

DIAGNOSTIC STUDIES: NUCLEAR MEDICINE - SCH

PRACTICE GUIDELINE

DOCUMENT SUMMARY/KEY POINTS

- Nuclear Medicine encompasses both the diagnostic and therapeutic application of radionuclides to a range of disease states. Radiotracers are used in diagnosis and treatment monitoring, primarily by using functional imaging but also with in vivo tests. The difference between Nuclear Medicine other imaging modalities is that it investigates the physiological and molecular characteristics, rather than the anatomical changes of disease. Therapeutic radionuclides are targeted to specific cellular functions, and therefore deliver therapeutic doses of radiation precisely to the target, minimising destruction of surrounding tissues.
- At SCH nuclear medicine services are provided by the Prince of Wales Hospital, Department of Nuclear Medicine and PET under a shared service arrangement with SCH.

CHANGE SUMMARY

- Document due for mandatory review
- Changes made:
 - 'Nuclear Medicine Department: General requirements'
 - Requirements updated
 - 'Protocol for Sedation'
 - List of studies performed updated
 - Timing of sedation for studies updated
 - Guide to Imaging Preparation for Specific Studies', including
 - PETSCAN – patient preparation, procedure and duration for individual PET tracers
 - MECKELS DIVERTICULUM – patient preparation (drug dosage)

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCHN Policy, Procedure and Guideline Committee	
Date Effective:	1 st June 2020	Review Period: 3 years
Team Leader:	Department Head	Area/Dept: Anaesthesia Department

- BILIARY SCAN - patient preparation (fasting and drug administration)
- DMSA SCAN – patient preparation (fasting for sedation)
- DTPA/MAG 3 – patient preparation (hydration)
- DTPA GFR – patient preparation (hydration and sedation) and procedure
- GFR – patient preparation (hydration) and procedure
- GASTRO-OESOPHAGEAL REFLUX SCAN – patient preparation (sedation)
- MIBG SCAN – preparation (Lugol’s iodine administration)
- MYOCARDIAL PERFUSION SCAN – preparation ,procedure and duration
- LUNG CLEARANCE SCAN - removed as no longer performed
- GALLIUM and THALLIUM SCANS - removed as no longer performed

READ ACKNOWLEDGEMENT

- Medical Officers, Nurse Unit Managers and Senior Nursing staff should be advised to check the changed sections, as outlined in the Change Summary.
- Nurses involved with preparation of and caring for patients undergoing Nuclear Medicine studies must be aware of the contents of this document

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1 Nuclear Medicine Department: General Requirements

1. A signed and dated request for consultation or an EMR request MUST accompany every patient and the type of scan must be specified. A brief history and indication for diagnostic problem is essential. Adequate patient identification details and contact details of referrer must be provided.
2. Relevant other imaging studies must accompany patients or should be provided electronically.
3. Medications are now prescribed on the eMM. Some routine medications and analgesia may interfere with studies and their use within 6 hours of imaging should be checked with the Department.
4. Patients in traction must come out of traction for the duration of the scan – the Orthopaedic team must be consulted regarding the removal of traction. If traction is for a fracture, a medical officer should be present to ensure the limb is properly aligned during the procedure.
5. Patients from ICU or requiring high level of nursing care must be discussed with a senior medical officer and nursing staff in the Department, and may require a nurse and medical escort.
6. Patients requiring sedation or general anaesthesia need to be booked by the team into the appropriate ward for pre and post procedure assessment.
7. If an interpreter is required, then the ward staff should organise this and let the nursing staff in the Nuclear Medicine Department know, so that the procedure can go ahead at the scheduled time.
8. Performing other procedures in conjunction with nuclear medicine studies is not recommended, unless clinically imperative. In such cases, consultation with Nuclear Medicine specialist and Nuclear Medicine physicist is required.

2 Protocol for Sedation:

The following provides a guide to the timing of sedation. For information on the drugs and doses used for sedation refer to:

- SCHN [Procedural Sedation \(Paediatric Ward, Clinic and Imaging Areas\)](#)
- [NSW Health Guidelines - Paediatric Procedural Sedation – Guide for Emergency Departments, Wards, Clinics and Imaging](#)

For many studies children between the ages of 3 months and 5 years of age need to be sedated for scanning procedures in the Nuclear Medicine Department. Older children with specific requirements may also require sedation for prolonged imaging.

The time of the appointment is not necessarily the time sedation is required.

