

Management of hyperammonaemia in retrieval

1. Overview / Description

Infants or children with known or suspected metabolic disease who are referred to PIPER comprise a complex and heterogenous group of patients who require rapid targeted triage. Regardless of whether or not the referral comes from a health service, RCH metabolic team member or other source the first priority is to identify patients who require a time critical transfer to RCH as the statewide metabolic centre. This enables mobilisation of a retrieval team at the earliest opportunity. ***These circumstances are most applicable to babies previously undiagnosed who present with signs that may be due to hyperammonaemia.*** In this context all initial actions must directly and substantively contribute to:

1. Minimising the time from referral to commencing haemofiltration in the RCH PICU where there is significant risk that this will be required. This risk is based on *either* clinical suspicion or a laboratory result such as serum ammonia.
2. Providing general and specific stabilisation advice and interventions that are feasible and practical in the specific context of the referral (limitations of the retrieval environment and referring hospital capability – clinical, laboratory, pharmacy)

A 2 day old baby with prominent vomiting, lethargy and a respiratory alkalosis is referred to PIPER from a regional health service 90 minutes from Melbourne. The presentation is suggestive of a metabolic condition that may be associated with hyperammonemia. PIPER provides immediate stabilisation advice and immediately mobilises a retrieval team as it will take at least 1 hour to get the ammonia result. PIPER takes sodium benzoate from its imprest supply on these retrievals. The Metabolic team are briefed on the referral. Management is tailored to the ammonia result when it becomes available.

Patients with **known** metabolic disease are complex patients who often have individualised treatment plans in place. Early involvement of the metabolic team in these referrals is essential. As part of optimising patients in the acute decompensation phase, the metabolic team may advise specific samples of urine or blood, alterations to feeds, and specific glucose infusion rate targets and specific medications.

2. Related Documents

[RCH CPG – Metabolic disorders](#)

[RCH Pharmacy – Intravenous Sodium Benzoate Infusion Protocol](#)

[RCH Pharmacy - Arginine Medication Guideline](#)

[Paediatric Intensive care guidelines – metabolic hyperammonaemia](#)

[Safer Care Victoria – Metabolic disease in neonates](#)

[PIPER Paediatric 'Go Now' Criteria](#)

3. Definition of Terms

Metabolic Disease	Metabolic disorders or inborn errors of metabolism (IEM) result from a block (partial or complete) to an essential pathway in the body's metabolism. There are a large number of conditions included in this group of disorders
Hyperammonaemia	Excess ammonia in the blood

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Haemofiltration Haemofiltration is a form of Continuous Renal Replacement Therapy (CRRT). It uses an extracorporeal circuit to pump blood through a filter with a highly porous membrane to remove excess body water and/or metabolic waste products from the intravascular compartment.

4. Responsibility

All PIPER Medical and Nursing staff

5. Procedure

5.1 Assessment of hyperammonaemia

See [metabolic clinical practice guideline](#) and [paediatric intensive care guidelines](#)

5.1.1 Ammonia is a direct neurotoxin which can present with encephalopathy, tachypnoea or respiratory alkalosis.

5.1.2 Ascertain during the referral call the referring hospital's capability to provide an urgent ammonia assay.

When sending a sample for ammonia, get a free flowing sample where possible, send on ice, and ensure laboratory are aware **the test is urgent and request that the result is rung through to the clinician caring for the patient**. There have been unnecessary delays in treatment due to poor communication with laboratory staff.

5.2 Priorities of care for suspected or known hyperammonaemia

5.2.1 Call PIPER to activate a retrieval team.

PIPER will contact metabolic team to ensure they are included in ongoing assessment and management

5.2.2 Continue to deliver protein free calories prior to and during transfer

Note: Sick newborns will be nil orally and managed with IV 10% dextrose

- Where illness acuity does not preclude the use of enteral feeds, advise the referring hospital to give protein free feeds such as energivit or polyjoule if available with specific instructions from the Metabolic Team.
- If protein free feed is not available locally or if enteral feeding is contraindicated use 10% /12.5% /15% dextrose; deliver at maintenance rate at a minimum.
- Aim for a glucose infusion rate of 6- 8mg/kg/min.
- Consider IV lipid infusion if available and feasible

5.2.3 Reduce ammonia level

In infants and children with a metabolic cause for hyperammonaemia the following are suggested thresholds:

Note that treatment thresholds differ for different diseases (e.g. liver failure 100mcmol/L).

