Whittington Health NHS

Reduced Conscious Level and Coma in Children

Subject:	Reduced conscious level and coma in children
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Policy Executive Owner:	Clinical Director, CYP ICSU
Designation of Author:	Dr O Abdel-Mannan, Paediatric ST2 Prof C Fertleman, Consultant Paediatrician
Name of Assurance Committee:	As above
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Target Audience:	General Paediatrics, ED
Key Words:	Coma, Children, Reduced conscious level, Glasgow Coma score, AVPU

Version Control Sheet

Version	Date	Author	Status	Comment
1.0	March 2015	Dr O Abdel-Mannan, Paediatric ST2 Dr C Fertleman, Consultant Paediatrician	Off line	New guideline ratified at March 2015 CGC. In accordance with current RCPCH guidance.
2.0	Feb 2019	Prof C Fertleman	Live	Reviewed. No change required

Abbreviations contained within this guideline

GCS	Glasgow Coma Score
AVPU score	Alert, Voice, Pain, Unresponsive
NICU	Neonatal Intensive Care Unit
CRP	C-reactive protein
FBC	Full blood count
WCC	White cell count
CT	Computed tomography
BGM	Blood glucose monitoring
ECG	Electrocardiagram
CSF	Cerebro spinal fluid
APLS	Advanced Paediatric Life Support

➢ Criteria for use

- Children (0-16 years) who present to hospital with reduced conscious level on Glasgow Coma Score (GCS) modified for children or AVPU score.

➢ Background/introduction

- The main causes of reduced conscious level/coma in a child are as follows:
  - ➢ Hypoxic ischaemic brain injury: following respiratory or circulatory failure
  - ➢ Epilepsy: Status epliepticus or post-ictal phase
  - ➢ Trauma: intracranial haemorrhage, non-accidental injury
  - ➢ Raised intracranial pressure: space occupying lesion, hydrocephalus
  - ➢ Infections: meningitis, encephalitis, malaria
  - ➢ Toxic: acute poisoning – including alcohol, substance abuse
  - ➢ Metabolic and endocrine: hypoglycaemia, renal/hepatic failure, electrolyte imbalances, hyperammonaemia

- The changes in mental state which precede coma are classified by the "Modified Glasgow Coma Scale For Infants And Young Children" (see below)

- In this scale, the total score = verbal response + motor response + eye opening. The best score is recorded, with the lowest possible score 3, and the highest 15 (the fully conscious child).

- **Children in coma have GCS scores of 8 or less**.

Glasgow coma scale with modification for children

Best eye response

1.	No eye opening
2.	Eye opening to pain
3.	Eye opening to verbal command
4.	Eyes open spontaneously

Best verbal response (use one of the following)

	Adult version (aged 5 +)	*Children's modification*	*Grimace response* for preverbal or intubated patients
1.	No verbal response	No vocal response	No response to pain
2.	Incomprehensible sounds	Occasionally whimpers and/or moans	Mild grimace to pain
3.	Inappropriate words	Cries inappropriately	Vigorous grimace to pain
4.	Confused	Less than usual ability and/or spontaneous irritable cry	Less than usual spontaneous ability or only response to touch stimuli
5.	Orientated	Alert, babbles, coos, words or sentences to usual ability	Spontaneous normal facial / oromotor activity

Best motor response

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

AVPU Scale

Record the condition which best describes the patient

Alert
responds to Voice
responds to Pain
Unresponsive

➢ Inclusion/exclusion criteria

Inclusion

- Reduced conscious level is defined as scoring less than 15 of the Glasgow Coma Score (GCS) or responding only to voice, pain or being unresponsive on the AVPU score
- The child must be fully roused from sleep prior to recording conscious level

Exclusion

- Infants in neonatal intensive care unit (NICU)
- Children with known condition causing reduced conscious level with a definitive management plan (e.g. epilepsy, diabetes)
- Children with learning disabilities whose GCS score is <15 when healthy
- Children with reduced conscious level as a result of a witnessed head injury

➢ Clinical management

Clinical presentation

Relevant history features to look for:

- Duration of symptoms
- Vomiting, headache, fever
- Convulsions, alternating periods of consciousness
- Trauma,
- Any previous infant deaths in family
- Ingestion of drugs and alcohol, presence of any drugs at home

