October 2012 Critical Care Case of the Month

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**History of Present Illness**

An 85 year old patient was admitted with hypotension and respiratory failure. He was intubated shortly after arrival and mechanical ventilation was begun. Fluids and vasopressors were begun for his hypotension.

**PMH, SH, FH**

His past medical history included peripheral vascular disease, abdominal aortic aneurysm repair, type 2 diabetes mellitus, hypertension, alcohol use, coronary artery disease, chronic obstructive pulmonary disease and hyperlipidemia.

**Physical Examination**

His vital signs were a temperature of 98.6 degrees F, heart rate 110 beats/min, respiratory rate 14 breaths per minute while intubated and receiving mechanical ventilation, and BP of 95/65 mmHg on vasopressors.

He was sedated. Lungs were clear and the heart had a regular rhythm without murmur or gallop. Abdominal examination was unremarkable and neurologic exam was limited because of sedation but without localizing signs. Plantar reflexes were down-going.

**Admission Laboratory**

Significant initial laboratory findings included a white blood cell count of 21,000 cells/μL, blood lactate level of 10 mmol/L and creatinine of 12 mg/dL. Urinanalysis showed pyuria and was positive for nitrates.

At this time which of the following are diagnostic possibilities?
1. Sepsis secondary to urinary tract infection (urosepsis)
2. Community-acquired pneumonia
3. Cardiogenic shock secondary to myocardial infarction
4. Critical illness related corticosteroid insufficiency
5. All of the above
The differential diagnosis of shock is large but falls into three major categories (1):

1. Hypovolemic
2. Cardiogenic
3. Distributive

These can usually be separated by common clinical ICU measurements (Table 1).

Table 1. Characterization of different types of shock by clinical ICU measurements.

<table>
<thead>
<tr>
<th>Type of shock</th>
<th>Pulmonary capillary wedge pressure</th>
<th>Cardiac output</th>
<th>Systemic vascular resistance</th>
<th>Mixed venous oxygen saturation</th>
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<tbody>
<tr>
<td>Hypovolemic</td>
<td>↓</td>
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<td>↑</td>
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<tr>
<td>Cardiogenic</td>
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<td>↓</td>
<td>↑</td>
<td>↓</td>
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<tr>
<td>Distributive</td>
<td>↓ or ↑</td>
<td>↑</td>
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</table>

In some cases clinical substitutes for pulmonary capillary wedge pressure such as stroke volume variation and central venous pressure (CVP).

In our patient’s case initial fluid resuscitation was guided by goal directed therapy (preload as monitored by stroke volume variation and CVP, ScVO₂ and falling lactate). Cardiac evaluation showed no significant rise in troponins and bedside echocardiography was not consistent with a cardiogenic cause of his shock. Hydrocortisone was started for possible critical illness related corticosteroid insufficiency. *E. coli* was cultured from the urine and was sensitive to the antibiotic started on day 1 within 4 hours of admission – ceftriaxone. His clinical picture was most consistent with distributive shock secondary to sepsis.

By 24 hours, lactate levels had fallen from 10 to 6 mmol/L but stabilized at around 6 despite treatment despite continued treatment. The patient's acute kidney injury had improved marginally from a creatinine of 12 to 9 mg/dL with the resuscitation.

An abdominal x-ray was taken for feeding tube placement (Figure 1).
Figure 1. Panel A. Abdominal film taken at admission. Panel B. Abdominal film taken during prior admission for comparison.

What abnormalities are seen on the abdominal film?
1. The feeding tube is coiled in the stomach
2. The feeding tube is in the lung
3. There is evidence of the previous abdominal aortic surgery
4. 1 + 3
5. All of the above
The feeding tube is below the diaphragm and appears coiled in the stomach (Figure 2, white arrow). There is evidence of the previous abdominal aortic aneurysm operation (Figure 2, red arrows).

Figure 2. Abdominal film showing feeding tube tip coiled in stomach (white arrow) and evidence of previous abdominal aortic aneurysm repair (red arrows).

What abnormality is indicated by the yellow arrows in Figure 2?
1. An air fecal interface
2. Free air under the diaphragm
3. Air in the bowel wall
4. 1 + 3
5. All of the above
The air in the bowel wall was initially missed because the abdominal film was taken for feeding tube placement. Air in the bowel wall goes by a number of names including pneumatosis, pneumatosis cystoides intestinalis, intramural gas, pneumatosis coli, pseudolipomatosis, intestinal emphysema, bullous emphysema of the intestine, and lymphopneumatosis (2). The differential diagnosis of air in the bowel wall is large but includes Intra-abdominal catastrophes, disorders associated with intestinal mucosal disruption, infections, diseases affecting intestinal motility, immunologic disorders, endoscopic procedures and even pulmonary disorders such as obstructive lung diseases or mechanical ventilation.

CT scans are more sensitive than plain films and may suggest the underlying cause of the air. Our patient’s CT scan clearly shows the air in the bowel wall (Figure 3).

Figure 3. Representative coronal (Panels A-C) and axial (Panels D and E) images from the abdominal CT scans showing air in the bowel wall.
Which of the following is true regarding air in the bowel wall?

1. Surgical consultation should be obtained when an intra-abdominal catastrophe is suspected
2. Observation is appropriate for patients who are asymptomatic
3. Antibiotics, hyperbaric oxygen, and an elemental diet are appropriate for patients with mild-moderate clinical severity
4. Palliation may be appropriate for non-surgical candidates with high clinical severity
5. All of the above
Correct!
5. All of the above

The first decision to be made in the management of air in the bowel wall is a judgment of the likelihood of an intra-abdominal catastrophe (2). A history of vascular disease, physical signs of an acute abdomen, metabolic acidosis, elevated lactate, elevated amylase or the presence of air in the portal vein all make an intra-abdominal catastrophe more likely. Emergent surgical exploration is indicated for patients with a suspected acute abdominal event.

If a patient is asymptomatic and an intra-abdominal catastrophe is not clinically suspected, observation is appropriate. Antibiotics, hyperbaric oxygen, and an elemental diet are appropriate for patients with mild-moderate clinical severity but without suspicion of a catastrophic event. Palliation may be appropriate for patients who are not surgical candidates.

Surgical consultation was obtained in our patient, and although they agreed a surgical intra-abdominal catastrophe was likely, the surgeons felt the patient was not a surgical candidate because of his advanced age and a multitude of underlying diseases. After consultation with the patient’s family, palliative care was instituted and the patient died peacefully.

References