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A Critical Review of Pneumomediastinum

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Agenda

Present Patient

- HPI

- Review Imaging

Anatomy Review

Evaluation of Pneumomediastinum

- Diagnosis/Signs

- Causes

- Treatment

Conclude Case



History:

HPI: Patient is a 63-year-old man who is complaining of fatigue and dyspnea. 5 days prior to admission the patient was struck by his a car door due to a gust of wind forcefully whipping the door into his right side. Since that time he has noticed that he has marked swelling spanning approximately from the epigastric area to the scalp.



Physical Exam

General: BP120/80, PR70 and regular, O2 sat 95% RA,
RR 16 per minute.

HEENT: Significant for dramatic subcutaneous
emphysema involving the face; eyelids and forehead.

CV: RRR, No MRG, No extra heart sounds

Pulm: CTAB, No wheezes, rales, rhonci



Menu of Radiologic tests

PA CXR Inspiration

PA CXR Expiration

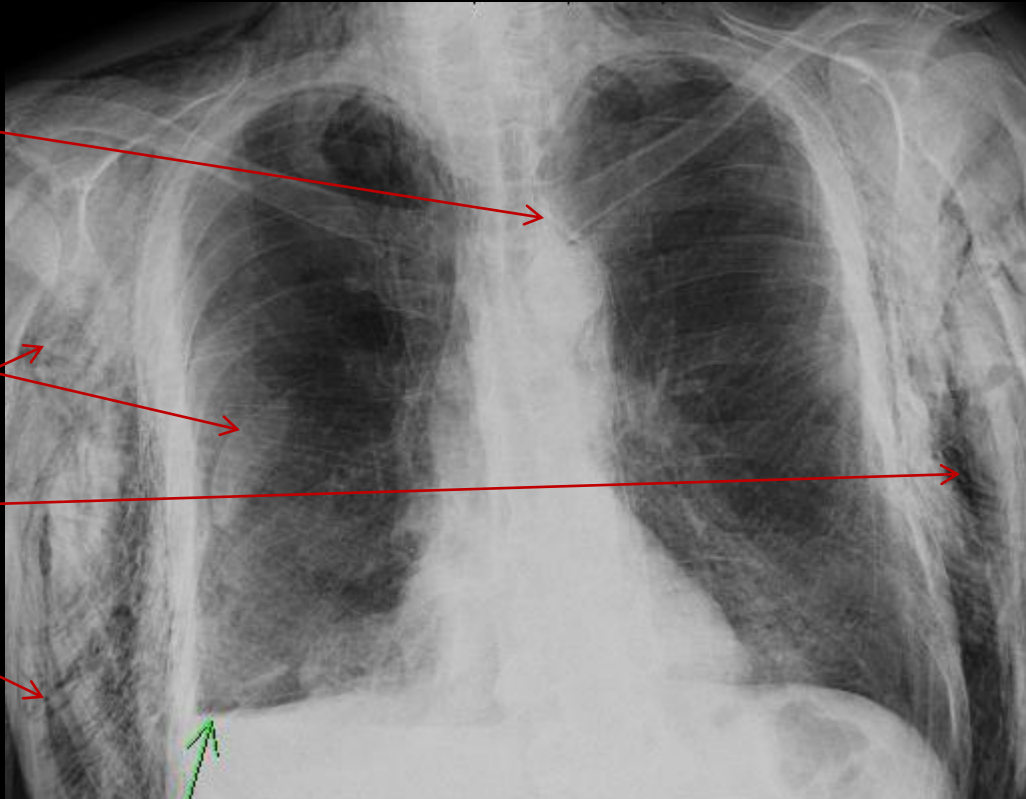
Lateral CXR

Lateral decubitus

Neck Films

Our Patient J.K: Frontal CXR

Upright CHEST (PA)