Examination

Complete physical examination including:

- ➢ Cardiovascular – peripheral perfusion, signs of shock
- ➢ Neurological – posture, localising signs, fundi, pupils
- ➢ Respiratory – cyanosis, work of breathing
- ➢ Skin – bruising, petechiae, jaundice
- ➢ Smell – alcohol, ketones, phenol
- ➢ Temperature – fever or hypothermia

Investigations

Immediate

These should be performed on all children with reduced consciousness except those post trauma and those within one hour post convulsion

	**Please see Whittington Health Guideline:** Head Injury Management Proforma in Children

- Capillary glucose
- Blood gas (capillary, venous or arterial)
- Urea and electrolytes
- CRP
- Liver function tests
- Full blood count and differential white cell count
- Clotting screen
- Urinalysis
- Laboratory glucose
- Plasma ammonia
- Blood culture – minimum paediatric volume should be 3-5 mls. If the child is over 12 years use adult bottles
- Consider CT head - especially in a child with an unknown cause of reduced consciousness

Non-immediate (especially if cause is unknown)

- Lumbar puncture
- Urine toxicology screen
- Urine organic and amino acids
- Plasma lactate

Management

The child with altered conscious state is always seriously ill. Call paediatric registrar urgently. Call anaesthetist if respiratory failure or if GCS<9 as child will need intubation and ventilation.

The paediatric SpR should contact the on-call consultant paediatrician as soon as they have carried out an initial assessment and instituted life-threatening emergency management.

Immediate

- **Assess airway + breathing**

  - Protect and maintain airway - use airway adjunct (e.g. oropharyngeal or laryngeal mask airway) or consider intubation if unable to maintain airway
  - Consider using a nasopharyngeal airway in children with a fluctuating GCS, who may not tolerate other airway adjuncts.
  - If breathing adequate give high flow 100% 0_2 via re-breath mask
  - If inadequate, start bag + mask ventilation until anaesthetists arrives

Consider intubation if:

- Airway obstructs when unsupported
- Airway compromise from vomiting
- Respiratory rate inadequate for ventilation O_2 saturations less than 92% despite high flow O_2 and airway opening manoeuvres
- Signs of shock despite 40ml/kg bolus
- Signs of exhaustion
- GCS < or equal to 8 or deteriorating
- Signs of raised intracranial pressure
- Status epilepticus unresponsive to Advanced Life Support management protocol

- **Assess circulation**

  - Obtain intravenous/intraosseus access and send off blood investigations
  - Assess for signs of shock – check capillary refill time, heart rate and blood pressure
  - Give 20mls/kg fluid bolus of normal saline if signs of shock and reassess
  - Further fluid therapy guided by clinical response and >60ml/kg may be required in shock

- **Urgent BGM**

  - If less than 4mmol/l send a lab glucose and hypoglycaemia screen, and give a bolus of 5mls/kg 10% dextrose (>4 weeks old) or bolus of 2ml/kg 10% dextrose (<4weeks old) and commence maintenance IV fluids (0.9% saline and 5% dextrose) until sugars stable between 4-7 mmol/l – BGM should be rechecked 15 minutes post bolus.

- **Assess disability:**

  - Check conscious level – GCS or AVPU
  - Pupils. Check size and reactivity
  - Fundi. Look for retinal haemorrhages and papilloedema
  - Decerebrate or decorticate posture in previously normal child suggests raised intracranial pressure. This may only be elicited with painful stimulus
  - Look for neck stiffness in a child and a full fontanelle in infant. This suggests meningitis

- **Expose patient**

  - Look for rashes (infection), bruising (trauma)
  - Check temperature - fever suggest infectious cause or poisoning (ecstacy, cocaine, salicylates)
  - Hypothermia may suggest alcohol or barbiturate poisoning

- **Infection is impossible to exclude initially,** so antibiotics and anitvirals are essential- ***send*** Blood cultures and start antibiotics and antivirals as per the 'encephalopathy' section in the 'Antibiotic Protocols for children seen in General Paediatrics' guideline.

