**PCCL Session: Summary Report and Resources**

**PCCL session topic: "*Electro-Frights! Biochemical derangement in a sick baby*"**

**Date: November 21, 2025**

**Learning objectives:**

1. Recognize and manage hypovolemic shock in a neonate, emphasizing early identification.
2. Discuss the assessment and management of hyperkalemia with a focus on practical, coordinated interventions across disciplines.
3. Identify symptoms of hyponatremia and implement treatment approaches.

**Case:**

- Patient Demographics: 6-week-old male admitted one week ago for presumed UTI, was febrile and culture sent (negative nasal swab, blood culture, CSF).
    - History of cows' milk protein allergy (CMPA)/ food protein induced allergic proctocolitis (FPIAP), exclusively breast fed with mom on dairy/soy-free diet.
    - Had received 2 days of cefotaxime and then 2-3 days of meropenem for low colony count Klebsiella aerogenes and Enterococcus faecalis in urine.
    - Saline locked peripheral IV for 24 hours prior as was feeding well.
- Focused History of Presenting Illness: On day of transfer, parents had concerns regarding poor colour, lethargy, abnormal gaze. Had received 10mls/kg NS bolus from day team and maintenance fluids restarted
    - Patient handed over to presenter at 5PM.
    - Called by bedside nurse due to concerns of clinical status and abnormal labs. Asked for a repeat lytes and a STAT blood gas.
- Investigations:
    - Labs
        - **Sodium 122, Potassium 7.9, Chloride 94, Carbon dioxide 18**
        - STAT gas: pH 7.18, pCO2 56, HCO3 21, BE -8, Sodium 127, Potassium 8.6, Lactate 5.5
- Progression: Vitals HR 145, RR 40, 99% RA, 103/74
    - Patient appears grey, mottled, could not blanch skin to obtain cap refill, intermittent eye rolling to back of head, LOC abnormal.
    - Review showed patient has had copious watery stools throughout the day. Urine output was likely interpreted as stool. Calculated 600-800ml stool output over about24 hours
    - Weight down 500 grams from 48 hours ago.
- Logistics:

- Location: Transfer patient to adult ICU with NICU and pediatric support staff. ITT is enroute.
- Access: Systemically shut down and unable to get second IV. Call ED physician to assist with IO insertion.
- Accurate ins and outs: Foley catheter insertion.
- Lab gathering: Requiring q30 minute gases ongoing. Issues with lab vs POC monitor vs RT monitor.

- Initial Management:
  - Hypovolemia
    - 20ml/kg normal saline bolus (x2) for perfusion and hypovolemia
    - Calculate fluid deficit and increase D10NS maintenance fluids (from 15ml/hr to 43ml/hr = 4 mls/kg to 10 mls/kg)
    - Monitor ongoing losses and replace as needed. Insert foley catheter for accurate ins and outs. Replace 1:1 stool output q4H with NS
  - Hyponatremia
    - 3% sodium chloride bolus (x2) for acute hyponatremia and treatment of associated seizures (vs benzo)
    - Colleague had done lytes day prior, so we knew this was an acute change that could be corrected fast
  - Hyperkalemia
    - Calcium Gluconate - 0.5 mL/kg/dose (50 mg/kg/dose) IV push over 10 min Max 3000 mg/dose. May repeat dose in 5 minutes if ECG changes persist.
    - Salbutamol continuous nebulization (already started)
    - Initiate insulin bolus and infusion with D10NS maintenance fluids
    - Sodium bicarbonate infusion *no benefit reported when used for hyperkalemia in non-acidotic patients.
- Progression: ITT arrival - Examination: HR 189, RR 39, 100% on RA. Cap refill 2-3 sec. Alert, colour improved, mild mottling (baseline for him). Slightly increased peripheral tone. Otherwise, normal examination. Perfusion had improved and obtained a second IV
  - Second Nasopharyngeal Swab - +entero/rhinovirus
  - Fluids: D10NS decreased to maintenance fluids at 15ml/hr. NS replacement fluids at 45ml/hr (as lost 140mL stool during our resuscitation). Urine at 18mL over 2ish hours (this is approx 1 ml/kg/hr for this patient output)

**Learnings:**

This case illustrates that in unstable infants, management often focuses on treating life-threatening derangements first, even without a definitive diagnosis. Multifactorial causes are common, and rapid shifts in physiology can create atypical presentations.

**Severe Infant Diarrhea, Shock, and Electrolyte Disturbance Case**

- Clinical Assessment & Initial Priorities

- Rapid classification of illness severity was crucial: the infant presented in hypovolemic shock, with multiple life-threatening electrolyte abnormalities (hyperkalemia, hyponatremia), profound diarrhea, and metabolic acidosis.
- In early management, clinicians must: Stabilize airway/breathing/circulation and identify immediately dangerous issues even without a full diagnosis.

    - Pathophysiology of Severe Diarrhea in Infants

- Massive fluid and electrolyte losses occur with infant diarrhea:
    - Loss of water, sodium, potassium, magnesium, bicarbonate.
    - Bicarbonate loss + unmeasured anions (propionate, acetate, butyrate) → metabolic acidosis.
    - Poor perfusion from hypovolemia → ↑ lactate → worsened acidosis.
    - Hypovolemia → AKI and reduced GFR → impaired acid clearance.