Procedure	Sedation for Scanning
Bone Scan	1.5 - 2 hours post injection
DMSA Scan	3 hours post injection
DTPA/Mag 3	No sedation unless requested by referring physician. Sedation for time of appointment if required.
Gated Heart Pool Scan, Thyroid, GIT Blood Loss Scan, Liver and/or Spleen Scan, Meckel's Diverticulum Scan, V/Q Scan	Sedation for time of appointment.
Brain (CereteC®) Scan	20 minutes to 1 hour post tracer injection.
MIBG Scan	No sedation necessary on the day of tracer injection. Sedation required for time of appointment for scanning (19 hours post injection) .
PET Scan (F18-FDG, Ga-68 DOTA, Ga-68 PSMA, other tracers)	Sedation required for the scan which is performed one hour after tracer administration.
Shunt Patency Study	No sedation is usually required.
White Blood Cell Scan	Approximately 3 hours post labelled cells reinjection
NB: NUCLEAR MEDICINE NURSING STAFF WILL NOTIFY THE WARD OF THE TIME SEDATION IS REQUIRED FOR PATIENTS HAVING NUCLEAR MEDICINE STUDIES	

3 Guide to Imaging Preparation for Specific Studies

Study	Preparation	Procedure	Duration
BRAIN PERFUSION SCAN (CERETEC)	Fast if sedation required otherwise nil	IV injection Scan at 20 minutes to 1 hour post injection	Approximately 45 minutes.
BONE SCAN	Fast if sedation required. Urinary catheter may be necessary in some instances	IV injection Scan at 1.5 hours post injection	Approximately 1.5 hours (after the 1.5 hour uptake period post injection).
BILIARY SCAN	Usually no fasting is required. Contact Nuclear Medicine for fasting and sedation instruction if required in selected patients. 5mg/kg/day phenobarbitone to commence five days prior to the study.	IV injection under gamma camera, scanning commences immediately.	Varies. Rarely less than 90 minutes. Usually 6 hour and 24 hour imaging is required.
PET SCAN (F18-FDG, Ga-68)	For F18-FDG scan patient to fast for 6 hours prior to	IV cannula is inserted in Nuclear Medicine Department. for	May vary from 2-4 hours in

<p>DOTA, Ga-68 PSMA, other tracers)</p>	<p>procedure. No IV or oral glucose for 6 hours prior to procedure.</p> <p>For Ga-68 tracers there is no fasting requirement for the scan. Sedation/GA fasting times apply.</p> <p>For other PET tracers fasting times may vary.</p> <p>Ingestion of water is to be encouraged, unless patient is for general anaesthetic.</p> <p>Nuclear medicine nursing staff will liaise with ward for additional, patient-specific instructions.</p>	<p>administration of radiopharmaceutical.</p> <p>Patient is required to rest for approximately 1 hour after administration of radiopharmaceutical and prior to scan.</p> <p>If required, a general anaesthetic will be administered in Nuclear Medicine, under the care of an anaesthetist. Patient will be recovered in Nuclear Medicine Department, unless otherwise pre-arranged.</p>	<p>Department.</p>
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Study	Preparation	Procedure	Duration
MIBG SCAN	<p>2 drops of Lugol's iodine BD orally for 4 days prior to IV injection and to continue until after scanning. Lugol's iodine to be given in minimum volume of 50 mL of milk, juice or water (never neat) as this can result in a chemical burn.</p> <p>Sedation if required on day of study.</p>	<p>IV injection.</p> <p>Fasting if sedation is required for scan which will occur at either 24 hours or 48 hours post injection.</p>	Approximately 1.5 hours.
GIT BLOOD LOSS	<p>Patient must be actively bleeding at the time of the study otherwise localisation of the site is impossible.</p>	<p>Patient's blood is labelled and re-injected.</p> <p>Scanning commences immediately after re-injection.</p>	Rarely less than 1.5 hours (varies).
MECKELS DIVERTICULUM	<p>4 hour fast from solids if no sedation required. Otherwise 6 hours fast from solids and 3 hour fast from liquids.</p> <p>If child requires sedation IV cannula is to be inserted prior to sedation.</p> <p>Sedation for time of appointment if required.</p>	<p>Oral H2 Antagonist to be administered in the ward. Scan occurs one hour later.</p> <p>Oral Ranitidine (2mg/kg, max 150mg/dose) for one dose. If unavailable, use famotidine (0.5mg/kg, max 20mg/dose) for one dose. 20mg tablets available or SAS product 40mg/5mL</p>	2 hours (approximately).
WHITE BLOOD CELL SCAN	<p>Nil unless patient fasting for sedation.</p> <p>Nuclear Medicine Nursing staff will notify ward of fasting time if sedation required.</p>	<p>Patient's blood is withdrawn, labelled and re-injected approximately 1.5 hours later.</p> <p>Scanning occurs 3 hours after re-injection.</p>	1 hour (approximately) after the uptake period.
VENTILATION PERFUSION LUNG SCAN	<p>Nil unless patient requires sedation.</p>	<p>Ventilation: Patient breathes in radioaerosol for approximately 5 minutes. Scan begins immediately.</p> <p>Perfusion: IV injection.</p> <p>Scan begins immediately.</p>	Approximately 1.5 hours.
DMSA SCAN	<p>Nil unless patient requires sedation.</p> <p>Otherwise fast 2 hours prior to appointment.</p>	<p>IV injection.</p> <p>Scan 2-3 hours post IV injection</p>	1 hour.

