The Management of a Child (aged 0 – 18 years) with a Decreased Conscious Level

An evidence-based guideline for health professionals based in the hospital setting

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Appraised by

Royal College of Paediatrics and Child Health

British Association for Emergency Medicine

Guideline for the management of a child aged 0-18 years with a decreased conscious level

Explanatory notes
Recommendations marked with the symbol (A) or (B) are based on the highest quality of evidence

Entry criteria
The following algorithm should be used for children aged 0 – 18 years who present to hospital with a reduced level of consciousness. This is defined as scoring <15 on the Glasgow Coma Scale (GCS) modified for children or responding only to voice, pain or being unresponsive on the AVPU scale. Ensure the child is maximally roused from sleep before recording conscious level.

Exclusion criteria
Infants on a neonatal intensive care unit.
Children with a known condition for episodes of reduced conscious level (e.g. epilepsy, diabetes) where a management plan is already agreed upon.
Children with learning disabilities, whose score on the GCS is <15 when they are healthy.

In certain children with reduced conscious level, it may be appropriate to watch and wait. However, if a decision is made to stick a needle into a child to investigate the cause, take all the samples listed as “core investigations” at the first opportunity.

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 **V**oice
responds to **P**ain
Unresponsive

Algorithm for the management of a child aged 0-18 years with a decreased conscious level

Patient entry criteria
(see page 2)

GCS<15
V, P or U on AVPU scale

Assessment

AIRWAY

BREATHING

CIRCULATION

DISABILITY

Give oxygen

Consider intubation if:
Airway obstructs if not supported
Airway compromised by vomiting
Resp rate inadequate for ventilation
O_2 sats <92% despite high flow O_2 / airway opening manoeuvres
Signs of shock despite 40ml/kg fluid
Exhaustion
GCS≤8 or deteriorating
Signs of raised ICP

See Problem list below

Monitoring

Heart rate *+
Resp rate *
O_2 sats *+
BP *
Temperature
ECG+

*recorded every hour
+monitored continuously

GCS assessment
If GCS <12 every 15mins
If GCS 12-14 every hour

Start urine collection

Core investigations (see page 9)

All children → **Capillary Glucose**

Perform the following in **all children** with reduced conscious level ***except*** those post trauma and those within one hour post convulsion (see pages 4&5)

Blood gas (capillary, venous, arterial)
Urinalysis (dipstick at bedside)
Laboratory glucose
(even if capillary glucose normal)
Urea and electrolytes (Na, K, Cr)
Liver function tests
Plasma ammonia
Full blood count
Blood culture
1-2ml plasma } to be separated, frozen and saved
1-2ml plain serum }
10ml urine to be frozen and saved

History features to ask about

Vomiting
Headache
Fever
Convulsions
Alternating periods of consciousness
Trauma
Ingestion of drugs
Presence of any drugs at home
Any previous infant deaths in family
Length of symptoms

Examine the child

Problem list

Identify all the problems considered below **(see pages 4 and 5)**

Shock
Sepsis
Trauma
Metabolic illness
Intracranial infections
Raised ICP
Prolonged convulsions
Hypertension
Post-convulsive state
Cause unknown e.g. drug ingestion

Management

Manage **concurrently** all the problems identified from the Problem list **(see pages 6, 7 and 8)**

Identify All Problems

Several suspected problems may co-exist and need concurrent management. Identify if each problem is suspected and tick the box❒. When <u>all problems</u> have been considered go to tables for tests and treatments (pages 6, 7, and 8).

SHOCK ❒ *Go to table 1*

Recognised clinically if reduced consciousness and **one or more** of the following:

- Capillary refill > 2 seconds
- Mottled, cool extremities
- Diminished peripheral pulses
- Systolic BP < 5th percentile for age
- Decreased urine output <1ml/kg/hour

SEPSIS ❒ *Go to table 2*

Recognised clinically if reduced consciousness and **two or more** of the following 4:

- Temp >38°C or <36°C
- Tachycardia
- Tachypnoea
- White cell count <4000cumm or >12000cumm

or

- a non-blanching rash (B)

TRAUMA ❒ *Go to table 3*

Recognised from history and examination findings

METABOLIC ILLNESS DIABETIC KETOACIDOSIS ❒ *Go to table 4*

Recognised if reduced consciousness and all of the following:

- capillary glucose >11mmol/l
- pH <7.3
- ketones in urine

METABOLIC ILLNESS HYPOGLYCAEMIA ❒ *Go to table 5*

Recognised if reduced consciousness and capillary glucose < 2.6 mmol/l
(if capillary glucose 2.6 - 3.5 check glucose result from core investigations urgently)

