

## **CHILDREN'S SERVICES**

# **Guideline for Management of a child with reduced consciousness level**

## Contents:

1. [Introduction](#)
2. [Glasgow coma scale](#)
3. [AVPU scale](#)
4. [Algorithm for child presenting with reduced consciousness](#)
5. [Further investigations](#)
  - a. Cranial imaging
  - b. Lumbar puncture
6. [Management of cause\(s\) for reduced consciousness and concurrent problems](#)
  - a. Trauma (See **APLS** and **Trust Head injury guidelines**)
  - b. [Shock](#)
  - c. [Sepsis](#)
  - d. [Intracranial infection](#)
  - e. [Metabolic illness](#)
  - f. [Convulsion](#) (see **Trust seizure guideline**)
  - g. [Raised intracranial pressure](#)
  - h. [Hypertensive encephalopathy](#)
  - i. [Reduced consciousness due to unknown cause](#)
7. [References](#)
  - [Appendix 1 Useful drug information](#)
  - [Appendix 2 Useful contact numbers](#)
  - [Appendix 3a Blood pressure nomogram for infants](#)
  - [Appendix 3b Blood pressure nomogram for older children](#)
  - [Appendix 4: Hyperlinks attached](#)
    1. Recent audit on management of loss of consciousness-  
Nov 2014
    2. RCPCH endorsed guidelines on Loss of consciousness  
published in 2005

# 1. INTRODUCTION

Children may present with reduced level of consciousness for many different reasons. A recent study found that about 30 children out of every 100,000 children will present per year in a coma not caused by trauma, and the overall mortality in this group of children was 46% (Wong et al, 2001). This evidence based guideline is aimed to help doctors to recognise clinically important problems, investigate and treat them relating to children presenting with reduced consciousness.

This guideline can be applied to any child with a Glasgow coma score less than 15 or responding only to Voice, Pain or being Unresponsive on the AVPU score. Attempts to fully rouse a sleeping child should be made before recording the conscious level. This guideline should not be applied to preterm infants on the neonatal unit, children for whom a known cause of their decreased conscious level exists (e.g. children with epilepsy, children with a ventriculo-peritoneal shunt, or children with a diagnosed metabolic condition), and children with a chronic abnormal conscious level where the management plan has already been agreed upon.

## 2. GLASGOW COMA SCALE

### Best Eye Response

4. Spontaneous eye opening
3. Opens eyes to verbal commands
2. Opens eyes to pain
1. No eye opening

### Best Verbal Response

	<b>Adult version; Age &gt; 5yrs</b>	<b>Age&lt;5yrs</b>	<b>Pre-verbal or intubated patients</b>
5.	Orientated	Words/ sentences to usual ability, alert, babbles/ coos	Spontaneous normal facial/ oro-motor activity
4.	Confused	Less than usual ability and/ or spontaneous irritable cry	Less than usual spontaneous ability or only response to touch stimuli
3.	Inappropriate words	Cries inappropriately	Vigorous grimace to pain
2.	Incomprehensible sounds	Occasionally whimpers and/ or moans	Mild grimace to pain
1.	No verbal response	No verbal response	No response to pain

### Best Motor Response

6. Obeys commands or normal spontaneous movements
5. Localisation of painful stimuli or withdraws to touch
4. Withdraws to painful stimuli
3. Abnormal flexion to pain
2. Abnormal extension to pain
1. No motor response to pain

