

What Is Occurring During A Tension Pneumothorax?

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A tension pneumothorax is a life-threatening medical emergency that occurs when air accumulates rapidly in the pleural space—the area between the lung and the chest wall—but unlike a regular pneumothorax, this air becomes trapped and continuously builds up under pressure. This increasing pressure can cause significant disruption to normal respiratory and cardiovascular functions. Understanding what happens during a tension pneumothorax is crucial for recognizing its signs, understanding its pathophysiology, and initiating prompt treatment to prevent fatal outcomes.

Understanding the Anatomy and Physiology Involved

To fully comprehend what occurs during a tension pneumothorax, it is essential first to understand the normal anatomy of the thoracic cavity and the physiology of breathing.

The Pleural Space and Lungs

- The lungs are paired organs responsible for gas exchange, enclosed within the thoracic cavity.
- Each lung is covered by a thin membrane called the visceral pleura, which adheres tightly to its surface.
- The chest wall and the parietal pleura lining the inner surface of the thoracic cavity form the outer boundary of the pleural space, which normally contains a small amount of lubricating fluid.
- This space maintains a negative pressure relative to atmospheric pressure, facilitating lung expansion during inhalation.

Normal Breathing Mechanics

- During inhalation, the diaphragm and intercostal muscles contract, expanding the thoracic cavity.
- The negative pressure in the pleural space causes the lungs to expand outward, drawing air into the alveoli.
- Exhalation is a passive process where muscles relax, and the lungs recoil, pushing air out.

What Happens During a Tension Pneumothorax?

When a tension pneumothorax develops, a series of pathophysiological events unfold rapidly, disrupting normal respiratory and circulatory functions.

Pathogenesis of Air Accumulation

- A breach in the visceral or parietal pleura allows air to enter the pleural space.
- This breach can result from trauma (e.g., rib fractures, penetrating injuries), medical procedures, or spontaneous rupture of lung blebs.

- Once air enters the pleural space, it can escape during exhalation but becomes trapped during inhalation, especially if a one-way (ball-valve) mechanism develops.

The One-Way Valve Effect

- In tension pneumothorax, the injury acts as a valve that permits air to enter but not exit the pleural space.
- Each inhalation causes more air to enter, increasing intrapleural pressure progressively.
- This trapped air exerts increasing pressure on the lung, leading to lung collapse.

Physiological Changes During a Tension Pneumothorax

The accumulation of air under pressure causes a cascade of physiological disturbances affecting both the lungs and the cardiovascular system.

Lung Compression and Collapse

- The expanding air pocket pushes inward on the affected lung, causing it to collapse, which leads to impaired gas exchange.
- As the lung collapses, oxygenation drops, resulting in hypoxia.