METABOLIC ILLNESS HYPERAMMONAEMIA ❒ *Go to table 6*

Recognised if plasma ammonia **>200**micromol/l

METABOLIC ILLNESS NON-HYPERGLYCAEMIC KETOACIDOSIS ❒ *Go to table 7*

Recognised if reduced consciousness and pH <7.3 and ketones in urine without hyperglycaemia

INTRACRANIAL INFECTION BACTERIAL MENINGITIS ❒ *Go to table 8*

Recognised clinically if neck stiffness / pain and total summed score is **8.5 or more** using the following rule:

<u>Symptom/sign</u>	<u>Score</u>
GCS ≤ 8	= 8
Neck stiffness	= 7.5
Time of symptoms	= 1 per each 24hrs
Vomiting	= 2
Cyanosis	= 6.5
Petechiae	= 4
Serum CRP	= (CRP in mg/l) / 100

or

If no neck stiffness suspect bacterial meningitis **if fever and two or more** of the following 3:

- rash
- bulging fontanelle
- irritability

INTRACRANIAL INFECTION

HERPES SIMPLEX ENCEPHALITIS (HSE) ❐

Go to table 9

Recognised clinically if reduced consciousness and **one or more** of the following:

- focal neurological signs
- fluctuating GCS >6 hours
- the child has or has been in contact with herpetic lesions

INTRACRANIAL INFECTION

ABSCESS ❐

Go to table 10

Recognised clinically if reduced conscious level and focal neurological signs +/- signs of infection and / or signs of raised ICP

INTRACRANIAL INFECTION

TB MENINGITIS ❐

Go to table 11

Recognised clinically if reduced consciousness and signs of meningitis and / or contact with pulmonary TB

RAISED ICP ❐

Go to table 12

Recognised clinically if **papilloedema** or **two or more** of the following 5:

- Reduced consciousness (U on AVPU or GCS ≤ 8)
- Abnormal pattern of respiration
- Abnormal pupils
- Abnormal posture
- Abnormal doll's eye / caloric response

HYPERTENSION ❐

Go to table 13

Recognised if systolic BP > 95th centile for age on two separate readings

PROLONGED CONVULSION ❐

Go to table 14

Recognised clinically if convulsion lasts >10 minutes

POST-CONVULSIVE STATE ❐

Go to table 15

Recognised clinically if reduced conscious level within one hour post convulsion **and** a normal capillary glucose

CAUSE UNKNOWN ❐

Go to table 16

No clinical clues to the cause **after core investigations reviewed**, consider drug ingestion, non-convulsive status, metabolic encephalopathy not presenting with hyperglycaemia / hypoglycaemia / hyperammonaemia / non-hyperglycaemic ketoacidosis, other infectious agents, inflammatory conditions – see Table 16

Have you identified all the suspected problems?

Only move on to the tables for further tests and treatments (pages 6, 7, and 8) **when ALL PROBLEMS have been considered.**

Management of all 16 identified problems

Table 1 SHOCK

Investigations

Core Investigations
and look for sepsis, trauma, anaphylaxis, heart failure

Treatment:

- Fluid bolus 20ml/kg (colloid / crystalloid) (A) and assess response (Good response = ↓ tachycardia, improved capillary refill time, ↑ urine output, ↑ GCS)
- Further fluid therapy guided by clinical response and >60ml/kg may be required (B)
- If >40ml/kg has been given consider intubation / ventilation and drugs for circulatory support

Table 2 SEPSIS

Investigations

Core Investigations and **consider:**
coagulation studies, chest Xray, throat swab, lumbar puncture (if safe*), urine culture (if urinalysis +ve), PCR meningo- / pneumococcus, skin swab, joint aspiration, thick/thin film, intracranial imaging (if no source detected)

Treatment:

- Broad spectrum IV antibiotics after appropriate cultures have been taken
- Review by experienced paediatrician within 1 hour of admission

Table 3 TRAUMA

Investigations

Imaging appropriate to examination
Consider Core Investigations if medical collapse led to cause of trauma

Treatment:

- Follow ATLS guidelines

Table 4 DIABETIC KETOACIDOSIS

Investigations

Core Investigations

Treatment:

- Follow NICE guideline for DKA in children and young people

Table 5 HYPOGLYCAEMIA

Investigations

If lab glucose result from **Core Investigations** is <2.6mmol/l then request following tests **from saved samples:**
plasma lactate, insulin, cortisol, growth hormone, free fatty acids, beta-hydroxybutyrate, acyl-carnitine profile (on "Guthrie card" or saved frozen plasma) and urine amino / organic acids