## 3. AVPU SCALE

Record the condition which best describes the patient

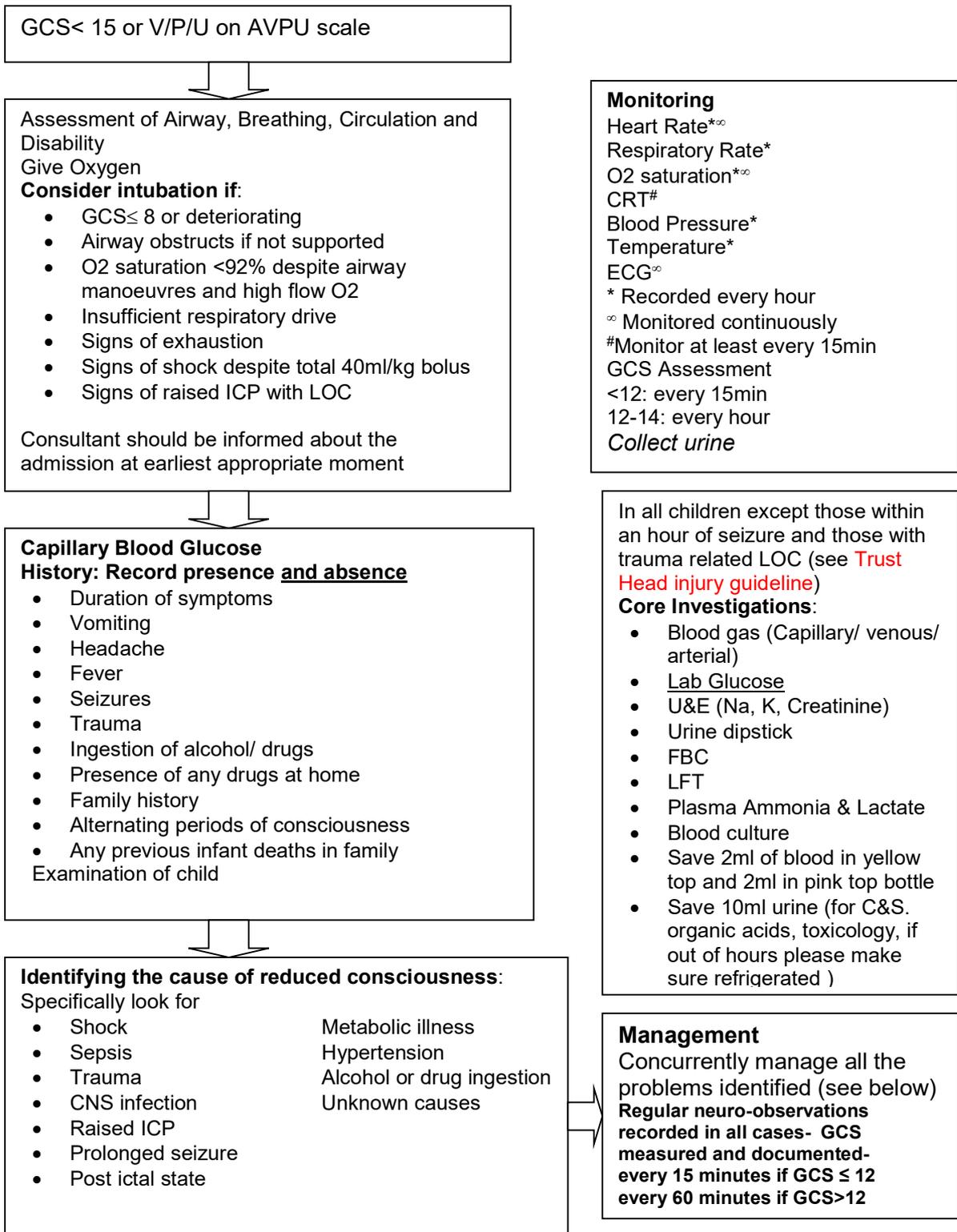
**A**lert

Responds to **V**oice

Responds to **P**ain

**U**nresponsive

## 4. Algorithm for children presenting with reduced consciousness



## 5. Further investigations:

### **a. Cranial Imaging:**

A cranial CT scan should be considered when the patient is stable and if the working diagnosis is:

- Raised intracranial pressure
- Intracranial abscess
- Cause unknown
- Cases of head trauma where imaging is indicated (see head injury guideline)

### **b. Lumbar puncture:**

A lumbar puncture should be considered, when no acute contraindications exist, if the clinical working diagnosis is:

- Bacterial meningitis
- Sepsis
- Herpes simplex encephalitis
- Tuberculous meningitis
- Cause is unknown

