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Case Presentations of the Harvard Affiliated Emergency Medicine Residencies

NEAR DROWNING AND ADULT RESPIRATORY DISTRESS SYNDROME

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Dr. Micheal Buggia: Today's case is that of a 19-year-old man presenting to the Emergency Department (ED) as a trauma activation. The patient was water tubing behind a boat, and as the boat stopped suddenly, he ran into it head first. The patient was wearing a life preserver vest. Witnesses reported that the patient had loss of consciousness and was pulled into the boat shortly after the accident. It took approximately 2 min for the patient to return to his baseline level of consciousness. On arrival to the ED, the patient was awake and his only complaint was mild headache. He denied any shortness of breath, chest pain, abdominal pain, or extremity injury.

Dr. Alden Landry: Did the patient have any significant past medical history?

Dr. Buggia: No, this was an otherwise healthy 19-year-old man.

Dr. Carrie Tibbles: What did you find on your primary survey of this patient?

Dr. Louisa Canham: On presentation, his initial vital signs were: temperature 36.8°C (98.2°F), heart rate 87 beats/min, blood pressure 130/70 mm Hg, respiratory rate 24 breaths/min, and oxygen saturation 94% on room air. On primary survey, the patient's airway was intact, he had equal and clear breath sounds bilaterally, and palpable radial pulses. His score on the Glasgow Coma Scale was 15.

Dr. Tibbles: What findings were discovered on secondary survey?

Dr. Canham: On secondary survey, the only significant finding was a 4-cm laceration to the chin. The patient had a nonfocal neurologic examination and did not seem to be in any acute distress. Our bedside FAST (focused assessment with sonography for trauma) was also negative.

Dr. Landry: After the primary and secondary survey, what was your differential diagnosis and work-up plan?

Dr. Buggia: Although his examination was reassuring, this patient had a significant mechanism of injury to his head, and our primary concerns were ruling out intracranial hemorrhage and cervical spine injury. As such, we ordered a STAT computed tomography (CT) scan of the head and cervical spine without contrast and a portable chest x-ray study.

Dr. Landry: What were the findings?

Dr. Buggia: The portable chest x-ray study was reassuring (Figure 1). There was no evidence of bony injury, pneumothorax, or pulmonary edema. Our radiologists quickly read his CT scans reporting no intracranial hemorrhage or cervical spine injury.

Dr. Tibbles: What were the results of the basic laboratory studies?

Dr. Canham: Laboratory tests showed: sodium 139 mEq/L, potassium 3.9 mEq/L, chloride 98 mEq/L, bicarbonate 28 mEq/L, blood urea nitrogen 17 mg/dL, creatinine 0.9 mg/dL, and glucose of 106 mg/dL; white blood cells 9 K/uL, hematocrit 40%, platelets K/uL. A serum toxicology screen including ethanol level was negative.

Dr. Landry: So essentially, the patient's initial work-up was reassuring, without any significant injuries identified. What was your plan with this patient?

Figure 1. Initial portable anteroposterior chest x-ray study without any acute process.

Dr. Buggia: Although the patient seemed quite stable, we planned to observe him in the ED. This patient likely had a component of freshwater aspiration secondary to his loss of consciousness while still in the water. Based on multiple studies on near-drowning events, there are recommendations that patients be observed for approximately 6 h, paying close attention to vital signs, utilizing continuous pulse oximetry and cardiac rhythm monitoring, and paying close attention to mental status (1–3). We know that initial chest radiographs can and often do underestimate the severity of pulmonary injury, and that the development of clinical signs of pulmonary compromise can be insidious. If there is evidence of respiratory distress, repeat chest radiograph, as well as arterial blood gas analysis, is indicated.

Dr. Landry: What was the patient's course while in observation?

Dr. Canham: About 90 min after our initial evaluation, the patient's respiratory rate increased and oxygen saturation decreased, as noted by the nursing staff. Repeat vital signs at that time revealed a heart rate of 82 beats/min, blood pressure of 124/80 mm Hg, respiratory rate of 28 breaths/min, and 88% oxygen saturation on 4 L oxygen via nasal cannula. Over the next 30 min, the patient's respiratory rate and oxygen requirement continued to climb. On examination, he had preserved mental status but significantly increased work of breathing. Auscultating his lungs revealed diffuse coarse crackles. At that time, a repeat anteroposterior chest x-ray study was obtained.

Dr. Tibbles: What was the result of the chest x-ray study?

Dr. Canham: Significant bilateral pulmonary edema, most likely noncardiogenic (Figure 2).

Dr. Tibbles: What was your plan for the patient at that time?

Dr. Buggia: As the patient's respiratory status continued to decline, we held a discussion with the patient and his family regarding the likely need for mechanical ventilation. At that time we prepared to perform endotracheal intubation. Three hours after initial presentation, rapid sequence intubation was performed using etomidate and succinylcholine. The patient was successfully intubated with a 7.5 mm endotracheal tube via direct laryngoscopy.

Dr. Tibbles: Did you initially feel that this patient was at risk for pulmonary decline?

Dr. Canham: Yes, as it was a near drowning, water aspiration and subsequent pulmonary compromise was a concern. Aspiration of 1–3 mL/kg body weight of either salt or fresh water compromises the integrity of pulmonary surfactant, leading to alveolar collapse, atelectasis, intrapulmonary shunting, and ventilation-perfusion mismatching and noncardiogenic pulmonary edema, resulting in acute respiratory distress syndrome (ARDS) (4–6). Pulmonary compromise can develop insidiously or rapidly. Signs and symptoms usually include tachypnea, shortness of breath, hypoxia, crackles, and wheezing, none of which were present in this patient initially.

Dr. Tibbles: What is the pathophysiology of drowning?

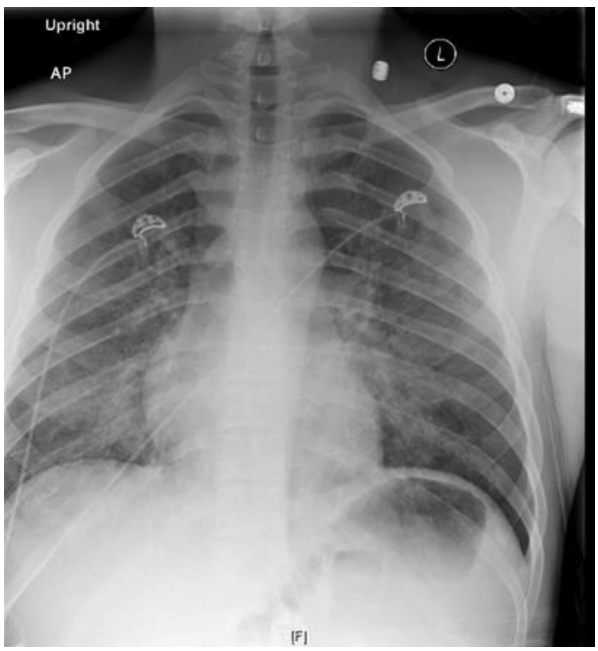

Figure 2. Repeat anteroposterior chest x-ray study when patient became hypoxic showing pulmonary edema likely representing acute respiratory distress syndrome.