Treatment: If capillary or lab glucose <2.6mmol/l

- After Core Investigations taken:
  - child > 4 weeks old give 5ml/kg I.V. 10% glucose bolus
  - child ≤ 4 weeks old give 2ml/kg I.V. 10% glucose bolus
- Start IV infusion 10% glucose to keep blood glucose between 4 and 7 mmol/l
- Seek advice from endocrinologist / metabolic specialist for further management

Table 6 HYPERAMMONAEMIA

Investigations

If ammonia result from **Core Investigations** is >200 micromol/l then request following **from saved samples:**
plasma amino acids, urine amino acids, urine organic acids, urine orotic acid
and check coagulation studies

Treatment:

- Seek urgent advice from a metabolic specialist
- Start IV sodium benzoate (loading dose 250mg/kg over 90 mins; followed by infusion 250mg/kg over 24 hrs – both diluted in 15ml/kg 10% glucose)
- If ammonia >500 micromol/l **or** is not improving and remains between 200-500 micromol/l after 6 hours of sodium benzoate therapy, consider emergency haemodialysis

***For acute contraindications and other details regarding lumbar punctures see Table 17**

Management of all 16 identified problems

Table 7 NON-HYPERGLYCAEMIC KETOACIDOSIS

Investigations

If pH < 7.3, ketones in urine and a normal or low capillary glucose noted from **Core Investigations** then request following **from saved samples:**
plasma lactate, plasma amino acids, urine amino acids, urine organic acids

Treatment:

- Seek urgent advice from a metabolic specialist if child has non-hyperglycaemic ketoacidosis or plasma lactate >15mmol/l
- Carefully monitor fluid balance due to risk of raised ICP
- Nutrition should be re-started early to prevent catabolism

Table 8 BACTERIAL MENINGITIS

Investigations

Core Investigations and **lumbar puncture** (if safe*)

Treatment:

- Give IV dexamethasone 0.15mg/kg before / with antibiotoics (A)
- Broad spectrum antibiotics (A) – don't delay if lumbar puncture contraindicated*

Table 9 HERPES SIMPLEX ENCEPHALITIS (HSE)

Investigations

Core Investigations and **consider:** MRI scan, EEG, lumbar puncture (if safe*) for HSV PCR (A)

Treatment:

- Give IV aciclovir 10mg/kg (or 500mg/m^2 if aged 3 months to 12 years) TDS (A) – don't delay if lumbar puncture contraindicated*
- Treatment should continue for 14 days if HSE highly suspected
- If no ongoing clinical suspicion of HSE aciclovir can be stopped before 14 days

Table 10 INTRACRANIAL ABSCESS

Investigations

Core Investigations and **CT scan**

Treatment:

- Broad spectrum antibiotics after blood cultures taken
- Seek urgent advice from a paediatric neurosurgeon

Table 11 TB MENINGITIS

Investigations

Core Investigations and **lumbar puncture** (if safe*) (B)

Treatment:

- If CSF microscopy is abnormal seek urgent advice from microbiology department

Table 12 RAISED ICP

Investigations

Core Investigations and **consider CT scan** (A)

Treatment:

- Position patient's head in midline
- Tilt patient head-up 20 degrees and avoid neck lines
- Maintenance fluids should not be hypotonic (B)
- Rate of maintenance fluids to be agreed locally
- Consider intubation and maintain $PaCO_2$ between 4.0 - 4.5kPa
- Mannitol or 3% saline indications and dose to be agreed locally

Table 13 HYPERTENSION

Investigations

Core Investigations especially reviewing urinalysis, creatinine and urea, look for raised ICP, papilloedema, and check four limb BP

Treatment:

- Seek urgent advice from a paediatric nephrologist or intensivist

***For acute contraindications and other details regarding lumbar punctures see Table 17**

Management of all 16 identified problems

Table 14 PROLONGED CONVULSION

Investigations

Core Investigations if child not known to have epilepsy

If child under 12 months old request plasma calcium and magnesium (B)

Treatment:

- Follow APLS guidelines for anticonvulsant therapy
- If the **convulsion is ongoing** despite anticonvulsants, consider specific treatments for electrolyte imbalance, e.g.
  - plasma sodium <115mmol/l, give 5ml/kg of 3% saline IV over one hour
  - plasma calcium is <1.7mmol/l or ionized calcium <0.75 mmol/l, give 0.3ml/kg of 10% calcium gluconate IV over 5 mins
  - plasma magnesium <0.65mmol/l, give 50mg/kg of magnesium sulphate IV over one hour