Please see Whittington Health Guideline:

Antibiotic Protocols for children seen in General Paediatrics

Start following monitoring as soon as possible:

Continuous monitoring

- Heart rate
- Oxygen saturations
- ECG

Hourly monitoring

- Blood pressure
- Respiratory rate
- Temperature

If GCS <12 – monitor GCS every 15 minutes
If GCS 12-14 - monitor GCS every 1 hour

Signs of raised intracranial pressure

- Bradycardia
- Hypertension
- Pupillary dilatation or asymmetry
- Abnormal breathing pattern
- Abnormal posture

- **If there are any signs of raised intracranial pressure,** use 3% saline as a first line 3 – 5 mls/kg – aiming for Na 145mmols/l and Mannitol 0.5g/kg as second line.

Lumbar puncture contraindications

Always discuss with the consultant paediatrician on call before carrying out a lumbar puncture on a child who has presented with decreased level of consciousness.

Lumbar Puncture should be deferred or not performed as part of the initial acute management in a child who has:

- GCS <8
- Deteriorating GCS
- Focal neurological signs
- Seizure more than 10 minutes long and GCS still <12
- Abnormal breathing pattern
- Abnormal posture, decerberate or decorticate posturing
- Impaired oculocephalic reflexes
- Shock, bradycardia (HR <60) or hypertension
- Clinical evidence of systemic meningococcal disease
- Pupillary dilatation

Management of specific causes.

If you suspect any of the following, discuss with On-call Paediatric consultant

- **Hyperammonaemia**: seek urgent advice from a metabolic specialist, start IV sodium benzoate (loading dose followed by infusion). If no improvement in ammonia level, consider emergency haemodialysis
- **Bacterial meningitis:** Give IV dexamethasone 0.15mg/kg with broad-spectrum IV antibiotics
- **TB meningitis:** If CSF microscopy abnormal, seek advice from on call microbiologist
- **Herpes Simplex Encephalitis**: Discuss with microbiology on call and give IV acyclovir as per the general paediatric antibiotic guideline
- **Intracranial abscess**: Broad spectrum antibiotics after blood cultures and seek urgent advice from paediatric neurosurgeon
- **Raised intracranial pressure**: position patient's head in midline, tilt head up to 20 degrees, consider intubation, 3% saline or Mannitol contact on call consultant
- **Hypertension**: consider use of antihypertensives and seek advice form paediatric nephrologist or paediatric intensive care unit
- **Prolonged convulsion**: follow APLS guidelines for anticonvulsant therapy. If on-going convulsion, consider correcting electrolyte imbalances

➢ Further information

Useful drug information:

Below is a list of infusions which may be required for support or treatment. Please check with your local pharmacist that the infusion calculations are appropriate for your local procedures.

Infusions to support the circulation:

Drug	Dose calculation	Fluid	Dose per kg per unit time	Usual dose range
Adrenaline / Epinephrine	0.3mg x wt (kg) in 50mls	5% Glucose	1ml / hr = 0.1 microgram/kg/min	0.1 – 1 microgram/kg/min
Noradrenaline base	0.3mg x wt (kg) in 50mls	5% Glucose	1ml / hr = 0.1 microgram/kg/min	0.1 – 1 microgram/kg/min
Dopamine	30mg x wt (kg) in 50mls	5% Glucose	1ml / hr = 10 microgram/kg/min	2 – 20 microgram/kg/min
Dobutamine	30mg x wt (kg) in 50mls	5% Glucose	1ml / hr = 10 microgram/kg/min	2 – 20 microgram/kg/min

Infusions for ongoing sedation in a ventilated child:

Drug	Dose calculation	Fluid	Dose per kg per unit time	Usual dose range
Morphine	1mg x wt (kg) in 50mls	5% Glucose	1ml / hr = 20 microgram/kg/hour	10 – 40 microgram/kg/hour
Midazolam	3mg x wt (kg) in 50mls	5% Glucose	1ml / hr = 1 microgram/kg/min	0.5 – 4 microgram/kg/min
Fentanyl	0.125mg x wt (kg) in 50mls	5% Glucose	1ml / hr = 2.5microgram/kg/hour	1 – 3 microgram/kg/hour
Ketamine	30mg x wt (kg) in 50mls	5% Glucose	1ml / hr = 10 microgram/kg/min	10 – 45 microgram/kg/min

