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Learning



## PCCL Session: Summary Report and Resources

PCCL session topic: "A Whole Clot of Trouble"

Date: October 17, 2025

### Learning objectives:

1. Describe the epidemiology and risk factors for pulmonary embolism (PE) in adolescents, considering mental health comorbidities.
2. Outline the initial stabilization and safe transport of adolescents with suspected or confirmed PE, while recognizing challenges posed by resource-limited settings.
3. Discuss strategies for long-term management and secondary prevention of PE, including anticoagulation duration, contraceptive counseling, and follow-up care.

### Case:

- Setting the stage: Challenging case due to lack of resources. This patient had multiple visits to ED with chronic medical/mental health conditions. The discussion included how this history impacted care and diagnosis.
  - Rural community hospital - Population: 30,000
  - Transport + Geographical challenges - Nearest transport center is 3.5 hours by flight (fixed wing jet). Weather delays are common. Medivac team = flight nurse + paramedic.
- Patient Demographics: 15-year-old assigned female at birth (AFAB), gender fluid. Wt 120 kg.
  - **Past medical history**: Asthma, elevated BMI, ADHD, generalized anxiety/MDD, gender dysphoria, ASD, seizure disorder, hx of trauma, query dissociative identity disorder
  - **Medications**: Risperidone, guanfacine, fluoxetine, lorazepam PRN, OCP (Lolo), fluticasone inhaler
- 1<sup>st</sup> Presentation:
  - Cough and SOB, 1-week hx URTI, CXR unremarkable;
  - Improved in ED and discharged home. Last recorded vitals: **HR 146, O2 94% RA**
- 2<sup>nd</sup> Presentation:
  - Re-presented to ED 3 days later with nausea/vomiting X 4/7
  - c/o chest pain, SOB, cold sweats; unable to tolerate PO
  - Triage vitals: 36.2, **HR 144, RR 20, 92/78, O2 92% RA**
  - **CXR**: Lungs and pleural space clear, Dx: **pneumonia**, Rx Azithromycin x 5 days
  - Last recorded vitals: **HR 110, O2 95% RA**
- 3<sup>rd</sup> Presentation (48 hrs later):
  - Increasing and worsening chest pain ("crushing pain") and work of breathing.
  - One episode of **hemoptysis/coffee ground emesis** at home. No diarrhea.
  - Decreased PO intake for several days. Tolerating fluids
  - Several episodes of presyncope this past week with <5 episodes of brief **syncope**.
  - Arrived via EMS: **HR 145, RR 22 shallow, 101/81, O2 70% RA, T 35.1, GCS 14**



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- Initial treatment of face mask O<sub>2</sub>, then switched to HFNC Flow rate 60L/min, FiO<sub>2</sub> **86%** - sats increase to **92%**
- Pediatrics assessment – alert and oriented - normal S1S2 no murmur - **lungs clear to bases**, no wheezes, mild WOB but complaining of difficulty breathing - abdomen soft, no HSM, some epigastric pain - CR 2 seconds centrally
- Investigations:
- **Labs**
  - Elevated WBC (24.4) and Neutrophils (19.8) and Influenza B NAT +
  - VBG 7.38/35 with HCO<sub>3</sub> 20, lactate 3.5
  - Cr 145, Urea 9.0 (elevated)
  - D-Dimer 2334 (elevated)
- **CXR**
  - Lungs and pleural spaces clear. There is **dilation of main/left pulmonary artery** which raise the possibility of congenital pulmonic stenosis. Cardiac echo suggested. No acute or suspicious osseous abnormality is seen.
- **ECG** – “sinus tachycardia, non-specific T wave abnormality, when compared with ECG Aug 2023 T wave changes are now present”.
- Initial Management:
  - Given FiO<sub>2</sub> > 80% with minimal change in O<sub>2</sub> sats, ongoing tachycardia, case discussed with BCCH PICU. Recommended CT chest to R/O PE. CT available 2 hours later...
  - **PULMONARY VESSELS: The main pulmonary artery is dilated 35 mm. Positive for acute large volume pulmonary embolism occluding the right main pulmonary artery, extensive right lobar and left lobar/segmental.**
  - **HEART/MEDIASTINUM: Severe dilatation of the RV with an RV LV ratio of 1.8.** No pericardial effusion.
- Progression: - PTN Conversation (**BCCH PICU & Hematology, Vancouver General Hospital (VGH) ICU and Interventional Radiology**):
  - Patient meets criteria for massive PE, compensated shock at this point but concern for possible acute decompensation.
  - Per BCCH Hematology: start Unfractionated Heparin (UFH) NOW 1000 units/hour IV
  - Balancing risks and benefits, decision to not intubate given hemodynamic stability and risks associated with intubation.
  - Patient qualified for IR intervention: transported to VGH ICU
  - Ongoing discussion with PICU/Heme, adjusting heparin based on PTT
  - Subsequently transferred to VGH via Critical Care EMS (total stay in ED 12 hours)

### Learnings:

### **The Complexity of Assessing and Managing Patients with Multiple Psychiatric Co-Morbidities**

- Assessing and managing patients with multiple psychiatric comorbidities can be complex, as their physical and psychological symptoms often overlap.