- Understanding Hyperkalemia
    - Hyperkalemia in diarrhea is uncommon (~5%).
    - The working explanation: extremely rapid onset of hypovolemia + acidosis → intracellular $K^+$ shifts to extracellular space before renal excretion could compensate.
    - The absence of persistent kidney injury supports a shift phenomenon, not primary renal failure.
- Hyperkalemia Management
    - Calcium gluconate preferred in less monitored or low-resource settings due to safer tissue profile (decreased risk with extravasation) vs. calcium chloride.
        1. Calcium thought to stabilize cardiac membrane; first line treatment in the setting of ECG changes in hyperkalemia
        2. Salbutamol - shifts potassium intracellular (temporizing measure)
        3. Glucose & Insulin - shifts potassium intracellular (monitor for hypoglycaemia)
        4. HCO3 - useful in the setting of acidemia to further shift potassium intracellular. Not useful if not acidemic.
    - Bolus dosing often necessary when IV access is limited due to incompatibility of Ca with many medications and infusions
    - Importantly: Calcium is only required if ECG changes or arrhythmias are present. Infants often tolerate elevated $K^+$ better than adults.

**Diagnostic Uncertainty & Multifactorial Etiology**

- No single cause can always be identified. For example, in this case the patient had:
    - Mild underlying gut vulnerability (e.g., possible non-IgE cow's milk protein sensitivity).
    - Recent enterovirus infection Enteroviruses are common in infants and can cause systemic illness, feeding intolerance, and GI symptoms even when PCR is negative (due to timing or sampling issues).
    - Broad-spectrum antibiotics like meropenem significantly alter gut microbiota diversity and composition, reducing beneficial bacteria and increasing pathogenic species. This can persist for weeks after treatment, impairing gut resilience and recovery. Volume depletion, impaired gut lining, and feeding intolerance all compounded severity.

- Key takeaway: In complex pediatric presentations, multifactorial explanations are common and acceptable (immune immaturity, microbiome disruption, infection, feeding practices, and environmental stressors).

**Communication With Distressed Parents**

- Managing parental distress in a high-acuity situation where emotions run high and time is critical.
- Effective strategies:
    - Acknowledging parental concerns with empathy: *"I hear you," "I can see how frightening this is."*
    - Reframing urgency: Emphasizing that immediate action is required now, with reassurance that questions will be addressed as soon as it is safe to do so.
    - Maintaining calm and steady communication. Using a slow, grounded tone to help regulate distress.
    - Avoiding premature discussions of prognosis. Prevents escalating fear and allows the team to focus on immediate stabilization.
    - Providing clear, simple explanations. Avoiding medical jargon and offering brief, honest updates.
    - Setting expectations: Explaining what parents will see next (e.g., monitors, procedures, team members entering the room).
    - Assigning a dedicated team member for family support.
    - Validating emotions without confirming worst-case fears
    - Offering choices when possible: Even small decisions can help restore a sense of control.
    - Repeating information as needed. Recognizing that distress limits information processing.

**Resources:**

- Management of Acute Severe Hyperkalemia
- IO Access
- Infusion Guidelines (Spodium Bicarbonate and Calcium Gluconate infusion)
- Insulin Dosing for Treatment of Hyperkalemia
- Virtual Support Pathways
- Critical Care Outreach RN and RT
- Weight based drug sheets

Here's how to **bookmark the Pediatric Critical Care Resources Website as a shortcut on your smartphone home screen**, depending on your device and browser:

📱 **For iPhone (Safari Browser):**

1. **Open Safari** and go to the website you want to save.
2. Tap the **Share icon** (square with an arrow pointing up) at the bottom of the screen.
3. Scroll down and tap **"Add to Home Screen."**
4. You can edit the name if you like, then tap **Add**.
5. The shortcut will appear on your **Home Screen** like an app icon.

☑ *Only Safari supports this on iPhone (not Chrome or Firefox).*

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🤖 **For Android (Chrome Browser):**

1. Open **Google Chrome** and go to the website.
2. Tap the **three-dot menu** in the upper-right corner.
3. Tap **"Add to Home screen."**
4. Edit the name if desired, then tap **Add.**
5. Confirm by tapping **Add automatically** or drag it to your preferred location.

☑ *Works with most Android devices using Chrome. Firefox has a similar option under its menu.*

The resources shared throughout this session are for reference purposes only. Please consult your health authority leaders for guidance on adoption and use of these resources within your local context. The advice provided during the PCCL sessions is not intended to replace the clinical judgment of the healthcare providers who are with the patient. While PCCL sessions may suggest recommendations, the final decisions regarding a child's care and treatment should always rest with the healthcare professionals involved in their care at both the referring and receiving centres.
If you need additional in the moment support refer to the Provincial Real Time Virtual Support Pathways: If you need additional in the moment support refer to the Provincial Pediatric Virtual Support Pathways: https://childhealthbc.ca/pcc/provincial-pediatric-virtual-support-pathways