CHILDREN’S SERVICES

Guideline for Management of a child with reduced consciousness level
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   e. Metabolic illness
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   g. Raised intracranial pressure
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   i. Reduced consciousness due to unknown cause
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   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

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

Best Motor Response

6. Obey 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
Alert
Responds to Voice
Responds to Pain
Unresponsive
4. Algorithm for children presenting with reduced consciousness

GCS< 15 or V/P/U on AVPU scale

Assessment of Airway, Breathing, Circulation and Disability
Give Oxygen

Consider intubation if:
- GCS ≤ 8 or deteriorating
- Airway obstructs if not supported
- O2 saturation <92% despite airway manoeuvres and high flow O2
- Insufficient respiratory drive
- Signs of exhaustion
- Signs of shock despite total 40ml/kg bolus
- Signs of raised ICP with LOC

Consultant should be informed about the admission at earliest appropriate moment

Monitoring
- Heart Rate**
- Respiratory Rate*
- O2 saturation**
- CRT*
- Blood Pressure*
- Temperature*
- ECG*
* Recorded every hour
** Monitored continuously
Monitor at least every 15min
GCS Assessment
<12: every 15min
12-14: every hour
Collect urine

In all children except those within an hour of seizure and those with trauma related LOC (see Trust Head injury guideline)

Core Investigations:
- Blood gas (Capillary/ venous/ arterial)
- Lab Glucose
- U&E (Na, K, Creatinine)
- Urine dipstick
- FBC
- LFT
- Plasma Ammonia & Lactate
- Blood culture
- Save 2ml of blood in yellow top and 2ml in pink top bottle
- Save 10ml urine (for C&S. organic acids, toxicology, if out of hours please make sure refrigerated)

Identifying the cause of reduced consciousness:
Specifically look for
- Shock
- Sepsis
- Trauma
- CNS infection
- Raised ICP
- Prolonged seizure
- Post ictal state
- Metabolic illness
- Hypertension
- Alcohol or drug ingestion
- Unknown causes

Management
Concurrently manage all the problems identified (see below)
Regular neuro-observations recorded in all cases- GCS measured and documented-every 15 minutes if GCS ≤ 12 every 60 minutes if GCS>12

Capillary Blood Glucose
History: Record presence and absence
- Duration of symptoms
- Vomiting
- Headache
- Fever
- Seizures
- Trauma
- Ingestion of alcohol/ drugs
- Presence of any drugs at home
- Family history
- Alternating periods of consciousness
- Any previous infant deaths in family
Examination of child
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 ≤ 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<50x 10^5/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 < 5th 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$^3$
- 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
- High Temperature
- Vomiting
- Cyanosis
- Petechiae
- Irritability
- High pitched cry in infants
- Bulging fontanella
- Rash especially 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 Abcess**

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/m² 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 $\geq 11\text{mmol/ L}$
- 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 $< 2.6\text{mmol/ L}$ 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 $> 200\mu\text{mol/ L}$.
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 $> 500\mu\text{mol/ L}$ or has been between 200-500µmol/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.

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**g. Raised Intracranial Pressure**

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

- GCS ≤ 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°
- Avoid Neck lines
- Child should be started on 2/3rd maintenance fluids, fluids used should not be hypotonic
- Consider intubation and ventilation to maintain PaCO2 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 >95th 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

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**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

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If a child rapidly deteriorates and dies without a diagnosis, trust guideline for sudden unexpected death should be followed.
7. References:


Produced by: Dr. Dushyant Batra
Specialist Registrar, Paediatrics

Presented to Paediatrics Clinical Guidelines Forum: 8th January and 5th February 2007