Infusions for metabolic illnesses

Drug	Dose calculation	Fluid	Dose per kg per unit time	Usual dose range
Insulin	50 units in 50mls	0.9% Saline	0.05 ml x wt (kg) / hr = 0.05 Units/kg/hour	0.025 – 0.1 Units/kg/hour
Sodium Benzoate	*Loading dose*: 250mg x wt (kg) add this to	15ml x wt (kg) 10% Glucose	Infuse whole volume over 90 minutes	
	Continuous infusion: 250mg x wt (kg) add this to	15ml x wt (kg) 10% Glucose	Infuse whole volume over 24 hours	
Sodium Phenylbutyrate	*Loading dose*: 250mg x wt (kg) add this to	15ml x wt (kg) 10% Glucose	Infuse whole volume over 90 minutes	
	Continuous infusion: 250mg x wt (kg) add this to	15ml x wt (kg) 10% Glucose	Infuse whole volume over 24 hours	

Infusions for convulsions due to electrolyte imbalance:

Drug	Dose calculation	Fluid for dilution	Dose
3% Saline (3% sodium chloride)	Remove 36ml from a 500ml bag of 0.9% sodium chloride (saline). Add 36ml of 30%sodium chloride	This makes a 500ml bag of 3%sodium chloride	5 ml x wt (kg) / hour single dose
Magnesium sulphate	2ml of 50% solution make up to 10ml with 5% Glucose (= 10% solution $MgSO_4$)	5% Glucose	0.5 ml x wt (kg) / hour single dose over 1 hour
Calcium gluconate	1g in 10ml = 10% solution	5% Dextrose	0.3 – 0.5 ml x wt (kg) over 5 mins

Infusions for raised intracranial pressure:

Drug	Dose calculation	Fluid	Dose per kg per unit time	Usual dose range
Mannitol	1.25 ml x wt (kg)	20% mannitol	0.25g / kg / hour single dose over 30 mins	0.25 - 1.0g / kg (1.25 – 5 ml / kg)
3% saline (sodium chloride)	Remove 36ml from a 500ml bag of 0.9% saline. Add 36ml of 30% saline.	This makes a 500ml bag of 3% saline	5 ml x wt (kg) single dose over 1 hour	
Thiopental Sodium	100mg x wt (kg) in 50ml	0.9% Sodium chloride	1ml / hour = 2mg / kg / hr	2 – 8 mg / kg /hr

➢ Contacts (inside and outside the Trust including out-of-hours contacts)

On-call Paediatric registrar - bleep 3111 (24 hour cover)
On-call Paediatric consultant - via switchboard
On-call Anaesthetics consultant- via switchboard
On-call Microbiology registrar – bleep 3069 (working hours), via switchboard (out of hours)
On-call Microbiology consultant - via switchboard
On-call radiology consultant - Ext 2877 (working hours), via switchboard (out of hours)
PICU, Metabolic specialist, Paediatric neurologist, Paediatric neurosurgeon, Paediatric endocrinologist - contact Great Ormond Street Hospital Switchboard
Children's Acute Transport Service - 0800085003

➢ References (evidence upon which the guideline is based)

- Avner JR. Altered States of Consciousness. Peds in Rev 2006;27:331-337.

- Kirkham FJ. Non-traumatic coma in children. Arch Dis Child 2001;85;303-312.

- Starship Children's Health Clinical Guideline: Coma (the unconscious child) - http://www.adhb.govt.nz/starshipclinicalguidelines/_Documents/Coma.pdf (accessed as at March 2015)

- The Paediatric Accident and Emergency Research Group: Management of a child (aged 0-18 years) with a decreased conscious level - www.nottingham.ac.uk/paediatric-guideline/Guideline%20algorithm.pdf (accessed as at March 2015)

- Wong CP, Forsyth RJ, Kelly TP, Eyre JA. Incidence, aetiology, and outcome of nontraumatic coma: a population based study. Arch Dis Child 2001;84;193-199

- 'Antibiotic Protocols for children seen in General Paediatrics' guideline – Whittington Hospital. November 2014

- **Compliance with this guideline (how and when the guideline will be monitored e.g. audit and which committee the results will be reported to) Please use the tool provided at the end of this template**

To be completed and attached to any procedural document when submitted to the appropriate committee for consideration and approval