Lumbar puncture should be **deferred or not performed** in a child who has:

- Deteriorating GCS or GCS of  $\leq 8$
- Shock
- Focal neurological signs
- Abnormal breathing pattern
- Abnormal posture
- Unilateral or bilateral pupillary dilatation or impaired light reflex
- Bradycardia
- Hypertension
- Clinical evidence of systemic meningococcal disease
- Abnormal Doll's eyes response (Abnormal response is random movement or no movement relative to socket on turning head to the left or right, or no upward gaze on flexing the neck)
- Distended/ tense anterior fontanelle
- Coagulopathy or Thrombocytopenia (Platelets  $< 50 \times 10^9/L$ )

Cerebro-spinal fluid should be initially analysed for:

- Culture and sensitivity
- Protein & Glucose
- Microscopy & Gram staining
- PCR for meningococcus, herpes simplex and other viruses

## 6. Managing the causes of reduced consciousness and concurrent problems:

### **a. Trauma:**

Trauma should be managed as per **Trust head injury** and **APLS** guidelines. Core investigations should be considered in a child presenting with reduced consciousness and evidence of trauma from a collapse.

### ***b. Shock:***

Circulatory shock is recognised clinically if one or more of the following are present in a child with reduced consciousness:

- Capillary refill time of >3sec
- Mottled cool peripheries
- Tachycardia
- Diminished peripheral pulses
- Systolic BP < 5<sup>th</sup> percentile for age
- Urine output < 1ml/kg/hr

If shock is present, following conditions should be looked for

- Sepsis
- Trauma (blood loss/ tension pneumothorax/ cardiac tamponade)
- Anaphylaxis
- Heart failure
- Hypovolemia

Treatment of Shock:

- Fluid bolus (20ml/kg) of 0.9% saline
- Assess response with pulse rate, capillary refill, urine output and GCS.
- Further fluid therapy guided by clinical response and up to and over 60ml/kg may be required, under consultant guidance.
- Intubation and ventilation should be considered if fluid boluses of >40ml/kg are given and inotropic support should be considered.
- Anaesthetic team and South Thames Retrieval team should be contacted (See [Appendix 2](#) for contact details)

### ***c. Sepsis:***

Sepsis should be suspected if following are present:

- Temperature of >38°C or <35.5 or history of fever at home
- Tachycardia
- Tachypnoea
- White cell count of >15000 per mm<sup>3</sup>
- petechial rash

Following investigations should be considered:

- Chest X-ray
- Throat swab
- Urine culture
- Lumbar puncture
- PCR for meningococcus, pneumococcus
- Coagulation studies

Thick and thin film for Malaria if foreign travel to endemic area

Microbiology of any obvious infected site (e.g. infected wound, joint aspirate)

*Treatment:*

- Broad spectrum intravenous antibiotic therapy after taking cultures

## **d. CNS Infection**

### **Bacterial Meningitis**

Bacterial meningitis should be suspected in a child presenting with fever and neck stiffness and/ or neck pain. Other symptoms or signs which should raise the suspicion of meningitis include:

GCS <15	Irritability
High Temperature	High pitched cry in infants
Vomiting	Bulging fontanella
Cyanosis	Rash especially petechiae
Petechiae	Raised CRP

All children with suspected meningitis should have Lumbar puncture in addition to core investigations unless contraindicated (see above for contraindications)

Treatment:

- Broad spectrum antibiotics (Ceftriaxone) should be started without waiting for a lumbar puncture if it is contraindicated.

### **Intracranial Abscess**

It should be suspected in a child with reduced conscious level if there are any focal neurological signs ± clinical signs of sepsis and/ or signs of raised ICP. In addition to core investigations, cranial imaging should be performed.