Study	Preparation	Procedure	Duration
DTPA/ Mag 3 SCAN	Patient to be well hydrated prior to the scan. Sedation is generally avoided for this examination. If required, hydration may be administered intravenously, per standard protocols.	IV injection. Scan begins immediately.	Approximately 40 minutes. Often delayed images will be required.
DTPA SCAN with GFR STUDY	Patient to be well hydrated prior to the scan. Sedation is generally avoided for this examination. If required, hydration may be administered intravenously, per standard protocols.	IV injection. Scan begins immediately. 2 mL of blood is taken at 2 hours and 3 hours following initial IV injection Implantable intravenous devices will be accessed for IV injection and blood collection for this study, if available.	Scanning time is 25 minutes and the length of the entire study is 3 hours.

Study	Preparation	Procedure	Duration
GFR STUDY	Patient to be well hydrated prior to the study. No sedation is required	IV injection and 2 mL of blood is taken at 2 hours and 3 hours following initial IV injection. Implantable intravenous devices will be accessed for IV injection and blood collection for this study if available.	3 hours.
GASTRO- OESOPHAGEAL REFLUX (MILK SCAN)	Babies should miss one feed prior to appointment. Formula or EBM must accompany child from ward to Nuclear Medicine Department. Sedation cannot be administered for this study.	Child is fed and imaged in various positions. Return 2 hours later for further imaging then at 6 hours after initial imaging.	Initial imaging: approximately 1.5 hours. Delayed Imaging 1: 2 hours later, approximately 15 minutes duration. Delayed Imaging 2: Approximately 6hr post tracer administration,

			approximately 15 minutes duration.
GATED HEART POOL SCAN	<p>Nil unless fasting for sedation.</p> <p>If child requires sedation IV cannula is to be inserted prior to sedation.</p>	<p>Patient's blood is withdrawn, labelled and re-injected – scan commences immediately after injection.</p>	<p>Approximately 1 hour.</p>
MYOCARDIAL PERFUSION STUDY	<p>Patient is to fast from 2400 hours, (minimum 4 hours fast). For pharmacological stress test, caffeine must be avoided for 24 hours.</p> <p>Nuclear Medicine Nursing staff will liaise with ward for specific instructions, including cessation of cardiac medications.</p>	<p>Patient has IV cannula inserted. Treadmill exercise or pharmacological stress test is performed according to standard protocol, with IV injection of tracer after adequate cardiac stress is achieved. Scan begins 40-60 minutes after tracer injection.</p>	<p>Together with the stress component, the stress study takes approximately 2 hours.</p> <p>Resting perfusion study is usually required for comparison. The total study duration may take approximately 5 hours.</p>

4 Related Information:

Radiation Safety Information

Many inpatients receive low doses of radioactive materials for diagnostic imaging investigations (nuclear medicine studies), and these patients may be accommodated anywhere within the Hospital. The external radiation hazard from such patients is small. The amount of radioactivity within the patient decreases rapidly with time according to the half-life of the radionuclide. In addition, the radionuclide is, in most cases, rapidly excreted from the body, mainly in the urine, so that the radioactivity in the patient is often not detectable after 1-2 days. It is therefore not necessary for ward staff to be issued with personal radiation monitors. The patients are generally not a hazard to themselves, staff, visitors or other patients. If, in a particular situation, special handling or treatment of the patients is required, then advice will be given to ward staff by the Department of Nuclear Medicine.

http://www.seslhd.health.nsw.gov.au/Policies_Procedures_Guidelines/Clinical/Radiation_Safety/Documents/SES_LHNP58-RadiationSafetyInWardAreas.pdf

Further information can be obtained from 'Information for Carers of Children having Nuclear Medicine Studies (Appendix 3).