Pneumomediastinum

Rib Fracture

Subcutaneous
Emphysema

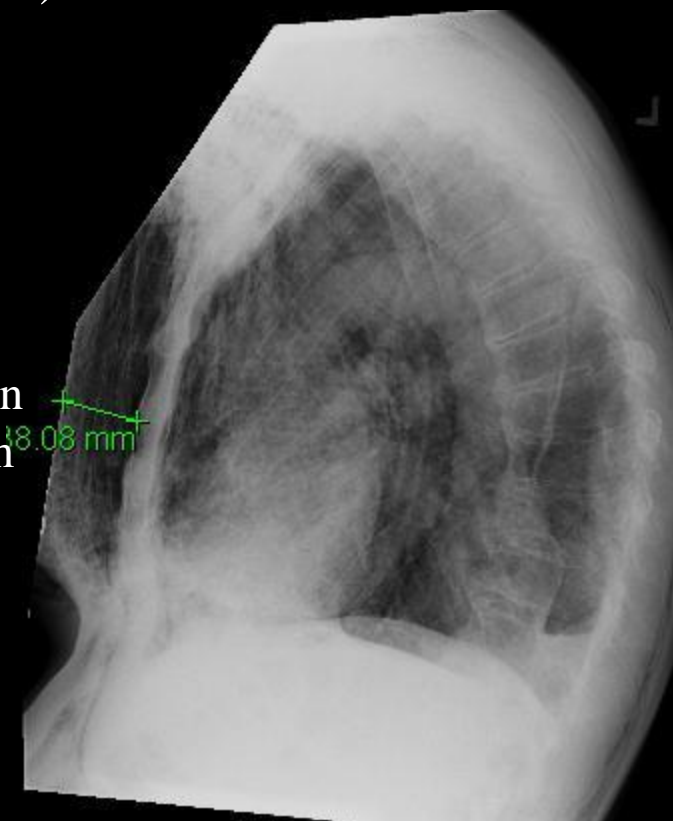
Rib Film views were ordered to elucidate fracture



Our Patient J.K: Lateral CXR

Upright CHEST (LAT)

Significant Air Collection
in Anterior Mediastinum



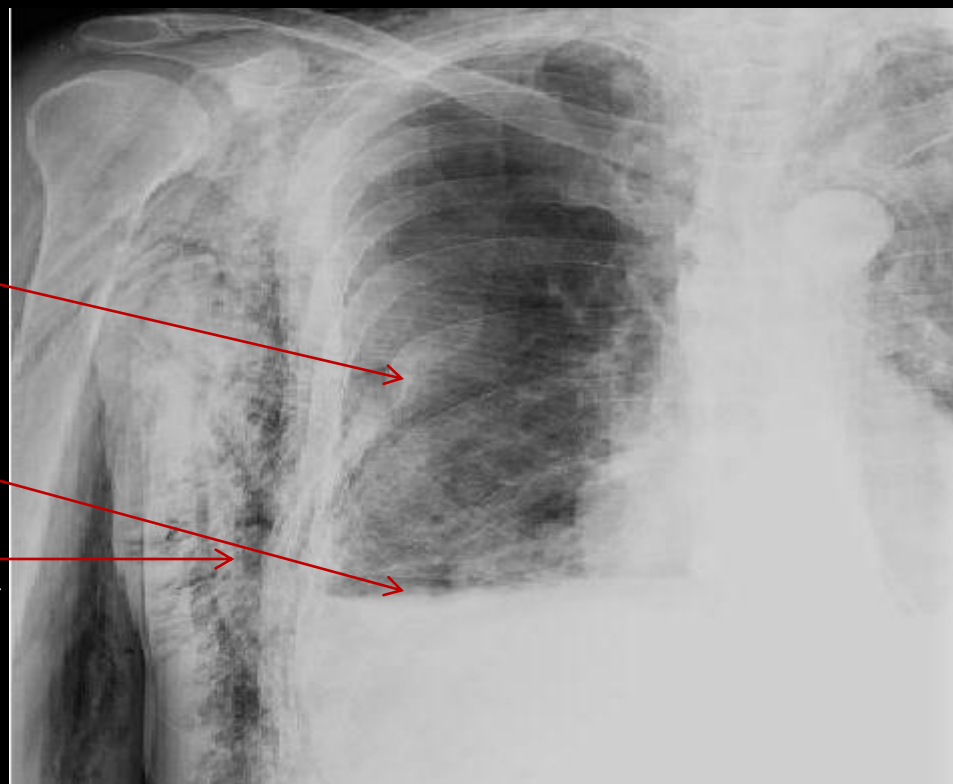


Our Patient J.K: Rib, Unilateral CXR

Two transverse non-displaced
rib fractures of ribs 7 and 8

Moderate Right Pleural effusion

Diffuse subcutaneous emphysema





Companion Patient #1

Subcutaneous Emphysema
tracking up to face





ANATOMY

What is the Mediastinum?