		Yes/No	Comments
1.	**Does the procedural document affect one group less or more favourably than another on the basis of:**		
	• Race	No	
	• Ethnic origins (including gypsies and travellers)	No	
	• Nationality	No	
	• Gender	No	
	• Culture	No	
	• Religion or belief	No	
	• Sexual orientation including lesbian, gay and bisexual people	No	
	• Age	No	
	• Disability - learning disabilities, physical disability, sensory impairment and mental health problems	No	
2.	**Is there any evidence that some groups are affected differently?**	No	
3.	**If you have identified potential discrimination, are any exceptions valid, legal and/or justifiable?**	No	
4.	**Is the impact of the procedural document likely to be negative?**	No	
5.	**If so can the impact be avoided?**	N/A	
6.	**What alternatives are there to achieving the procedural document without the impact?**	N/A	
7.	**Can we reduce the impact by taking different action?**	N/A	

If you have identified a potential discriminatory impact of this procedural document, please refer it to the Director of Human Resources, together with any suggestions as to the action required to avoid/reduce this impact.

For advice in respect of answering the above questions, please contact the Director of Human Resources.

Checklist for the Review and Approval of Procedural Document

To be completed and attached to any procedural document when submitted to the relevant committee for consideration and approval.

	Title of document being reviewed:	Yes/No	Comments
1.	**Title**		
	Is the title clear and unambiguous?	Yes	
	Is it clear whether the document is a guideline, policy, protocol or standard?	Yes	
2.	**Rationale**		
	Are reasons for development of the document stated?	Yes	
3.	**Development Process**		
	Is it clear that the relevant people/groups have been involved in the development of the document?	Yes	
	Are people involved in the development?	Yes	
	Is there evidence of consultation with stakeholders and users?	Yes	
4.	**Content**		
	Is the objective of the document clear?	Yes	
	Is the target population clear and unambiguous?	Yes	
	Are the intended outcomes described?	Yes	
5.	**Evidence Base**		
	Are key references cited in full?	N/A	
	Are supporting documents referenced?	N/A	
6.	**Approval**		
	Does the document identify which committee/ group will approve it?	Yes	
7.	**Dissemination and Implementation**		
	Is there an outline/plan to identify how this will be done?	Yes	
8.	**Document Control**		
	Does the document identify where it will be held?	Yes	
9.	**Process to Monitor Compliance and Effectiveness**		

	Title of document being reviewed:	Yes/No	Comments
	Are there measurable standards or KPIs to support the monitoring of compliance with and effectiveness of the document?	Yes	
	Is there a plan to review or audit compliance with the document?	Yes	
10.	**Review Date**		
	Is the review date identified?	Yes	
	Is the frequency of review identified? If so is it acceptable?	Yes	
11.	**Overall Responsibility for the Document**		
	Is it clear who will be responsible for co-ordinating the dissemination, implementation and review of the document?	Yes	

Executive Sponsor Approval			
If you approve the document, please sign and date it and forward to the author. Procedural documents will not be forwarded for ratification without Executive Sponsor Approval			
Name		Date	
Signature			
Relevant Committee Approval			
The Director of Nursing and Patient Experience's signature below confirms that this procedural document was ratified by the appropriate Governance Committee.			
Name		Date	
Signature			
Responsible Committee Approval – only applies to reviewed procedural documents with minor changes			
The Committee Chair's signature below confirms that this procedural document was ratified by the responsible Committee			
Name		Date	
Name of Committee		Name & role of Committee Chair	
Signature			

Tool to Develop Monitoring Arrangements for Policies and guidelines

What key element(s) need(s) monitoring as per local approved policy or guidance?	Who will lead on this aspect of monitoring? Name the lead and what is the role of the multidisciplinary team or others if any.	What tool will be used to monitor/check/observe/Assess/inspect/ authenticate that everything is working according to this key element from the approved policy?	How often is the need to monitor each element? How often is the need complete a report ? How often is the need to share the report?	What committee will the completed report go to?
Element to be monitored	**Lead**	**Tool**	**Frequency**	**Reporting arrangements**
Guideline is based upon RCPCH national guidance and will be audited by the College. Local audit of adherence will be undertaken	Author	Audit. Additional incent reporting via DATIX	Bi-annual	PCGG Departmental meetings