CPG: METABOLIC HYPERAMMONEMIC ENCEPHALOPATHY

Monroe Carell Jr. Children's Hospital at Vanderbilt

Inclusion Criteria: Rapidly rising ammonia (50 mcmol/L/hour) and/or ammonia >300 mcmol/L and acute encephalopathy

Exclusion: Hepatic Encephalopathy

Patient with high ammonia or rapidly rising ammonia and acute encephalopathy identified.

STAT Admit to ICU*

Place STAT Consults (even if pre-admission):

- Genetics
- Nephrology
  - ICU to Call E1 (615-775-5861) to notify need for CRRT STAT
- Surgery/IR if needed for vascath/CVL placement (All NICU patients, PICU patients < 2 kg)

Treatment:

- Start D10 NS or D10 1/2 NS IVF (based on gestational age, avoid LR) at 1.5x MIVF STAT
- Stop all protein intake
- Send initial STAT lab work up**
- Order blood for CRRT blood prime
- If recommended by Genetics team, start Ammonul bolus and/or Arginine (ok to use PIV while obtaining CVL)
- STAT placement of vascath and CVL
- **If hemodynamically unstable, consider ECMO**

CRRT:

- Goals: ammonia levels decrease by 50 mcmol/L/hour OR halved by 3 hours
- Send ammonia immediately before going on CRRT to monitor rate of decrease
- Call Nephrology STAT if ammonia is not decreasing as expected

Discontinuation of CRRT:

- Remain on CRRT until ammonia normalizes and discontinuation approved by Genetics/Nephrology
- Discuss restarting Ammonul with Genetics prior to weaning off CRRT
- Consider decreasing CRRT flow rates to evaluate for rebound effect

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BACKGROUND

Genetic conditions with hyperammonemia causing metabolic encephalopathy are rare but high-risk events. Timely effective clearance of ammonia can drastically improve patient outcomes. Length and peak of hyperammonemic states have a direct correlation to neurologic prognosis.

OBJECTIVES

- Multidisciplinary coordination for timely ICU admission and initiation of CRRT which requires:
  - CVL and Vascath placement (size recommendation on table 1)
  - Nephrology consult for CRRT orders
  - Genetics consult for diagnostic evaluation and decisions regarding alternative/adjunct therapies
  - Mobilization of ECMO team, pharmacy and blood bank for CRRT initiation
- Close monitoring to ensure CRRT rapidly improving ammonia levels
- Team discussion concerning diagnosis and plan to discontinue CRRT

***Admit to ICU:** All in-born and NICU to NICU transfers to the NICU. Outpatients, ED, or PICU transfers to the PICU.

****Lab Evaluation:**

Initial labs:

- ICU labs (STAT on admission): blood gas, CBC, CMP, ammonia, lactate, PT/INR/PTT/fibrinogen, type and screen/ABO screen
- Genetics labs pre-CRRT: quantitative plasma amino acids, urinalysis, urine orotic acid, urine organic acids, NBS (if newborn), acylcarnitine profile, pyruvate and lactate, CK, Homocysteine

Scheduled labs:

- At least Q2h STAT ammonia while on CRRT (unless told to space by genetics)
- Q1h POC glucose initially, space once stable
- Q4H blood gases, BMP, Mg, Phosphorus- space to q6H once stable
- Daily CBC, CMP, PT/PTT/INR, Fibrinogen, triglycerides, plasma amino acids

CRRT Considerations:

- CVVHD preferred modality of ammonia removal[5]
- Recommend to warm dialysate to assist with hemodynamic stability[5]
- If ammonia not decreasing by 50 mcmol/L/hr on CRRT, discuss with nephrology if able to increase solute clearance. (*Typical CRRT settings would be blood flow (Qb) of 30 ml/min and dialysate flow (Qd) of 1000 ml/hr in neonates; while larger pediatric patients may have initial settings for Qb of 4-6 ml/min/kg and Qd of 4000-8000 ml/hr/1.73 m2*)
- Consider decreasing CRRT flow rates to evaluate for rebound effect before discontinuing dialysis

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Table 1. Recommended Temporary Dialysis Catheter Sizes Based on Patient Weight

Patient size	Catheter size	Site of insertion
Neonate	Dual-lumen 7.0 F	Internal jugular, femoral, or subclavian vein
3–6 kg	Dual-lumen 7.0 F Triple-lumen 7.0 F	Internal jugular, femoral, or subclavian vein
6–30 kg	Dual-lumen 8.0 F	Internal jugular, femoral, or subclavian vein
>15 kg	Dual-lumen 9.0 F	Internal jugular, femoral, or subclavian vein
>30 kg	Dual-lumen 10.0 F Triple-lumen 12.0 F	Internal jugular, femoral, or subclavian vein

Bridges et al: Pediatric renal replacement therapy in the intensive care unit. Blood Purif 34:138-148, 2012.

*2-3 kg: recommend dual lumen 7.0F

**< 2 kg: consult surgery for vascath placement

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