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:
17th May 2007

Review date: May 2010

Reviewed: November 2014          Next Review: November 2017
# Appendix 1

## Useful Drug Information

### 1. Infusions to support circulation

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose Calculation</th>
<th>Fluid</th>
<th>Infusion strength 1ml/hr is equivalent to:</th>
<th>Usual dose range</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dopamine</td>
<td>30mg x Wt(kg) in 50ml</td>
<td>5% Dextrose or 0.9% Saline</td>
<td>10 micrograms/kg/min Max. conc. 3.2mg/ml</td>
<td>2 - 20 microgram/kg/min</td>
<td>High risk of extravasation; Incompatible with Sodium Bicarbonate and other alkaline solutions</td>
</tr>
<tr>
<td>Dobutamine</td>
<td>15mg x Wt(kg) in 50ml</td>
<td>5% Dextrose or 0.9% Saline</td>
<td>5 micrograms/kg/min Max conc 5mg/ml via peripheral line</td>
<td>2 - 20 microgram/kg/min</td>
<td>High risk of extravasation; Incompatible with Sodium Bicarbonate and other alkaline solutions</td>
</tr>
<tr>
<td>Adrenaline</td>
<td>0.3mg x Wt(kg) in 50ml</td>
<td>5% Dextrose or 0.9% Saline</td>
<td>100 nanograms/kg/min</td>
<td>100 nanograms - 1.5 micrograms/kg/min</td>
<td>Protect from light; Incompatible with Sodium Bicarbonate and other alkaline solutions</td>
</tr>
<tr>
<td>Noradrenaline</td>
<td>0.3mg x Wt(kg) in 50ml</td>
<td>5% Dextrose</td>
<td>100 nanograms/kg/min Max conc. 40mg/ml</td>
<td>20 – 100 nanograms (base form)/kg/min</td>
<td>Protect from light; Incompatible with Sodium Bicarbonate and other alkaline solutions; Dose expressed as base (1mg of Noradrenaline acid tartrate is equivalent to 500microgram of base)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose Calculation</th>
<th>Fluid</th>
<th>Infusion Strength 1ml/hr is equivalent to:</th>
<th>Usual dose range</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine</td>
<td>1mg x Wt(kg) in 50ml</td>
<td>5% Dextrose or 0.9% Saline</td>
<td>20 micrograms/kg/hr</td>
<td>Loading dose (over 5min): 1month -12yrs: 100 - 200micrograms/kg; 12-18yrs: 2.5 - 10mg INFUSION:10 - 40 microgram/kg/hr Adjust dose according to response Respiratory monitoring required</td>
<td></td>
</tr>
<tr>
<td>Midazolam</td>
<td>3mg x Wt(kg) in 50ml</td>
<td>5% Dextrose or 0.9% Saline</td>
<td>1 microgram/kg/min wt &lt;15kg: Max. conc. 1mg/mL</td>
<td>Loading dose: 6months -12yrs: 50 - 200micrograms/kg, 12-18yrs: 30 - 300micrograms/kg (in steps of 1 - 2.5mg every 2 min) INFUSION: 1-6 microgram/kg/min Adjust dose according to response Reduce dose in hypovolaemia, vasoconstriction or hypothermia</td>
<td></td>
</tr>
<tr>
<td>Fentanyl</td>
<td>0.1mg x Wt(kg) in 50ml</td>
<td>5% Dextrose or 0.9% Saline</td>
<td>2 microgram/kg/hr</td>
<td>Loading dose: 10 micrograms/kg over 10min INFUSION: neonates: 1.5mg/kg/hr; in older children: 1-6 micrograms/kg/hr ONLY TO BE PRESCRIBED/ADMINISTERED BY PAEDIATRIC INTENSIVIST OR ANAESTHETIST IN ICU SETUP Continuous infusion may result in accumulation</td>
<td></td>
</tr>
</tbody>
</table>

### 3. Infusions for Raised Intracranial Pressure

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose Calculation</th>
<th>Infusion Rate/Strength</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>20% Mannitol</td>
<td>1.25 - 5ml x Wt(kg)</td>
<td>Infuse over 30min</td>
<td>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</td>
</tr>
<tr>
<td>3% Sodium Chloride</td>
<td>2 - 3ml x Wt(kg)</td>
<td>Infuse over 60min</td>
<td>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</td>
</tr>
</tbody>
</table>

# 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

<table>
<thead>
<tr>
<th>S No</th>
<th>Personnel</th>
<th>Contact No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anaesthetic Registrar on call</td>
<td>Bleep: 5066</td>
</tr>
<tr>
<td>2</td>
<td>South Thames Retrieval team</td>
<td>02071885000</td>
</tr>
<tr>
<td>3</td>
<td>St Georges Hospital Switch board</td>
<td>1518/ 02086721255</td>
</tr>
<tr>
<td>4</td>
<td>Neurosurgery Registrar (St George’s Hospital)</td>
<td>Bleep: 7242</td>
</tr>
<tr>
<td>5</td>
<td>Paediatric Registrar (St George’s Hospital)</td>
<td>Bleep: 7474</td>
</tr>
<tr>
<td>6</td>
<td>Paediatric Surgical Registrar (St George’s Hospital)</td>
<td>Bleep: 6763</td>
</tr>
<tr>
<td>7</td>
<td>CT Scan</td>
<td>2401/ Bleep: 5021</td>
</tr>
<tr>
<td>8</td>
<td>Radiology Hot Seat</td>
<td>2797</td>
</tr>
</tbody>
</table>
### APPENDIX 3a Blood pressure Nomogram for Infants

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

<table>
<thead>
<tr>
<th>Age (mo)</th>
<th>Systolic Blood pressure (mm of Hg)</th>
<th>Diastolic Blood Pressure (mm of Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>95th Centile</td>
<td>50th Centile</td>
</tr>
<tr>
<td>Term baby</td>
<td>92</td>
<td>72</td>
</tr>
<tr>
<td>1mo</td>
<td>106</td>
<td>85</td>
</tr>
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<td>2mo</td>
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<td>3mo</td>
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<td>90</td>
</tr>
<tr>
<td>12mo</td>
<td>110</td>
<td>90</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Age (mo)</th>
<th>Systolic Blood pressure (mm of Hg)</th>
<th>Diastolic Blood Pressure (mm of Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>95th Centile</td>
<td>50th Centile</td>
</tr>
<tr>
<td>Term baby</td>
<td>83</td>
<td>65</td>
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<tr>
<td>1mo</td>
<td>103</td>
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<td>92</td>
</tr>
<tr>
<td>12mo</td>
<td>110</td>
<td>92</td>
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</tbody>
</table>
**Appendix 3b Blood pressure nomogram for older children**

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

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Systolic Blood pressure (mm of Hg)</th>
<th>Diastolic Blood Pressure (mm of Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>95\textsuperscript{th} Centile</td>
<td>50\textsuperscript{th} Centile</td>
</tr>
<tr>
<td>1</td>
<td>110</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>111</td>
<td>92</td>
</tr>
<tr>
<td>3</td>
<td>112</td>
<td>92</td>
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Table 3b (ii): Blood pressure level for older **girls**

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<th>Age (yrs)</th>
<th>Systolic Blood pressure (mm of Hg)</th>
<th>Diastolic Blood Pressure (mm of Hg)</th>
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<td>95\textsuperscript{th} Centile</td>
<td>50\textsuperscript{th} Centile</td>
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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.


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