...is the central compartment of the thorax between the two pleural cavities.

Covered by mediastinal pleura.

Contains all thoracic viscera EXCEPT lungs

Looseness of structures enable mediastinum to accommodate changes in movement, volume & pressure in the thoracic cavity



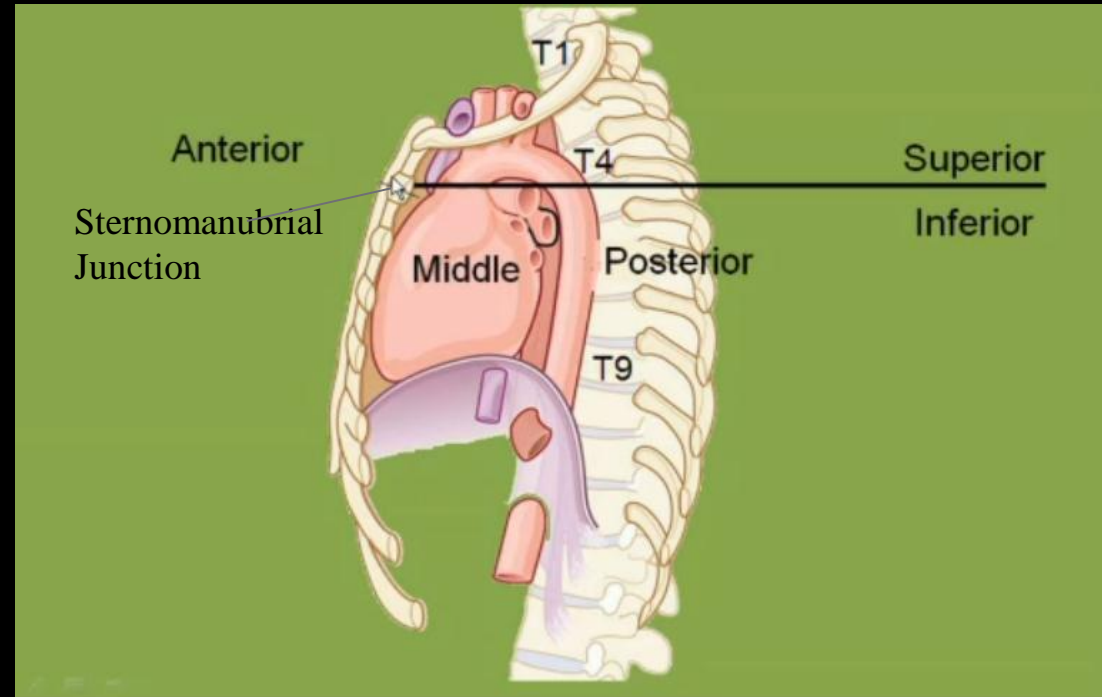
ANATOMY

Superior Mediastinum

extends from the thoracic inlet to a plane at the level of the sternal angle and the T4/5 intervertebral disc

Inferior Mediastinum

T4/5 intervertebral disc to the diaphragm



ANATOMY

Superior Mediastinum contains:

