PCCL Session: Summary Report and Resources

PCCL session topic: "When Drugs Mean Bugs: Immunosuppression and Septic Shock"

Date: September 19, 2025

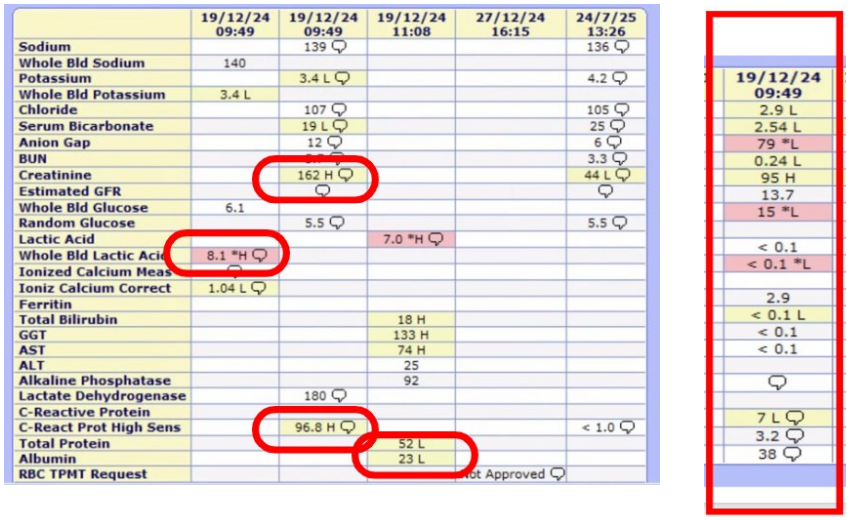
Learning objectives:

1. Review a structured approach to starting pressors in the management of refractory septic shock.
2. Discuss intubation in refractory shock and identify peri-intubation strategies to reduce risk
3. Summarize the role for blood products in septic shock

Case:

- Setting the stage: Large urban centre with 24/7 pediatric support, no PICU. Adult anesthesia, ER physicians, pediatric trained nurses, and onsite ER pharmacist
- Patient Demographics: 14-year-old female, 57kgs, immunizations up to date
- Focus History of Presenting Illness:
    - Systemic Lupus Erythematosus (SLE) diagnosed within 6 months of presentation
    - Started on Azathioprine and Prednisone 1 month ago, weaning prednisone dose
    - 1 day history of non-bloody non-bilious emesis and diarrhea, abdominal cramping, headache, sore throat and dark urine
    - Syncopal episode upon standing in AM, EHS found bp to be 45/30 mmHg and gave a 700 ml bolus and brought to the ER

- Presenting Vital Signs and Physical Exam:
    - Vitals at presentation: BP 62/39, HR 98, improved to 105/55 with HR 134 but drifted back to 80/44 over the next hr. Normal Sats 97% on RA, RR 24. Temp 38.4C
    - Mild suprapubic abdominal tenderness. Brisk cap refill. Weak appearing, GCS 13-15, fluctuating with BP. Normal S1/S2, GAEB no WOB or adventitious sounds, no rashes no edema. Bounding pulses
- Investigations: Normal Chest Xray
    - Bland Urine
    - Blood cultures pending → + *Serratia marcescens* (gram negative) at <12 hours



	19/12/24 09:49	19/12/24 09:49	19/12/24 11:08	27/12/24 16:15	24/7/25 13:26
Sodium		139			136
Whole Bld Sodium	140				
Potassium		3.4 L			4.2
Whole Bld Potassium	3.4 L				
Chloride		107			105
Serum Bicarbonate		19 L			25
Anion Gap		12			6
BUN		[illegible]			3.3
Creatinine		162 H			44 L
Estimated GFR					
Whole Bld Glucose	6.1				
Random Glucose		5.5			5.5
Lactic Acid			7.0 *H		
Whole Bld Lactic Acid	8.1 *H				
Ionized Calcium Meas					
Ioniz Calcium Correct	1.04 L				
Ferritin					
Total Bilirubin			18 H		
GGT			133 H		
AST			74 H		
ALT			25		
Alkaline Phosphatase			92		
Lactate Dehydrogenase		180			
C-Reactive Protein					
C-React Prot High Sens		96.8 H			< 1.0
Total Protein			52 L		
Albumin			23 L		
RBC TPMT Request				Not Approved	