Treatment:

- Broad spectrum antibiotics (Ceftriaxone + Metronidazole) after taking blood for culture.
- Urgent advice from paediatric neurosurgeon

### **Herpes Simplex Encephalitis (HSE)**

It should be suspected in a child with reduced consciousness if ≥1 of following is present (Keep very low threshold for neonates):

- Focal neurological signs
- Fluctuating GCS for six hours or more
- H/O contact with person with herpetic lesions

In addition to core investigations Lumbar puncture (unless contraindicated), MRI scan and EEG should be performed.

Treatment:

- Intravenous Aciclovir (High dose; 20mg/kg in children <3mo and 500mg/m<sup>2</sup> in older children) continued for 14days if HSE is confirmed or highly suspected.
- Aciclovir should be stopped earlier if there is no ongoing clinical suspicion of HSE.

### **Tuberculous Meningitis (TBM)**

TBM should be suspected in a child with reduced consciousness if:

- Clinical features of meningitis
- H/O contact with a case of Pulmonary Tuberculosis

In children with suspected TBM, LP should be performed unless contraindicated. If CSF microscopy is abnormal, urgent microbiology advice should be obtained.

## **e. Metabolic Illness**

### **Hyperglycaemia**

Diabetic ketoacidosis (DKA) should be diagnosed in a child with reduced consciousness if all of the following are present:

- A capillary or Venous Blood Glucose of  $\geq 11$ mmol/ L
- A capillary or venous pH of  $< 7.3$
- Ketonuria

If DKA is diagnosed, then **paediatric guideline for DKA** should be followed

### **Hypoglycaemia**

In a child presenting with reduced consciousness, a capillary blood glucose level of  $< 2.6$ mmol/ L is low and should be urgently corrected and investigated. Blood glucose level of 2.6- 3.5mmol/L is borderline; the result from lab blood glucose should be reviewed urgently. The departmental **guideline for management of hypoglycaemia** should be followed.

### **Non-Hyperglycaemic Ketoacidosis**

Non-hyperglycaemic ketoacidosis is diagnosed in a child with reduced consciousness, if he has a normal or low blood glucose, a capillary/ venous pH of  $< 7.3$  and ketonuria.

In addition to core investigations, the diagnostic work up should include plasma lactate, plasma amino acids, urinary amino acids and organic acids.

Treatment

- Urgent advice from metabolic specialist
- Need intensive monitoring of vital signs and fluid balance (high risk of developing raised ICP)

### **Hyperammonaemia**

Hyperammonaemia is recognised if plasma ammonia level is  $> 200$  $\mu$ mol/L.

Investigations: plasma amino acids, urinary amino acids, organic acids and orotic acid, and Coagulation studies (Prothrombin time, Activated Partial Thromboplastin time, Fibrinogen, and Fibrin degradation products)

Treatment

- Urgent advice from metabolic consultant
- Consider intravenous Sodium Benzoate infusion (initially 250mg/kg over 90min followed by 20mg/kg/hr adjusted according to response)

If ammonia level is  $> 500$  $\mu$ mol/L or has been between 200-500 $\mu$ mol/L without any improvement after six hours of sodium benzoate infusion:

- Urgent transfer to specialist centre for emergency haemodialysis should be considered
- Intravenous infusion of Sodium Phenyl Butyrate should be considered after discussion with specialist. (initially 250mg/kg over 90min followed by 20mg/kg/hr adjusted according to response)
- Arginine is another medication useful in management of acute Hyperammonaemia but is not licensed for use in children in injection form. Discuss with specialist

## ***f. Convulsion***

### **Prolonged Convulsion**

Prolonged convulsion should be managed as per [Trust seizure guideline](#).

### **Post Convulsive State**

After having a convulsion, child often has a period of reduced consciousness. This 'Post convulsive state usually lasts up to an hour but may last longer. A detailed history and examination should be performed. If the capillary blood glucose is normal, it may be appropriate to closely monitor the child without performing the core investigations unless this state lasts more than one hour.

When evaluating a post-ictal child consideration should be given to medications given to achieve seizure control but if in doubt about the cause of prolonged post-ictal phase core investigations should be carried out along with close monitoring.