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Serum ammonia >150 micromol/L

PIPER retrieval team activated immediately

- PIPER involve metabolic team
- Destination: Plan PICU admission to minimise delays if the risk of requiring haemofiltration is significant.
- Advise referring hospital to provide protein free calories as above.
- PIPER take sodium benzoate to referring hospital. Doses must be authorised by a Metabolic physician. **Sodium benzoate is a high-risk medicine; overdose may be fatal.**
- The loading dose of sodium benzoate loading dose is 250mg/kg IV. Refer to the RCH Sodium Benzoate Infusion Protocol for further instructions. **Contact the Pharmacy department to check dose calculations and volume to be administered prior to administration.**

Note: Patients with hyperammonaemia are at risk for cerebral edema and total fluid intake needs to be adjusted accordingly, as sodium benzoate is administered in a dilute solution. A second IV is required for benzoate administration.

- The metabolic team will Inform Pharmacy of therapies that may be required on return to RCH that are manufactured in the Pharmacy Sterile Room. These include IV sodium benzoate doses, IV arginine, carglumic acid, and RCH Haemofiltration solution for patients under the age of 2.
- Institute neuroprotective measures: normothermia, normal sodium, avoid hypoglycaemia

Pharmacy contact details:

- Monday - Friday during opening hours, contact RCH PICU pharmacist on 52781
- Weekends and public holidays during opening hours, contact the dispensary on extension 53525.
- After hours, contact the on-call pharmacist via switchboard.

Serum ammonia > 250 micromol/L

- In addition to the steps above for serum ammonia above 150 micromol/L:
- PICU, with input from metabolic team, may prepare other medications to reduce ammonia on arrival (arginine, carglumic acid)
- PICU, with input from metabolic team, prepare for haemofiltration

Serum ammonia > 400 micromol/L

- In addition to above measures for serum ammonia >250
- If anticipated delay in transfer >1 hour consider 3% saline 3ml/kg / mannitol 0.5g/kg

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- **PICU, with input from the metabolic team, plan to start haemofiltration as soon as possible in patients:**
 - Who are encephalopathic
 - With serum ammonia >400 micromol/L
 - With serum ammonia rising more than 50micromol/L/hr or not stabilising within 3 hours

If ammonia >1000mcmol/L

- As above
- A decision of whether to offer treatment or palliative care is usually made in conjunction with the metabolic team after the patient has been assessed at RCH.
- The PIPER team should be deployed in the first instance, and can be recalled if the patient is palliated

5.3 Pharmacological Therapies in retrieval

5.3.1 Sodium benzoate

Please refer to the [Sodium Benzoate guideline on the RCH Medicines Information](#) page which can provide safe and clear instructions on proper dilution and administration. A printed copy of this is stored with the medication in the PIPER drug room

5.3.2 Second tier therapies

These do not need to be brought on transport, will be guided by the metabolic team in preparation for arrival at RCH.

Contact the RCH PICU Pharmacist (52781) 0830 – 1700 Monday - Friday / on call pharmacist after hours to assist / with attaining these medications, otherwise they can be found in the following locations:

References

This Guideline has been established by PIPER in consultation with the RCH metabolic team, RCH pharmacy and RCH Paediatric Intensive care.

6. Disclaimer

The Paediatric, Infant Perinatal Emergency Retrieval (PIPER) Neonatal and Paediatric guidelines were developed by PIPER clinicians for the sole use within the PIPER service at The Royal Children's Hospital Melbourne.

The authors of these guidelines have made considerable effort to ensure the information upon which they are based is accurate and up to date. Users of these guidelines are strongly recommended to confirm that the information contained within them especially drug doses is correct by way of independent resources. The authors accept no responsibility for any inaccuracies or information perceived as misleading.

7. Appendices

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8. End of Document
