July Critical Care Case of the Month

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**History of Present Illness**

The patient is a 20-year-old man with admitted to Maricopa Integrated Health System unconscious after being found down on a hiking trail.

**Past Medical History**

Hypertension and morbid obesity.

**Physical Examination**

- Vital signs: BP 90/60 mm Hg, P 128 beats/min, Respiration 28 breaths/min, T 105.8° F, SpO2 98% on 2 L/min by NC.
- General: he is unresponsive to verbal stimuli but withdraws from pain
- Neck: there is no jugular venous distention. Thyroid is not palpable.
- Lungs: clear
- Heart: Regular tachycardia without murmur
- Abdomen: Obese but soft without organomegaly or tendernesses
- Extremities: apparent burns over both lower extremities

Which of the following should be done *initially*?

1. Cool the patient as quickly as possible
2. Cool the patient slowly to prevent cerebral edema
3. Aggressively administer normal saline to correct hypotension
4. 1 and 3
5. All of the above
Correct!

1. Cool the patient as quickly as possible

The patient was found unresponsive on a trail in Arizona which can be quite hot. He has a core body temperature of 105.8°C which meets the definition of heatstroke. The initial treatment of heatstroke is to cool the patient as quickly as possible (1). Rapid reduction of the core body temperature is the cornerstone of treatment because the duration of hyperthermia is the primary determinant of outcome.

The optimal method of rapidly cooling patients has been a matter of debate for some time. Ice-water immersion or an equivalent method has the advantage of rapidly reducing core body temperature which can reduce core body temperature to less than 39°C in approximately 20-40 minutes. Evaporative heat loss, although perhaps less effective than immersion techniques, poses fewer practical difficulties. Evaporative body heat loss may be accomplished by removing all of the patient's clothes and intermittently spraying the patient's body with warm water while a powerful fan blows across the body, allowing the heat to evaporate. A number of other cooling techniques have been suggested, but none has proven superior to or equal to cold-water immersion or evaporative techniques. These include peritoneal, thoracic, rectal, and gastric lavage with ice water; cold intravenous fluids; cold humidified oxygen; cooling blankets; and wet towels. Antipyretics (e.g., acetaminophen, aspirin, other nonsteroidal anti-inflammatory drugs) have no role in the treatment of heatstroke.

Patients with heatstroke invariably are volume depleted, but cooling alone may improve hypotension and cardiac function by allowing blood to redistribute centrally. Aggressive fluid resuscitation generally is not recommended.

Which of the following laboratory values should be obtained?

1. CBC with platelet count
2. CPK, serum and urine myoglobin
3. Electrolytes, BUN and creatinine
4. Prothrombin time (PT), partial thromboplastin time (PTT)
5. All of the above
Heatstroke can lead to multisystem organ failure. Liver function tests (serum aspartate transaminase, alanine transaminase, and bilirubin) should be measured to monitor for liver failure. In addition to the usual serum electrolytes ($\text{Na}^+$, $\text{K}^+$, $\text{Cl}^-$, $\text{HCO}_3^-$) magnesium and phosphate should be measured. Unfortunately, despite rapid cooling and moderate fluid administration, the patient developed rhabdomyolysis, renal failure, hepatic failure, and disseminated intravascular coagulation (DIC). He remained minimally responsive and was intubated for airway protection.

He had a complicated hospital course that included hypovolemic and septic shock, DIC, bilateral lower extremity partial thickness burns, ischemic hepatitis, and rhabdomyolysis with renal failure. He was then transferred to a burn ICU for higher level of care, and was subsequently intubated for airway protection. Several days after his admission to the burn ICU he developed thick secretions. A CT scan was performed (Figure 1).

Figure 1. Representative view of thoracic CT scan in lung windows.

Which of the following have been shown to improve atelectasis in mechanically ventilated patients?

1. Manual hyperinflation and insufflation-exsufflation
2. N-acetylcysteine to thin secretions
3. Percussion and postural drainage
4. Therapeutic bronchoscopy
5. All of the above
Correct!

4. Therapeutic bronchoscopy

The CT scan shows atelectasis of the left lower lobe. The management of atelectasis in mechanically ventilated patients is controversial but most agree there is a role for therapeutic bronchoscopy in selected patients (2,3). The other modalities have not been convincingly demonstrated to improve atelectasis. Bronchoscopy was performed and revealed a soft, vascular mass in the left mainstem bronchus (Figure 2).

![Figure 2. Bronchoscopic view of the left mainstem bronchus.](image)

Biopsies and washings from the endobronchial mass were performed (Figure 3).

![Figure 3. Grocott silver stain of lung washings.](image)
At about the same time the patient showed a coffee-ground return from his nasogastric (NG) tube. Esophagastroduodenoscopy (EGD) was performed and showed numerous gastric ulcers (Figure 4).

![Figure 4. View from the EGD showing numerous gastric ulcers.](image)

Biopsy of the ulcers showed organisms similar to those found at bronchoscopy.

What should be **done next**?

1. Add additional antibiotics to broaden the coverage
2. Begin antifungal therapy
3. Continue his present therapy—the organism is colonizing the airway and stomach
4. Laser the endobronchial lesion
5. Radiation therapy for the endobronchial lesion
Correct!

2. Begin antifungal therapy

The washings and the biopsies all show an organism consistent with mucormycosis. Mucormycosis rarely colonizes and has a high mortality rate. For this reason he was treated with inhaled and systemic amphotericin and micafungin. Despite the therapy his left lung atelectasis progressed (Figure 5).

![Figure 5. Portable chest x-ray showing complete opacification of the left chest.](image)

Bronchoscopy revealed complete occlusion of the left upper and lower lobes by the endobronchial lesions and endoscopic balloon dilatation was performed, however, the atelectasis persisted. Because of the life-threatening nature of the infection and its progression in this patient, a left pneumonectomy was performed (4,5). He was started on prophylactic posaconazole after surgery and made a slow recovery. He was doing well when last seen five months afterwards on clinic follow up.

References