Therapeutic studies are rarely performed on children. In the event of such a procedure, special instructions would be given to carers and parents.

Any concerns can be directed to the Department **Radiation Safety Officer on 9382 2200.**

5 References

1. Nuclear Medicine Department P.O.W.H. Intranet site:
<http://seslnweb/powh/Services/Nuclear%20Medicine/default.asp>
2. Guide to Routine Procedures: Nuclear Medicine Department P.O.W.H.
<http://seslnweb/powh/Services/Nuclear%20Medicine/guidetoroutineprocedures.asp>
3. AMH Children's Dosing Companion
<https://childrens.amh.net.au/auth>
4. MIMS product information www.ciap.nsw.health.gov.au [accessed October 2019]
5. Up to Date "Chloral hydrate (United States: Not available): Paediatric drug information"
6. Thomas M et al, 2018. Consensus statement on clear fluid fasting for elective paediatric general anaesthesia. *Paediatric Anaesthesia*.
7. *Micromedex (clonidine)* www.ciap.health.gov.au [accessed October 2019]
8. Haning SM et al, 2017. A mini-review of non-parenteral clonidine preparations for paediatric sedation [Review] *J Pharm Pharmacol*. 69(4):398-40
9. Sumiya K et al, 2003. Sedation and plasma concentration of clonidine hydrochloride for pre-anesthetic medication in pediatric surgery. *Biol Pharm Bull*. 26(4):421-3.
10. Mikawa K et al, 1993. Efficacy of oral clonidine premedication in children. *Anesthesiology*. Nov;79(5):926-31.
11. Mataftsi A et al, 2017. Safety and efficacy of chloral hydrate for procedural sedation in paediatric ophthalmology: a systematic review and meta-analysis. *Br J Ophthalmol*. 101(10):1423-1430
12. Stephen MC et al, 2015. A Randomized Controlled Trial Comparing Intranasal Midazolam and Chloral Hydrate for Procedural Sedation in Children. *Otolaryngol Head Neck Surg*. 153(6):1042-50.

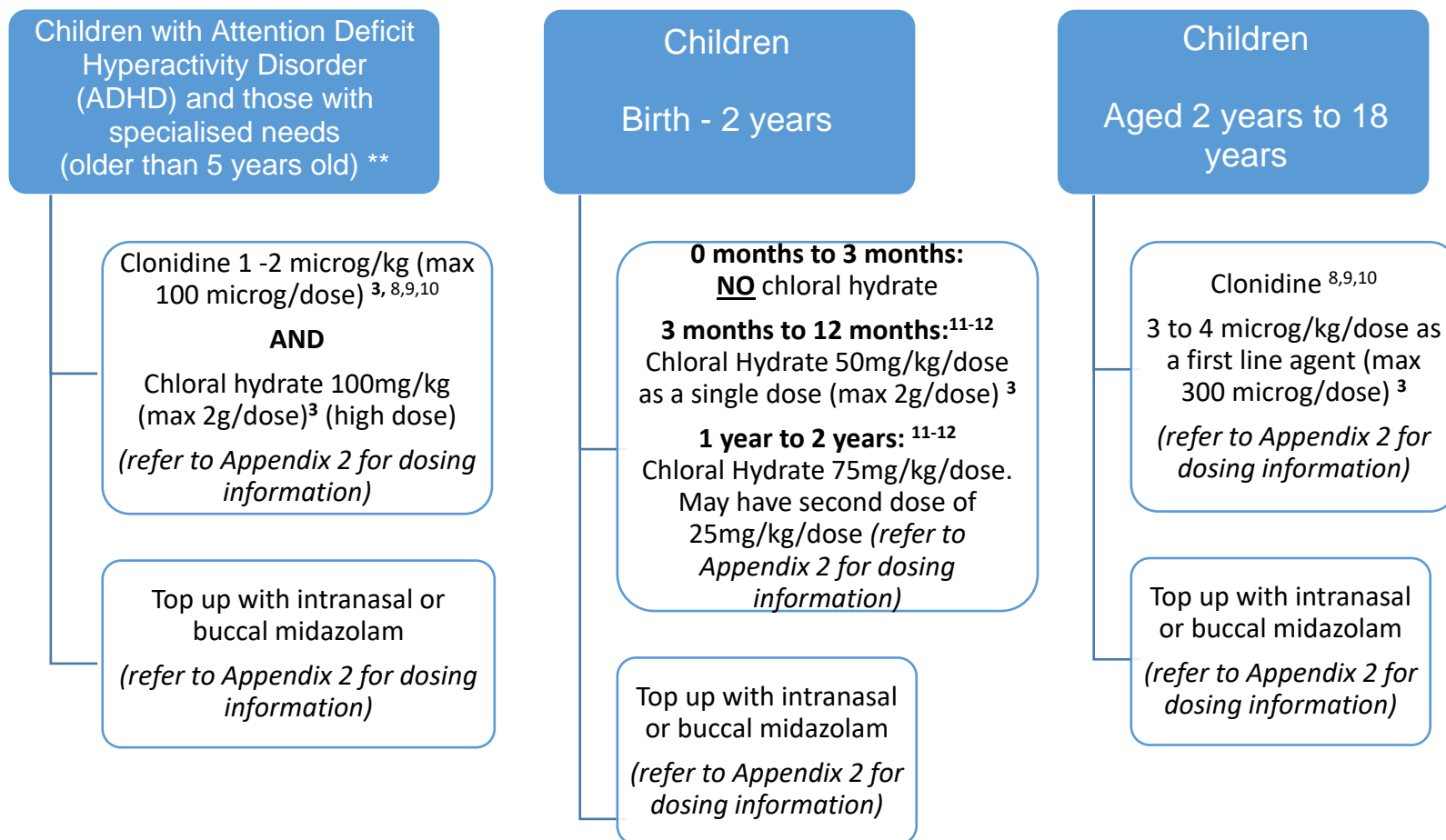
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Appendix 1: SEDATION FLOWCHART – a guide for clinicians