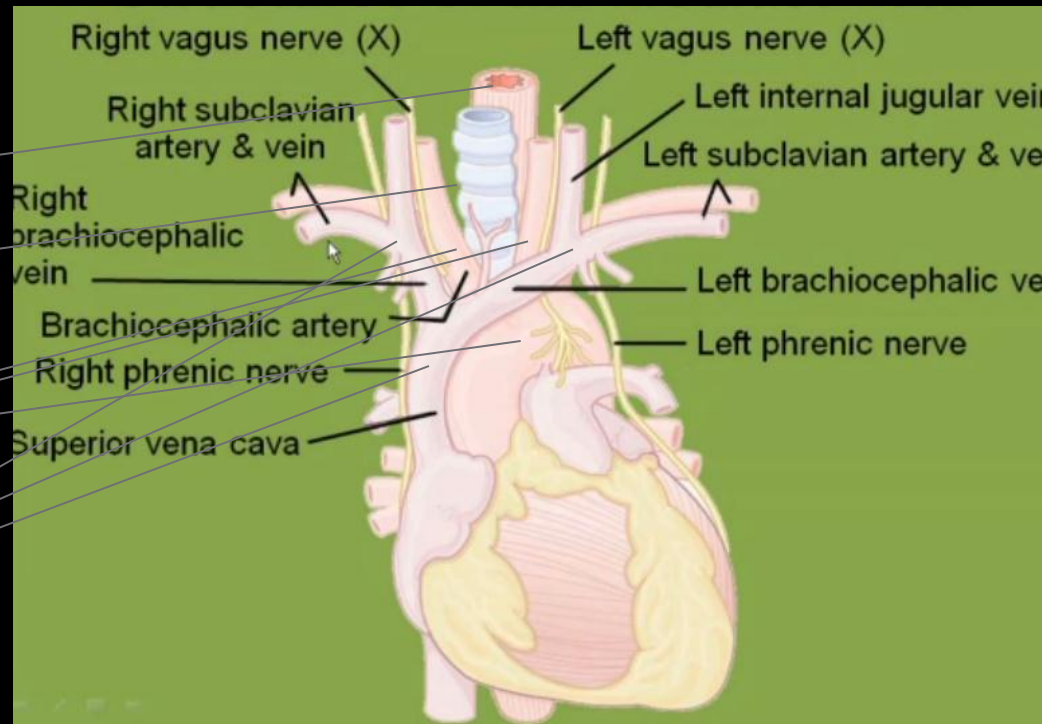
Esophagus

Trachea

Arterial Layer

Venous Layer

Thymus (not shown)





ANATOMY

Inferior mediastinum is subdivided into

anterior mediastinum

contains fats, remnant of thymus, lymph nodes.

middle mediastinum

heart surrounded by the pericardium

great vessels:

ascending aorta

superior vena cava

pulmonary trunk

posterior mediastinum

esophagus

descending aorta

thoracic duct

azygos and hemiazygos veins

thoracic sympathetic trunks

thoracic splanchnic nerves

tracheobronchial lymph nodes



EVALUATION OF PNEUMOMEDIASTINUM SYMPTOMS:

Adults-

May complain of retrosternal chest pain radiating down both arms that is exacerbated by respiration and swallowing

Dyspnea

Fever-due to cytokine release with an air leak

Throat or jaw pain, dysphonia, dysphagia, neck swelling and torticollis

Infants-

Typically Asymptomatic



EVALUATION OF PNEUMOMEDIASTINUM PHYSICAL EXAM:

Subcutaneous Air

Associated Pneumothorax

Low Oxygen Saturations

Hamman's Sign-

“Crunching” sound heard over
the apex of the heart with the
cardiac cycle



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EVALUATION OF PNEUMOMEDIASTINUM: SIGNS

The upcoming slides will address pneumomediastinum on:

Frontal Views

Lateral Decubitus Views

Lateral Views

Neck Films

Additionally you will be shown:

Continuous Diaphragm Sign

Extrapleural Air Sign

Spinnaker Sign (Thymic Sail Sign)



PNEUMOMEDIASTINUM: ON FRONTAL CXR

Characterized by lucent streaking lines or bubbles of gas that:

- outline mediastinal structures
- elevate the mediastinal pleura
- extend into the neck or chest wall
- most often visible just above the heart on the left

Gas commonly outlines the:

- Inner surface of mediastinal pleura
- Main pulmonary artery
- Aortic arch,
- Left superior intercostal vein





PNEUMOMEDIASTINUM: ON LATERAL CXR

Findings can be more
conspicuous

Gas outlines:

- Pulmonary artery
- Ascending aorta (arrows)
- Thymic remnant
- Trachea
- Proximal bronchi.