## ***g. Raised Intracranial Pressure***

It is recognised clinically if two or more of following are present:

- GCS  $\leq$  8 or U on AVPU score
- Abnormal pattern of respiration
- Abnormal pupils (Unilateral or bilateral)
- Abnormal posture
- Abnormal Doll's eye response/ Caloric response
- Papilloedema

Children suspected of raised ICP should have urgent cranial imaging when stable in addition to the core investigations.

#### **Treatment**

- Position head in midline
- Patient's bed should be tilted to keep head elevated by 20<sup>0</sup> ,
- Avoid Neck lines
- Child should be started on 2/3<sup>rd</sup> maintenance fluids, fluids used should not be hypotonic
- Consider intubation and ventilation to maintain PaCO<sub>2</sub> between 4.0- 4.5kPa
- Consider Mannitol or 3% Saline infusion
- Contact South Thames Retrieval team for transferring patient to PICU (see [Appendix 2](#) for contact details)

### ***h. Hypertensive Encephalopathy***

Hypertension is recognised by two or more separate readings of systolic blood pressure >95<sup>th</sup> centile for age (see [appendix 3a](#) and [3b](#)).

In a child presenting with reduced consciousness and hypertension, results of urinalysis and renal function tests should be reviewed urgently. One should always look for

- Signs of raised ICP
- Papilloedema
- Four limb blood pressure

Treatment

Urgent advice should be obtained from Paediatric cardiologist or Paediatric Nephrologist

### ***i. Decreased consciousness due to unknown cause***

If there are no clinical clues to the cause of reduced consciousness and core investigations results are unremarkable, following additional investigations should be considered

- CT scan of head
- Lumbar puncture (unless contraindicated)
- Urine toxicology screen
- Urinary organic and amino acids
- Plasma lactate

Other investigations that might be considered include EEG (to exclude non-convulsive status epilepticus, Acyl carnitine and plasma amino acid profile, ESR and auto immune screen (cerebral vasculitis), Thyroid function tests (Hashimoto encephalitis)

TOXBASE should be contacted if there is a history or suspicion of drug ingestion

Treatment

- Intensive monitoring
- Supporting the vital signs
- Broad spectrum antibiotics (Ceftriaxone + Azithromycin) and intravenous Aciclovir

If a child rapidly deteriorates and dies without a diagnosis, trust [guideline for sudden unexpected death](#) should be followed.

## 7. References:

1. Wong, C., et al., Incidence, aetiology, and outcome of non-traumatic coma: a population based study. *Archives of Diseases of Childhood* 2001; 84(3): p. 193-9.
2. The Paediatric Accident and Emergency Research Group. *The management of a child (0-18yrs) with a decrease consciousness level: An evidence based guideline for health professionals based in hospital settings*, Nottingham, Nov 2005
3. RCPCH guideline appraisal and summary. *Decreased consciousness level: The management of a child (0-18yrs) with a decrease consciousness level: An evidence based guideline for health professionals based in hospital settings. Volume 31, Oct 2006.*
4. *British National Formulary for Children*, BMJ Publishing group, 2006.
5. *PICU guide*. P Lister. Great Ormond Street Hospital Paediatric Intensive Care Unit and CATS, January 2007.
6. *Report of the second task force on blood pressure control in children-1987. Task Force on Blood Pressure Control in Children. National Heart, Lung, and Blood Institute, Bethesda, Maryland. Pediatrics* 1987;79:1.

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*Infusion tables in Appendix 1 ratified by Heidi Galang, Lead Pharmacist – Paediatrics  
May 2007*

*Ratified by Dr Diab Haddad on behalf of Children's Services Clinical Governance Committee on:  
17<sup>th</sup> May 2007*

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*Next Review: December 2023*