Table 15 POST CONVULSIVE STATE

Investigations

- It may be appropriate to closely observe the child if normal capillary glucose, without performing any further tests, in the first hour
- Detailed history and exam
  If still reduced GCS after one hour perform **Core Investigations** and investigations for "**Cause unknown**" (Table 16)

Treatment:

- Treat according to history and examination findings
- If after 1 hour child has not recovered to their normal conscious level, treat as "**Cause unknown**" (Table 16)

Table 16 CAUSE UNKNOWN

Investigations

Core Investigations and if after reviewing these results the cause of reduced consciousness remains unknown request / perform the following: **CT scan, lumbar puncture** (if safe*)**, urine toxicology screen, urine organic and amino acids, plasma lactate**

If the cause is still unknown after reviewing Core Investigations results, CT scan and initial CSF results, **consider** the following: EEG (?non-convulsive status); acyl-carnitine (on Guthrie card or from saved plasma); ESR and autoimmune screen (?cerebral vasculitis); thyroid function test and thyroid autoantibodies (?Hashimoto's encephalitis)

Treatment:

- Supportive treatments to protect airway, breathing and circulation
- Start broad spectrum antibiotics and IV aciclovir
- Discuss with paediatric neurologist within 6 hours of admission

***For acute contraindications and other details regarding lumbar punctures see Table 17**

Table 17 LUMBAR PUNCTURE

A 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
- had a seizure lasting more than 10 mins and still has a GCS ≤ 12
- abnormal breathing pattern
- abnormal doll's eye response
- abnormal posture
- shock
- bradycardia (heart rate <60)
- hypertension (BP >95th centile for age)
- clinical evidence of systemic meningococcal disease
- pupillary dilatation (unilateral / bilateral)
- pupillary reaction to light impaired or lost
- signs of raised ICP

A normal CT scan does not exclude acutely raised ICP (A)

If a lumbar puncture is performed, CSF should be sent for **microscopy (B), gram staining, culture and sensitivity, glucose (B), protein, PCR for HSE (B) and other viruses**

ABBREVIATIONS

BP	Blood pressure
CSF	Cerebrospinal fluid
DKA	Diabetic ketoacidosis
GCS	Glascow coma scale

ICP	Intracranial pressure
IV	Intravenous
TB	Tuberculosis
Temp	Temperature

Useful information:

LOCAL CONTACT DETAILS (e.g. name / hospital / contact number / out of hours service):

Anaesthetist covering paediatrics =

PICU =

Metabolic specialist / Biochemist =

Paediatric neurologist =

Paediatric neurosurgeon =

Paediatric endocrinologist =

CT service =

EEG service =

Toxicology unit = Toxbase = www.spib.axl.co.uk

CORE INVESTIGATIONS

These will be requested in most children with reduced conscious level.

Bedside tests

Capillary glucose
Blood gas (capillary / venous / arterial)
Urinalysis (dipstick)

Laboratory tests	**Request form** (what to write)	**Bottle (top colour)**	**Volume of sample**
Clinical chemistry	Glucose Urea, electrolytes, and creatinine Liver function tests Ammonia Saved sample plasma and serum (separated and frozen)	Fluoride oxalate(grey) Lithium heparin (green) Plain (red) Your labs may use different coloured bottles or require different volumes	0.5ml 2.5ml 1.0ml
Haematology	FBC	EDTA (pink)	0.5ml
Microbiology	Blood culture and sensitivity	Culture bottle	0.5ml
Clinical chemistry	Urine save and freeze sample	Urine plain container	10ml urine if possible

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 *Continuous infusion:* 250mg x wt (kg) add this to	 15ml x wt (kg) 10% Glucose 15ml x wt (kg) 10% Glucose	 Infuse whole volume over 90 minutes Infuse whole volume over 24 hours	
Sodium Phenylbutyrate	*Loading dose*: 250mg x wt (kg) add this to *Continuous infusion:* 250mg x wt (kg) add this to	 15ml x wt (kg) 10% Glucose 15ml x wt (kg) 10% Glucose	 Infuse whole volume over 90 minutes 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

Pharmacy information

Contact details =
Out of hours service =

Location of drugs for infusions

Drug	Emergency availability of drug (e.g. ward / pharmacy)
Adrenaline / Epinephrine	
Noradrenaline	
Dopamine	
Dobutamine	
Morphine	
Midazolam	
Fentanyl	
Ketamine	
Sodium Benzoate	
Sodium Phenylbutyrate	
Magnesium sulphate	
Calcium gluconate	
30% saline (sodium chloride)	
Mannitol	
Thiopental Sodium	

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