From Tackle to Tension Pneumothorax



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Matt is a 22-year-old Caucasian male, a resident of Dallas, Texas, who came to the emergency department (ED) complaining of severe pain over his right chest area along with shortness of breath. He was injured during a college football game. He stated that he was tackled from the front and the side by multiple opponents. After the tackle, he was immediately short of breath and felt a sharp pain in the area of his right chest. Matt was transferred by ambulance to a local hospital, with paramedics administering oxygen at 12 L/min via a non-rebreather mask. He also received a nebulized albuterol treatment. Along with oxygen administration and breathing treatments, an 18-gauge IV catheter was placed in his left forearm. Upon arrival at the hospital, the following medical history was gathered from the nurse. While obtaining the medical history, the nurse took Matt's vital signs and began a physical assessment.

Medical History

- Childhood-onset atopic asthma.
 - Uses two metered-dose inhalers (Symbicort and Serevent), twice daily. Also uses an albuterol metered-dose inhaler when necessary.
- Previous diagnosis of moderate obstructive airway disease with marked bronchodilator response.
- His father died of an asthma exacerbation at age 50 a few years ago.
- All immunizations are up-to-date, albeit no tetanus shot.
- He has no smoking history, but does occasionally use marijuana brownies recreationally.
- Drinks alcohol a few times a month, usually during the weekend.
- He has no known drug allergies, but he avoids aspirin and aspirin-related medications.
- Other history was unremarkable.

Vital Signs

Table 1. Vital Signs

Objective Data	Vital Signs	Normal Values
Blood Pressure	90/50 mmHg	120/80 mmHg
Heart Rate	140 bpm	60–100 bpm
Respiratory Rate	36 breaths per minute	12–18 breaths per minute
SpO2	90%	> 95% on (21%) FiO2
Body Temperature	36.5 °C	36.1–37.2 °C
Body Mass Index	29.8 kg/m ²	18.5–24.9 kg/m ²
Height	6 ft	5 ft 8 in – 6 ft
Weight	220 lb	165 lb – 180 lb

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Physical Assessment

Matt presents oriented to time, place, and location, but appears anxious and agitated. He also claims an 8/10 sharp right chest pain. Pupils are equal, round, and reactive to light and accommodation at 5 mm bilaterally. His skin is pale with cyanosis noted around the lips despite the supplemental oxygen. The right chest wall has scattered ecchymosis from his sternum to axillary region. Auscultation of the lungs sound diminished on the right with wheezing on the left side of his thorax. A murmur over his pulmonic valve is noted. Palpitation of the chest wall demonstrates subcutaneous emphysema on the right side of his neck and tympanic hyperresonance with percussion over the right chest wall. Pulses are present in all four extremities that are weak and rapid with a delayed capillary refill of three seconds. While performing a physical assessment, a lab technician obtains blood samples from arterial and venous sources to be sent to the lab.

Data

	Matt's Lab Results	Normal Values
ABG values (below):		
ABG pH	7.30	7.35–7.45
PaCO2	50 mm Hg	35–45 mm Hg
PaO2	60 mm Hg	80–100 mmHg (21% FiO2)
FiO2	80% FiO2 with NRB at 12 L/min	21% FiO2 (Room Air)
Venous Values (below):	- ·	·
Electrolytes: K⁺, Cl⁻, Na⁺, HCO₃⁻	K ⁺ 4.0 mEq/L Cl ⁻ 100 mEq/L Na ⁺ 140 mEq/L HCO ₃ ⁻ 24 mEq/L	K ⁺ (3.5–5.0 mEq/L) Cl ⁻ (95–105 mEq/L) Na ⁺ (135–145 mEq/L) HCO ₃ ⁻ (22–26 mEq/L)
Complete blood count (CBC) (RBCs, WBCs with differential, platelets, hemoglobin, hematocrit)	Within normal limits (WNL)	Hemoglobin (12–16 gm/dL) Hematocrit (40–50%) Platelets (150–350,000 cells/mcL) WBC (5,000–10,000 cells/mcL)

Table 2. Laboratory Data: Arterial and venous blood laboratory values.

Table 3. Diagnostic Data

12-Lead EKG	Sinus tachycardia with left axis deviation and right ventricular strain pattern.
Chest X-Ray	Large right pneumothorax with left tracheal deviation. Fifth and sixth right-sided rib fractures.

Diagnosis

The ED physician diagnosed Matt with tension pneumothorax with consequential hypotension and acute respiratory acidosis with partially compensated hypoxemia.

Care Plan

- Continue oxygen titration to maintain oxygen saturation greater than 95% with non-rebreather mask.
- Administer a procedural IV fentanyl 50 mcg bolus, continuous 0.9% NS at 125 mL/hr, and 1% lidocaine locally to prepare for chest tube insertion.
- Insert a 20 French chest tube at the right midaxillary line at the level of the 4^{th} intercostal space and connect to suction at -20 cm H_2O .

- Obtain follow-up ABG within 1 hr post chest tube insertion.
- Obtain follow-up EKG post procedure to ensure EKG abnormalities return to WNL.
- Obtain follow-up chest X-ray to ensure full lung expansion and absence of pneumothorax.
- Provide albuterol bronchodilator nebulizer treatments every four hours as needed.
- Administer a tetanus shot.
- Transfer to ICU for continuous monitoring and chest tube maintenance until stable for removal.
- After discharge, follow-up with primary care physician and pulmonologist.

Questions

- 1. Which signs, symptoms, and laboratory or other findings are directly related to asthma? What are the probable mechanisms for these changes?
- 2. Which signs, symptoms, and laboratory or other findings are associated with the tension pneumothorax? Explain the possible mechanisms causing these changes.
- 3. Interpret the ABGs for the injured football player and explain the mechanism of how the tension pneumothorax caused the abnormal ABGs.
- 4. Why is the bicarbonate still within normal limits? Calculate the anion gap. Is the gap consistent with the ABGs or not? Justify your answers.
- 5. What is the routine treatment for a tension pneumothorax and how is this procedure performed?
- 6. After resolution of the pneumothorax, what follow-up strategy should be instituted?