# Appendix 1

## Useful Drug Information

### 1. Infusions to support circulation<sup>#</sup>

Drug	Dose calculation	Fluid	Infusion strength 1ml/hr is equivalent to:	Usual dose range	Comments
Dopamine	30mg x Wt(kg) in 50ml	5% Dextrose or 0.9% Saline	1 0 micrograms/kg/min <i>Max. conc. 3.2mg/ml</i>	2 - 20 microgram/kg/min	High risk of extravasation; Incompatible with Sodium Bicarbonate and other alkaline solutions
Dobutamine	15mg x Wt(kg) in 50ml	5% Dextrose or 0.9% Saline	5 micrograms/kg/min <i>Max conc 5mg/ml via peripheral line</i>	2 - 20 microgram/kg/min	High risk of extravasation; Incompatible with Sodium Bicarbonate and other alkaline solutions
Adrenaline	0.3mg x Wt(kg) in 50ml	5% Dextrose or 0.9% Saline	100 nanograms/kg/min	100 nanograms - 1.5 micrograms/kg/min	Protect from light; Incompatible with Sodium Bicarbonate and other alkaline solutions
Noradrenaline	0.3mg x Wt(kg) in 50ml	5% Dextrose	100 nanograms/kg/min <i>Max conc. 40mg/ml</i>	20 – 100 nanograms (base form)/kg/min	Protect from light; Incompatible with Sodium Bicarbonate and other alkaline solutions; <b>Dose expressed as base (1mg of Noradrenaline acid tartrate is equivalent to 500microgram of base)</b>

### 2. Infusions used for sedation in ventilated child

Drug	Dose Calculation	Fluid	Infusion Strength 1ml/hr is equivalent to:	Usual dose range	Comments
Morphine	1mg x Wt(kg) in 50ml	5% Dextrose or 0.9% Saline	20 micrograms/kg/hr	Loading dose (over 5min): 1month -12yrs: 100 - 200micrograms/kg; 12-18yrs: 2.5 - 10mg <b>INFUSION: 10 - 40 microgram/kg/hr</b>	Adjust dose according to response  Respiratory monitoring required
Midazolam	3mg x Wt(kg) in 50ml	5% Dextrose or 0.9% Saline	1 microgram/kg/min <i>wt &lt;15kg: Max. conc. 1mg/mL</i>	Loading dose: 6months -12yrs: 50 - 200micrograms/kg, 12 -18yrs: 30 - 300micrograms/kg (in steps of 1 - 2.5mg every 2 min) <b>INFUSION: 1-6 microgram/kg/min</b>	Do not give loading dose if child is on Morphine  Adjust dose according to response  Reduce dose in hypovolaemia, vasoconstriction or hypothermia
Fentanyl	0.1mg x Wt(kg) in 50ml	5% Dextrose or 0.9% Saline	2 microgram/kg/hr	Loading dose: 10 micrograms/kg over 10min <b>INFUSION: neonates: 1.5mg/kg/hr; in older children: 1- 6 micrograms/kg/hr</b>	<b>ONLY TO BE PRESCRIBED/ ADMINISTERED BY PAEDIATRIC INTENSIVIST OR ANAESTHETIST IN ICU SETUP</b>  Continuous infusion may result in accumulation

### 3. Infusions for Raised Intracranial Pressure

Drug	Dose Calculation	Infusion Rate/ Strength	Comments
20% Mannitol	1.25 - 5ml x Wt(kg)	Infuse over 30min	Use 5micron filter; Examine infusion for crystals, Dissolve by warming infusion (allow to cool to body temperature before administration); monitor renal function, fluid balance, serum osmolality and infusion site for extravasation
3% Sodium Chloride	2 - 3ml x Wt(kg)	Infuse over 60min	To make remove 36ml from a 500ml bag of 0.9% Saline and add 36ml of 30% Saline; give via a central line as hypertonic

<sup>#</sup> All of the inotropes (except low dose Dobutamine) need to be given via a central line. Please discuss with Anaesthetic and Retrieval team.