Sydney Children's Hospital Randwick and
Department of Nuclear Medicine and PET, Prince of Wales Hospital

SEDATION GUIDELINE FOR NUCLEAR MEDICINE STUDIES



Appendix 2: SEDATION GUIDELINE

Sydney Children's Hospital Randwick and Department of Nuclear Medicine and PET, Prince of Wales Hospital

SEDATION GUIDELINE FOR NUCLEAR MEDICINE STUDIES

****For patients with ADHD (>5 years old) and those specialised needs, consider using dual agents such as:**

1. Clonidine 1-2 microg/kg/dose stat (max 100 microg/dose) AND
2. Chloral hydrate 100mg/kg/dose (max 2g/dose)

Refer to table below for full monograph:

Drug Formulary	Onset-Duration	Dose	Administration	Side effects
Chloral Hydrate (S4D) Oral Syrup 1g/10mL (100mg/mL)	Onset: within 30 minutes Duration: 60 mins to 120 mins	0 – 3 months: Do not use chloral hydrate. Fast/feed/wrap 3 months – 12 months: oral 50mg/kg as a single dose (max 50mg/kg/day) 1 – 2 years*: oral 75 mg/kg as a single dose. May give a second dose of 25 mg/kg if required after 30 minutes. For children >30kg: consider using 100mg/kg/dose (Max 2g/dose) Total maximum dose is 100mg/kg/DAY (not to exceed 2g)³ *For children >2 years old, clonidine recommended over chloral hydrate	Give 35-40 mins before procedure. ⁴ Administer undiluted slowly or dilute with equal volumes of water, juice or milk to increase palatability (bitter taste) and avoid gastric irritation. (Please note restrictions for juice or milk administration for some studies, e.g. F18-FDG PET). If diluting dose, maximum volume of juice allowed is 3mL/kg/hour (max 50mL) ⁶ Monitor child according to level of sedation. Most effective in children <2years old and <15kg ³	GIT: nausea, vomiting, gastric irritation ⁵ CNS: hangover, disorientation, paradoxical excitement, delirium, ataxia, headaches, nightmares, hallucinations ⁵ Respiratory: Depression, airway obstruction (especially at higher doses) ⁵ Other: Dermatologic, acute intermittent porphyria, ketonuria, leukopenia ⁵