19/12/24 09:49
2.9 L
2.54 L
79 *L
0.24 L
95 H
13.7
15 *L
< 0.1
< 0.1 *L
2.9
< 0.1 L
< 0.1
< 0.1
7 L
3.2
38

- Initial Management:
  - 2nd IV placed in ACF, Second 500ml fluid bolus initiated, BP improves 105/55
  - Septic panel and cultures drawn and Ceftriaxone administered
  - Within 30 min BP drops 80/44, Hb returns 82 (previously known 132)
  - Blood transfusion initiated: 1 unit of unmatched O-negative pRBCs
  - Pharmacy + 3rd nurse work to mix pressors, epinephrine, norepinephrine, and hydrocortisone
  - **E**pinephrine infusion started and titrated up to a max of 1.1 mcg/kg/min while awaiting other infusions
- Progression: Pediatrician on phone with BCCH PICU
  - BP systolic drops to 49, patient becomes drowsier GCS 12
  - **H**ydrocortisone 100mg given IV
  - Ongoing hypotension so norepinephrine infusion started at 0.3mcg/kg/min, BP stabilizes at 80s/40
  - Adult anesthesia called to place an arterial line for BP monitoring
  - Antibiotics broadened to Pip-Tazo
  - Discussion re securing the airway to assist hypotension but concerns re: sedation

Learnings:

Intubation in Refractory Shock – Pediatric Considerations

Early intubation is recommended in children with refractory shock to secure the airway and optimize overall management. While intubating a hemodynamically unstable child can be daunting, anticipation and preparation is key to ensuring safety and control. Do not rely on a normal GCS for reassurance—neurologic decline is a late finding, and delaying intubation until mental status worsens may be too late.

Rapid Sequence Intubation (RSI) Induction

- Goal: Safe, rapid intubation with minimal hemodynamic compromise. Patients in shock have slow circulation times, which means the medications administered for sedation and paralysis reach their end organs slower –it takes longer to sedate and longer to paralyze, while potentially

having a greater impact on BP, hence the REDUCED sedative dose recommendation. At the same time, the muscle relaxant delivery to the muscle receptor is also delayed and requires FULL dosing to ensure optimal intubating conditions – a fully paralyzed patient.

  - Use reduced-dose sedative agent for induction to reduce the risk of hypotension
  - Use FULL dose of muscled relaxant to improve the chances of a fully paralyzed patient

- *Recommended:* Half-dose ketamine with a full-dose muscle relaxant to ensure full paralysis and facilitate first-pass intubation success.
- Manage post-intubation hypertension with analgesia/sedation (e.g., fentanyl, ketamine) once the airway is safely secured.
- Multifactorial risk of hypotension with intubation due to sedatives and change in hemodynamics with positive pressure. Consider starting vasoactive infusion prior to intubation and have bolus fluid and low-dose push epinephrine ("spritzer epi") available.

Post-Intubation Sedation

- Prioritize agents that maintain hemodynamic stability.
- *Avoid:* Propofol (bolus or infusion), midazolam boluses.
- *Preferred:* Ketamine PRN, morphine or fentanyl infusions. Ketamine infusion is also appropriate.
- Midazolam infusion may be considered once stable, but boluses remain contraindicated.
- Use institutionally familiar agents/protocols, ensuring alignment with the patient's hemodynamic status.

Vasoactive Medications

- *Epinephrine* is often the preferred first-line agent in pediatric septic shock, given the high frequency of associated myocardial depression.
- *Norepinephrine* may be added if tachycardia becomes excessive on epinephrine or if the patient does not respond to adequate dosing.
- In children and teenagers presenting with warm, vasodilated shock, norepinephrine can be considered as a first-line agent.
- Do *not delay initiation* of vasoactive support while waiting for central access—vasoactive agents can be safely started via peripheral IV or IO.