## Appendix 2

### Useful contact information

S No	Personnel	Contact No
1	Anaesthetic Registrar on call	Bleep: 5066
2	South Thames Retrieval team	02071885000
3	St Georges Hospital Switch board	1518/ 02086721255
4	Neurosurgery Registrar (St George's Hospital)	Bleep: 7242
5	Paediatric Registrar (St George's Hospital)	Bleep: 7474
6	Paediatric Surgical Registrar (St George's Hospital)	Bleep: 6763
7	CT Scan	2401/ Bleep: 5021
8.	Radiology Hot Seat	2797

## APPENDIX 3a Blood pressure Nomogram for Infants

Table 3a (i): Blood pressure level for **male** infants

Age (mo)	Systolic Blood pressure (mm of Hg)		Diastolic Blood Pressure (mm of Hg)	
	95 <sup>th</sup> Centile	50 <sup>th</sup> Centile	95 <sup>th</sup> Centile	50 <sup>th</sup> Centile
Term baby	92	72	72	55
1mo	106	85	68	52
2mo	110	90	67	50
3mo	110	90	67	50
4mo	110	90	68	51
5mo	110	90	69	52
6mo	110	90	70	54
7mo	110	90	71	55
8mo	110	90	72	55
9mo	110	90	72	56
10mo	110	90	73	56
11mo	110	90	74	56
12mo	110	90	74	57

Table 3a (ii): Blood pressure level for **female** infants

Age (mo)	Systolic Blood pressure (mm of Hg)		Diastolic Blood Pressure (mm of Hg)	
	95 <sup>th</sup> Centile	50 <sup>th</sup> Centile	95 <sup>th</sup> Centile	50 <sup>th</sup> Centile
Term baby	83	65	71	55
1mo	103	85	68	52
2mo	106	86	68	51
3mo	108	90	68	51
4mo	110	90	68	52
5mo	110	91	69	52
6mo	110	92	70	53
7mo	110	92	70	53
8mo	110	92	70	54
9mo	110	92	70	54
10mo	110	92	71	54
11mo	110	92	71	55
12mo	110	92	72	55

## Appendix 3b Blood pressure nomogram for older children

Table 3b (i): Blood pressure level for older **boys**

Age (yrs)	Systolic Blood pressure (mm of Hg)		Diastolic Blood Pressure (mm of Hg)	
	95 <sup>th</sup> Centile	50 <sup>th</sup> Centile	95 <sup>th</sup> Centile	50 <sup>th</sup> Centile
1	110	90	74	57
2	111	92	73	55
3	112	92	73	55
4	113	94	73	56
5	114	95	74	56
6	115	96	75	57
7	116	98	75	59
8	118	100	77	60
9	120	102	78	62
10	122	104	80	63
11	125	106	81	65
12	127	108	83	66
13	130	110	84	67
14	132	113	83	64
15	135	115	84	65
16	138	118	86	67
17	140	121	87	69
18	142	124	90	71

Table 3b (ii): Blood pressure level for older **girls**

Age (yrs)	Systolic Blood pressure (mm of Hg)		Diastolic Blood Pressure (mm of Hg)	
	95 <sup>th</sup> Centile	50 <sup>th</sup> Centile	95 <sup>th</sup> Centile	50 <sup>th</sup> Centile
1	110	92	72	55
2	110	90	73	57
3	110	92	73	57
4	112	93	73	56
5	114	95	73	56
6	115	95	74	58
7	117	98	75	59
8	120	100	77	60
9	121	102	79	61
10	123	104	80	63
11	125	106	82	65
12	127	109	84	66
13	130	111	85	67
14	128	110	85	67
15	130	111	85	68
16	130	114	85	68
17	131	114	85	67
18	132	114	85	67

## Appendix 4

1. A recent audit has looked into failings in various trusts to comply to the guidelines published in 2005: *The Paediatric Accident and Emergency Research Group. The management of a child (0-18yrs) with a decrease consciousness level: An evidence based guideline for health professionals based in hospital settings, Nottingham, Nov 2005.*

<http://www.rcpch.ac.uk/system/files/protected/page/RCPCH%20Decon%20Report%20Paper%20version%20for%20the%20web.pdf>

2. A hyperlink into the guideline endorsed by the RCPCH is attached for perusal if interested

<http://www.nottingham.ac.uk/paediatric-guideline/home2.htm>