A Study in Scarlet Effluent

Annual Dialysis Conference 2020
Stump the Consultants

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Disclosures

- I have no conflicts of interest to disclose
History of present illness

On a Friday night, Dr. Lestrade pages you for a new consult in the PICU....

- “JM” is a 17 y.o. M being transferred to your facility for methamphetamine overdose after being found unresponsive on the street for an unknown amount of time

- PMHx
  - Morbid obesity
  - Bipolar disorder
  - Hypertension
  - Hx of drug abuse
Clinical course at the referring hospital

- Upon admission: Intubated
  - Received succinylcholine
  - Developed malignant hyperthermia with Tmax 107 F. Treated with dantrolene
- Developed ventricular arrhythmias with troponin increasing from 800s to 3958
- Hypotensive
  - Started on epinephrine and norepinephrine
He was then transferred to your hospital for higher level of care....

<table>
<thead>
<tr>
<th>VBG: pH</th>
<th>pCO2</th>
<th>pO2</th>
<th>HCO3</th>
<th>Lactate</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.068</td>
<td>60 mmHg</td>
<td>52 mmHg</td>
<td>16.5 mmol/L</td>
<td>11.6 mmol/L</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BUN</th>
<th>Serum Cr</th>
<th>CK</th>
<th>Troponin</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>3.7 mg/dL</td>
<td>&gt;22,000 U/L</td>
<td>3958 ng/mL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AST</th>
<th>ALT</th>
<th>PT/INR</th>
<th>PTT</th>
<th>D-Dimer</th>
<th>Platelets</th>
</tr>
</thead>
<tbody>
<tr>
<td>2586 U/L</td>
<td>1304 U/L</td>
<td>27.4 s 3.6</td>
<td>43.7 s</td>
<td>&gt; 20 ug/mL</td>
<td>115K</td>
</tr>
</tbody>
</table>
Hospital day #1

- CRRT initiated for anuric renal failure and severe rhabdomyolysis
- Found to have E. coli sepsis
- Persistent lactic acidosis, hypoxemia, clinical instability \( \rightarrow \) cannulated onto VA ECMO on the day of admission
- He received multiple vasopressors and interventions for severe hypotension
Hospital day #2...

He continues on CRRT

The effluent turns dark red

The blood leak detector alarms multiple times

The Prismaflex shuts down after 2 minutes
What are potential causes of the blood leak alarm?
What are potential causes of the blood leak alarm?

- Actual blood in the tubing (due to rupture of the filter)
- Free heme (due to severe hemolysis in the patient)
- The blood leak detector is dirty
- Medications
What are potential causes of the blood leak alarm?

- Actual blood in the tubing (due to rupture of the filter)
- Free heme (due to severe hemolysis in the patient)
- The blood leak detector is dirty
- Recent administration of hydroxocobalamin (injectable form of Vitamin B12) - for refractory vasoplegia
Vasoplegic Syndrome

- Can be seen in patients with septic shock, burns, major surgery, or after cardiopulmonary bypass
- No universally accepted definition
- Clinically: Low systemic vascular resistance in setting of normal or increased cardiac output
  - Dysregulation of nitric oxide system
  - Vasodilation
  - Hypotension

Roderique et al.; Lamden et al.
Mechanism of action of hydroxocobalamin

![Diagram showing the mechanism of action of hydroxocobalamin](image)

- **Cystathionine γ-lyase**
- **K+**
- **H2S**
- **NO**
- **Nitric Oxide Synthase**

Shapeton et al.
Hydroxocobalamin

- Deep purple/red hue
- Medication imparts dark red/purple discoloration of skin, mucosal membranes, and body fluids
- Remains in plasma and urine/effluent for 5-35 days – can lead to a false blood leak alarm
How do you circumvent a false blood leak alarm?
How do you circumvent a false blood leak alarm?

How does the blood leak detector work?
Understanding how the blood leak detector (BLD) works

Detection is based on refraction of light

Scattering of light
Reduced signal □ BLD Alarm
How DO you circumvent a false blood leak alarm?

1) Normalize during priming process
   a) With red effluent instead of NS

2) Normalize during “Run” mode (Press “Normalize BLD”)
   a) Remove effluent line before running and replace after effluent has turned red
   b) Or, Replace effluent line in BLD with NS-containing effluent line
Which safety measures can be implemented after normalization of the blood leak detector?

- Test effluent for blood until discoloration resolves
- Monitor patient’s vital signs and hemoglobin on routine blood gases and CBCs
- Monitor for increased intensity of color in the effluent
Back to our patient...

After you cleverly recalibrate the blood leak detector, CRRT is restarted without event.

He received injectable Vitamin B12 again without disruption of CRRT.

The effluent started clearing on hospital day #4 to a rose color, and the pink coloration resolved on hospital day #7.

CRRT was continued without event throughout his admission.
Key Points

- Hydroxocobalamin is being used increasingly for refractory vasoplegia in the pediatric population.
- Hydroxocobalamin can lead to red effluent (up to 35 days) and a false blood leak alarm, resulting in CRRT shutting down.
Key Points

- Methods to circumvent a false blood leak alarm focus on preventing changes in the wavelength of light that is detected by the phototransistor in the blood leak detector.

- Safety measures are required after normalization of the blood leak detector, as an alarm signaling a true blood leak can still occur after a false blood leak alarm.
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References


- Prismaflex Operators Manual, courtesy of Baxter
Questions?

Illustration from “A Study in Scarlet”, a Sherlock Holmes adventure

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