Fluid and Blood Product Resuscitation

- Any available crystalloid can be used for initial resuscitation; there is no evidence of superiority.
- If available, *balanced crystalloids* (e.g., Plasmalyte or lactated ringers may be preferred over high-chloride solutions to reduce the risk of hyperchloremic metabolic acidosis.
  - LR is incompatible with some antibiotics, eg ceftriaxone and piperacillin-tazobactam, check compatibility before co-administering with any medications.

- *Blood products*:
    - PRBC transfusion should be considered in non-bleeding patients with septic shock if hemoglobin is ~70 g/L after adequate fluid resuscitation, to improve oxygen delivery.
    - Other products (e.g., platelets, plasma) should be guided by coagulation studies and clinical context.

Vascular Access

- Reliable access is critical—use any available route.
- If peripheral IV access is difficult in a shut-down child, *IO access is effective and acceptable* for both fluids and medications.
- Central venous access can be pursued once the child is more stable, often after intubation.

Key Steps for Intubating the Hemodynamically Unstable Patient

Main Takeaway: *Intubation can be performed safely in hypotensive patients with the right preparation to prevent cardiovascular collapse.*

1. **Pre-emptive Support**
    - Start **epinephrine infusion at 0.05 mcg/kg/min** *before* intubation.
    - Have epinephrine running and ready as baseline support.
2. **Epinephrine Spritzers**
    - Use **"Low Dose Push Epinephrine aka spritzers or dirty epi"** to provide rapid BP/HR augmentation, giving 1ml at a time. (See prep and instruction here).
    - You can give Epinephrine spritzers **before, during, or after intubation**, especially if the epinephrine infusion is not yet up.
3. **Steroids**
    - See recommendations below for stress dose steroids – if the patient qualifies, consider giving this early/prior to intubation as well.
4. **Volume Optimization**
    - Consider a **fluid bolus immediately prior to or during intubation** for preload support (if not contraindicated).
5. **Choice of Induction Agent**
    - **Ketamine** is preferred: although mildly myocardial depressant, it usually increases HR and BP, making it advantageous in shock states.
6. **Mindset**

- Intubation in shock **is not unsafe if anticipated**—prepare vasopressors, fluids, and induction agent *before* pushing meds.

Management of Immunosuppressed Patients

Children on chronic steroids (e.g., prednisone) are at increased risk for adrenal insufficiency and refractory shock.

- Stress-dose hydrocortisone should be administered to children with known or suspected adrenal suppression.
- In cases of catecholamine-refractory shock, even in children without a prior history of steroid use, empiric hydrocortisone should be considered.
- While corticosteroids have not consistently demonstrated a mortality benefit, they can reduce the duration and severity of refractory shock and have not been associated with worse outcomes.

Support Services and Resources

- *CCON (Critical Care Outreach Nurse):* Available 24/7 for nurse consultation on medication support, validation of clinical assessments, and guidance on policies and resources.
- *Respiratory Therapy Support:* Accessible through the same 24/7 CCON contact line, with expertise in ventilating pediatric patients and adapting available equipment (e.g., adult ventilators) for safe pediatric use.
- *Transport Teams (PTN):* Consultation should be initiated early for any critically ill child. Transport advisors can also help connect clinicians with additional supports such as CCON and RT.
- *Local Management:* Clinicians in community settings are encouraged to use medications and strategies they are most familiar and comfortable with, provided they are safe and appropriate for the child's clinical condition. Outreach services are available to support local decision-making and management.

Resources:

- Sepsis Screening
- Sepsis Care Algorithm
- Provincial Pediatric Sepsis Recognition and Management Guideline
- Child Health BC Sepsis page for Provincial Sepsis Toolkit
- Antimicrobial Guide
- Rapid Sequence Intubation in Pediatrics
- Low Dose Epinephrine Push

- IO access
- Virtual Support Pathways
- Critical Care Outreach RN and RT
- Weight based drug sheets
- RIPPL: Resources for Interdisciplinary Pediatric Practice and Learning. Domain 4 Clinical Practice - Sepsis Collection

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).*

🤖 **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.*