand splint child

2x size 6fr NG tubes

2x size 8fr NG tubes

1x roll of pH paper

2x 20ml enteral syringes

1x sterile dressing pack

**Bag 3 – Blue**

2x 20ml syringes

2x 50ml syringes

**Bag 4 – Blue**

5x green 21G needles

5x red filter needles

5x 10ml syringes

5x 5ml syringes

5x 2ml syringes

**Bag 5 – yellow**

2x bandages, one small and one medium

5x sterile plasters

10x sani-cloth wipes

10x alcohol wipes

4x packs of sterile gauze

2x sterile scissors

4x paediatric cannula dressings

1x roll of elastoplast

1x roll of wide micropore

1x roll of narrow micropore

**Bag 6 – yellow**

1x pen torch

6x adult ECG electrodes

6x paediatric ECG electrodes

4x non-sterile gloves

2x sterile gloves for sizes: small, medium and large

**Bag 7 – orange**

10x 10ml sodium chloride ampoules

4x water for injection ampules

4x chlor-prep wipes

6x purple capillary finger/heel prickers

**Bag 8 – orange**

1x stethescope

1x Nellcor neonatal SpO2 lead

2x Nellcor paediatric-adult SpO2 lead

**Emergency drugs in blue tray**

5x Glass vials of 50units in 5ml Heparin Sodium solution

5x 5mg Salbutamol nebules

5x 2.5mg Salbutamol nebules

5x Chlorphenamine Maleate 10mg/ml solution ampoules

2x 1:10,000 Adrenaline minijets

1x Epipen junior

1x Epipen

1x Naloxone minijet

**Separate within bag**

2x 500ml 0.9% Sodium Chloride bags

**Separate to bag**

1x adult valve bag mask system

##### References:

1. Sedation for diagnostic and therapeutic procedures in children and young people, NICE CG112, Dec 2010
2. Anaesthesia UK, Sedation tutorial, <http://www.frca.co.uk/Documents/105%20Paediatric%20sedation.pdf>
3. Pediatric Procedural Sedation and Analgesia Outside the Operating Room: Strategies to Reduce the Incidence of Adverse Events During Procedural Sedation. Ramesh Ramaiah; Sanjay Bhananker, Expert Review of Neurotherapeutics, CME: 05/04/2011
4. Sedation protocol, MRI sedation unit, Great Ormond Street Hospital, Feb 2012

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## Development of the guideline

#### Changes compared to previous document - N/A

#### Statement of clinical evidence

The sedation service was developed as there was a huge demand for MRI and to reduce delay in imaging children being referred from our trust to Addenbrooke’s hospital. There were two serious incidents of delayed diagnosis of brain tumours that led to large payouts by the trust. The additional challenge was to provide a sedation service with limited resources, after funding for an anaesthesia only service for MRI, for 2 scans per month, was refused because of high costs.

The NICE guideline (CG112) on sedation of children was initially adopted, however, an audit showed high failure rates. Subsequently, we visited the MRI sedation unit at GOSH seeking to improve our sedation practice. Changes were then made to our guideline, which is presented here, almost completely based on the GOSH sedation protocol. Whilst their MRI sedation unit uses both oral and IV sedation, we have adopted only the oral sedation guidelines which are well established. The main recommendations in our guideline are unchanged from theirs; however, some augmentations have been informed by continuing annual audits of our practice, keeping patient safety uppermost in mind. This mainly pertains to staff training. A re-audit of practice showed substantial improvement in successful sedation (70 to 91%), and no major adverse events.

#### Distribution list/dissemination method

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Drugs & Therapeutics Committee

#### Document configuration information

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