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- In this case, the patient's anxious appearance and mild dyspnea contrasted with her otherwise well presentation, creating an incongruent clinical picture. Her history of frequent visits for anxiety and respiratory complaints complicated the assessment of illness severity. However, the significantly **elevated heart rate (130–140 bpm compared to a baseline of ~100 bpm)** and **high oxygen requirement (FiO<sub>2</sub> 86%) but clear lung fields on CXR** were key indicators of potential underlying medical deterioration.

### Pediatric Pulmonary Embolism (PE)

- **Recognition challenges:**
  - Pediatric PE can be difficult to identify, especially in patients who appear well.
  - Subtle red flags may include unexplained hypoxia, minimal or normal chest X-ray findings, and elevated oxygen requirements.
- **Diagnostic limitations:**
  - Adult tools (e.g., Wells criteria, D-dimer) are unreliable in children.
  - **D-dimer** has a poor negative predictive value and should not exclude imaging or empiric anticoagulation when clinical suspicion is high.
- **Importance of clinical context:**
  - Recognition relies on identifying risk factors and understanding the broader clinical picture.
- **Patient-specific risk factors:**
  - Obesity
  - Sedentary lifestyle
  - Oral contraceptive use
  - Acute inflammatory trigger (Influenza B infection)
- **Pathophysiologic insight:**
  - Although oral contraceptives pose the greatest risk in the first six months of use, the combination of chronic (obesity, inactivity) and acute (infection) factors likely contributed to thrombosis.

### Pediatric Physiology

- **Pathophysiology:**
  - Right heart coronary perfusion usually occurs during both diastole and systole (unlike the LV which is perfused only during diastole. Acute pulmonary embolism (PE) increases pulmonary pressures which can compromise right heart perfusion and lead to right heart ischemia and



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dilatation. Right heart dilatation shifts the septum to the left, compromising LV ejection fraction and cardiac output.

- **Management principles:**

- **Avoid aggressive fluid resuscitation** – the RV is already dilated secondary pulmonary HT
- **Focus on maintaining systemic blood pressure** to preserve coronary perfusion.
- **Preferred agents:** vasoactive medications such as **norepinephrine** or **phenylephrine**, rather than fluids or inodilators.

- **Clinical goal:**

- Prioritize **prevention of cardiac arrest**, as outcomes following arrest in massive PE are extremely poor.

## Key Considerations

- **Primary management:**

- **Anticoagulation** is the cornerstone of treatment for suspected or confirmed pediatric PE and should be initiated as soon as the diagnosis is made (or strongly suspected, if no contraindication)
- **Unfractionated heparin (UFH)** is chosen when anticoagulant effect needs to be able to be turned off faster – i.e. if bleeding / significant bleeding risk or procedures with bleeding risk may be needed imminently, due to its rapid titration and reversibility.
  - A **heparin bolus followed by infusion** achieves therapeutic levels more quickly.
- **Thrombolysis or thrombectomy** should be considered for high-risk / massive PE. Feasibility and appropriateness of catheter-directed thrombolysis or thrombectomy should be discussed with pediatric IR teams and multi-disciplinary discussion with critical care, IR, and hematology is warranted
- **Low molecular weight heparin (LMWH)** is appropriate and less prone to logistical difficulties and is often the first-line anticoagulant of choice

- **Specialist involvement:**

- After initiating anticoagulation, consultation with critical care and hematology is essential to assess the need for reperfusion therapy.
- Risk stratification parallels adult practice:
  - **Massive PE:** associated with cardiovascular collapse.
  - **Submassive PE:** right heart failure but preserved perfusion.

- **Clinical recognition and context:**



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- Although rare, PE should be considered in **adolescents with unexplained hypoxia, disproportionate tachycardia, or risk factors** such as obesity, oral contraceptive use, and recent infection with minimal CXR signs.
- **Clinical judgment** should guide decision-making, as adult scoring systems (e.g., Wells) are unreliable in pediatrics.
- **Remote and resource-limited settings** require awareness of right heart failure physiology, early initiation of anticoagulation, and close coordination with **tertiary centers**.
- **Supporting resources:**
  - Pediatric PE protocols and heparin therapy guidelines from BC Children's Hospital and PubMed provide practical guidance for clinicians managing similar high-acuity cases.

#### Resources:

- [BCCH heparin policy](#)
- [Pedmed – support documents](#)
- [ECG Changes in PE](#)
- [Venous Thromboembolism in Pediatric Patients](#)
- [Pulmonary Embolism in Children](#)
- [D-dimer in the diagnosis of PE in Children](#)
- [Long Term Outcomes of PE in Children and Adolescence](#)
- [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."**



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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>