<p>Clonidine (S4)</p> <p><u>Oral</u> syrup 10 microg/mL available from SCH Pharmacy Department (21368) **ORAL SYRUP IS REFRIGERATED**</p> <p><u>Oral</u> tablets 100 microgram and 150 microgram strengths</p>	<p>Onset: 30-60 minutes</p> <p>Duration: 6 to 12 hours^{4,7}</p>	<p>2 – 18 years for pre-operative sedation: oral 3–4 microg/kg/dose (maximum 300 microg/dose).^{3,8-10}</p> <p><i>Note: 2-4 microg/kg/dose is the usual dose, but when combining with other sedating agents, it is recommended to use the lower range of dosing.⁸⁻¹⁰</i></p>	<p>Give 30 to 45 mins before needed</p> <p>Tablets are preferred for patients undergoing F18-FDG PET scan due to sugar content of the oral suspension.</p> <p><i>If tablets are required, the dose must be rounded to a quarter, half or whole tablet.</i></p> <p><i>Tablets can be crushed & dispersed in water.</i></p>	<p>Ensure adequate monitoring for adverse effects such as bradycardia, hypotension and excessive sedation</p> <p>Other side effects: dry mouth, nausea³</p>
<p>Midazolam (S4D)</p> <p>NASAL ADMINISTRATION PREFERRED (although it stings)</p> <p><u>Nasal/Buccal:</u> use parenteral preparation: 5mg/mL (plastic amps)</p>	<p>Onset: Nasal/Buccal- maximum effect within 15 to 30 mins</p> <p>Duration: Up to 120 mins (2 hours) especially in combination with other sedating agents</p> <p>Note: MIDAZOLAM IS THE PREFERRED AGENT FOR FURTHER SEDATION DURING A PROCEDURE, rather than INITIATION</p>	<p>Nasal: 6 months – 18 years: intranasal 0.2–0.3 mg/kg/dose (maximum 10 mg/dose). Some patients may require 0.4 mg/kg/dose (maximum 10mg/dose) . Repeat in 5–15 minutes if required.³</p> <p>Buccal: 6 months – 18 years: buccal 0.3–0.5 mg/kg (maximum 10 mg/dose)³</p> <p><i>Use the lower dose if combining with other sedating agents.</i></p>	<p>Nasal: Administer using a mucosal atomisation device (MAD) when possible. Drops can be administered into nostrils if MAD not available.</p> <p>Buccal: Administer drops into the side of the cheek. Dose can be drawn into an oral syringe to assist administration.</p>	<p>CNS: paradoxical excitement, coma, confusion, synergistic effects with opioids⁴</p> <p>CVS: Hypotension</p> <p>Respiratory: Depression, airway obstruction (especially at higher doses), apnoea. **CODE BLUE IF OXYGEN SATURATION <90%**</p> <p>Other: ataxia (rare) CAUTION – close supervision required to prevent falls.</p>

Appendix 3: Information for carers of children having Nuclear Medicine studies

Your child has received a small dose of a radioactive substance

You may be concerned, particularly if you are pregnant, about the radiation dose you may receive from being in close contact with your child after he or she has been injected with this radioactive substance for a Nuclear Medicine study.

There are no essential precautions that need to be taken and the needs of your child should always come first. However as good radiation handling practice, it is preferable not to have prolonged cuddling and holding of your child in the first few hours after the scan.

If you come in contact with any body fluids from your child you should wash your hands thoroughly.

If you have any concerns regarding the radiation aspects of this test please talk to a member of the Nuclear Medicine staff who, if you wish, can refer you to the Department's Radiation Safety Officer.

Appendix 4: Standards for Paediatric Intravenous Fluids: NSW Health (second edition)

Link: http://www0.health.nsw.gov.au/policies/ql/2015/pdf/GL2015_008.pdf

Guideline



Standards for Paediatric Intravenous Fluids: NSW Health (second edition)

Document Number GL2015_008

Publication date 31-Aug-2015

Functional Sub group Clinical/ Patient Services - Medical Treatment
Clinical/ Patient Services - Baby and child

Summary The Standards address the appropriate choice of IV fluids and measures related to their procurement, storage and safe administration. The key changes in the second edition of the Standards regarding the content of IV fluids for children and neonates include: incorporating further evidence supporting the use of isotonic saline solutions in IV maintenance therapy; standardising the use of 1000mL bags in the care of children beyond the specialist children's hospitals; and incorporating Special Care Nursery practice and clarification around IV fluids for neonates.

Replaces Doc. No. Standards for Paediatric Intravenous Fluids: NSW Health [GL2014_009]

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Applies to Local Health Districts, Specialty Network Governed Statutory Health Corporations, Public Hospitals

Audience All medical and nursing staff and pharmacy and procurement staff

Distributed to Public Health System, Divisions of General Practice, NSW Ambulance Service, Ministry of Health, Private Hospitals and Day Procedure Centres, Tertiary Education Institutes

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Policy Manual Patient Matters

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