

Clinical Guidance

Paediatric Critical Care: Acute Liver Failure

Summary

This is for staff to use to provide guidance regarding the management of children with acute liver failure on Paediatric critical care and on retrieval. It discusses areas for considerations and offers treatment advice.

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Owner	Clinical Lead, Sara Hanna
Author(s)	Jon Lillie, PICU Consultant
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<p>This clinical guideline has been produced by the South Thames Retrieval Service (STRS) at Evelina London for nurses, doctors and ambulance staff to refer to in the emergency care of critically ill children.</p> <p>This guideline represents the views of STRS and was produced after careful consideration of available evidence in conjunction with clinical expertise and experience. The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient.</p>	

Change History		
Date	Change details, since approval	Approved by

Acute Liver Failure

Advice on assessment and management of liver failure.

Definition

Multi-system illness with severe derangement of liver function

- Coagulopathy (INR>2) OR
- Coagulopathy (INR>1.5) AND Encephalopathy
- Within 8 weeks of liver insult

Causes¹: Infective, metabolic, drugs, auto-immune, vascular, ischaemic, infiltrative unknown > 50%)

Grading Encephalopathy²

- 1: Confused, mood changes
- 2: Drowsy, inappropriate behaviour
- 3: Stuporous, sleepy but rousable
- 4a: Comatose but rousable to pain
- 4b: Deep coma, unrousable (Encephalopathy rare in children)

Poor Prognostic Indicators:²

- INR>4 despite 1 dose of vitamin K
- Any coagulopathy in neonates
- Under 5 years old
- Bilirubin \geq 235 micromol/l
- Grade 3/4 coma in Paracetamol overdose
- WBC $> 9 \times 10^9/l$
- Elevated lactate

NB Fixed dilated pupils may be reversible

Transfer early before uncontrolled bleeding & encephalopathy

Contact King's PICU 0203 2993660 Or

Rays of Sunshine Ward 0203 2993577

Ask for Kings Liver Registrar (bleep 427)

Resuscitation and routine management:

Baseline investigations FBC, glucose, U&E, baseline coagulation tests, Blood gas, lactate, Bilirubin and Liver function tests, Ammonia, blood cultures & CXR

Management Ensure frequent re-evaluation of patient and baseline investigations

- High flow oxygen
- Standard fluid resus (20 ml/kg aliquots) titrated to CVS response
- Intubate if pulmonary oedema, fluid refractory shock (>60ml/kg), or encephalopathy Grade 2 and above
- Insert orogastric tube
- 60% maintenance with 0.9% sodium chloride and 5%/10% glucose
- **AVOID** hypotonic fluids (\uparrow risk hyponatraemia & cerebral oedema)
- Site urinary catheter to monitor urine output (risk of renal failure)
- Central line if on inotropes, femoral or internal jugular not subclavian (bleeding risk). Optimise clotting before procedure
- IV Cefuroxime, Amoxicillin, Fluconazole in all patients, IV Aciclovir in neonates. Seek advice from microbiology in penicillin allergy
- Sedate with morphine / midazolam infusion as required if intubated
- Discuss with pharmacy regarding drugs metabolised by liver

Intubation:

Consider intubation if > Grade1 Encephalopathy

- 3 ml/kg 2.7% sodium chloride pre-induction if encephalopathic
- Muscle relaxation to intubate,
- Use oral tracheal tube (coagulopathy).

Ventilation:

- PEEP \geq 5cmH₂O for SpO₂ \geq 96%, ETCO₂ 4 to 5cmH₂O

Fluid refractory shock:

- Noradrenaline is first line vasopressor (warm shock)³
- Add dopamine/adrenaline if poor cardiac function
- Consider 2mg/kg IV hydrocortisone

Encephalopathy:

- Intubate if encephalopathy Grade 2 or more
- Maintain ETCO₂ 4 to 5 cmH₂O (ETCO₂ monitoring mandatory)
- Osmotherapy 2.7% sodium chloride (1-2 mmol/kg) or **Mannitol** 0.5g/kg
- Treat seizures: APLS, Load with IV Phenytoin 20mg/kg.
- Target mean arterial pressures:
 - > 65 mmHg if over 4 years
 - > 60 mmHg if under 4 years
 - >50mmHg if <1yr,

Management of Raised ICP: Assume raised if:

- Hypertensive, bradycardic or dilated pupil(s)
- Bolus 3 ml/kg 2.7% sodium chloride. Hyperventilation if ICP crisis

Hypoglycaemia:

Target blood glucose is 4 to 7 mmol/l. If < 4 mmol/l:

- (i) Bolus 5ml/kg 10% glucose
- (ii) Increase glucose concentration in maintenance, give centrally if > 12.5% glucose, to a maximum of 25%

Avoid repeated boluses of glucose (risk of rebound hypoglycaemia)

Calculate glucose requirement in mg/kg/min

Glucose mg/kg/min = (%Glucose x ml/hr) / (6 x weight)

Coagulopathy:

- IV Vitamin K (Phytomenadione) 1mg/kg, maximum 10 mg
- FFP e.g. Octoplas 10 ml/kg. Platelets 15 ml/kg, Cryoprecipitate 5ml/kg
- Consider recombinant factor VIIa 80 micrograms/kg in persistent haemorrhage² (Fibrinogen must be >1g/L)

GI Haemorrhage:

- IV/NGT pantoprazole/ omeprazole or ranitidine
- Consider variceal bleed & get Surgical consultation
- **Octreotide** Bolus 1 microgram/kg then infusion 1 to 3 micrograms/kg/hr (start at DGH if suspected variceal bleed)
- Place Sengstaken tube if available & competent staff (usually surgeon)

Renal Impairment:

- Causes: Shock, GI haemorrhage & hepatorenal syndrome
- Maintain urine output > 1ml/kg/hr with: standard fluid challenge and frusemide 1 mg/kg IV
- Correct hypokalaemia, low Calcium or Magnesium

Paracetamol overdose (see local guideline)

Advice from: **GSTT toxicology** or **TOXBASE** 0344 8920111

N- acetyl cysteine should be commenced as follows:

- **Single point ingestions:** Plot timed paracetamol concentration on treatment nomogram, based on risk stratification
- **Staggered ingestions:** Treat if more than 150mg/kg per 24 hours has been ingested (75mg/kg if high risk i.e. malnutrition/ chronic diseases, therapeutic use of inducers such as phenobarbitone, phenytoin or chronic alcohol excess.)

Remember recommended fluid volumes for administration with NAC may need to be reduced in young individuals

NAC should be continued at 150mg/kg/24hrs in those with evidence of acute liver/ kidney failure or deranged coagulation.

Discuss all cases with toxicology consultant on call

References

1. PALF Study Group. J Pediatr 2006. Squires
2. Pediatr Emerg Care 2007. Cochran et al
3. KCH Guideline. 2004
4. Ind J Ped. 2006. Bansal et al