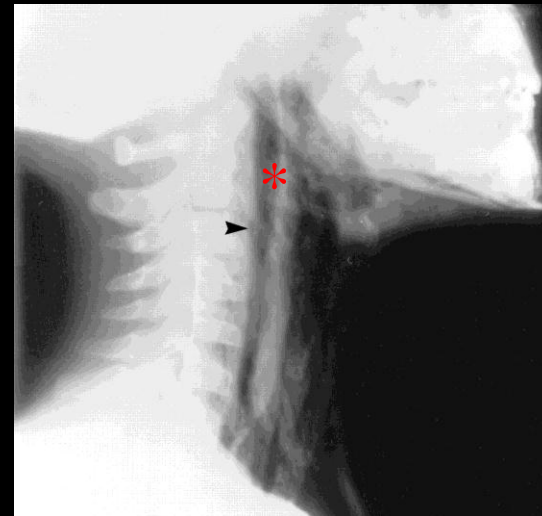
PNEUMOMEDIASTINUM: ON LATERAL AND NECK FILMS

Lateral Decubitus

Air remains in place regardless of change in position
This is extremely important when comparing this to
-Pneumopericardium
-Pneumothorax

Neck Films

Show pneumomediastinum and air in the neck and soft
tissues. **Air in retropharyngeal space**

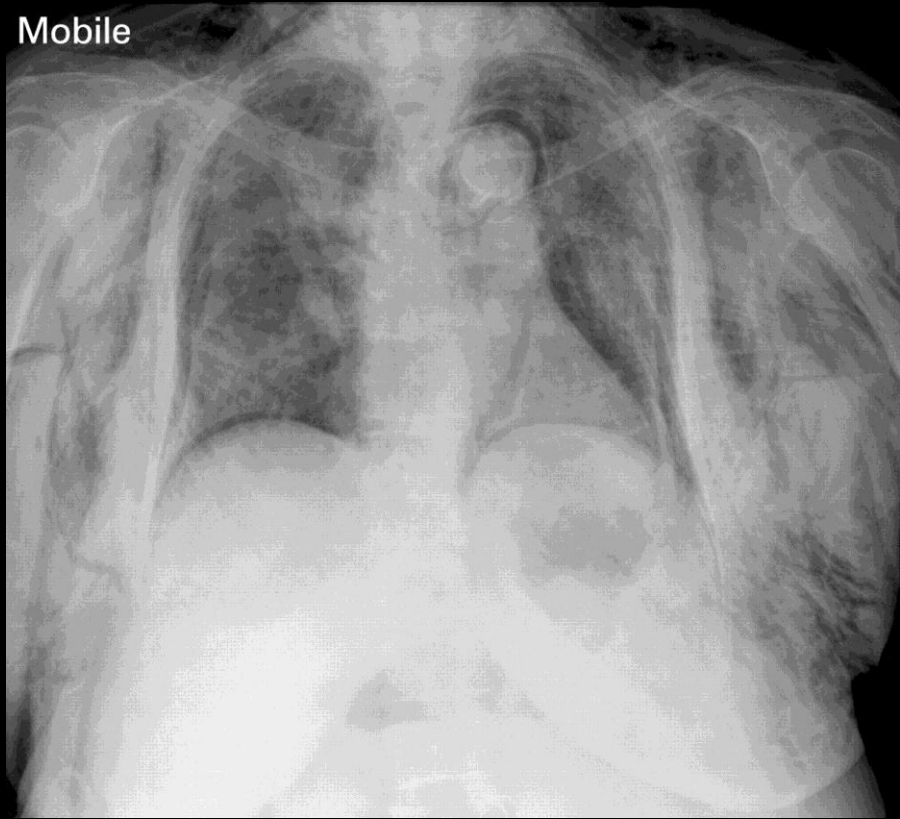




COMPANION CASE 2: Extrapleural Air Sign on CXR

Characterized by:

- a collection of free mediastinal air between the parietal pleura and the diaphragm.
- This collection is limited above by a sharp pleural stripe, is located posterior to the domes of the diaphragm, and, unlike a pneumothorax, does not shift with a change in body position.

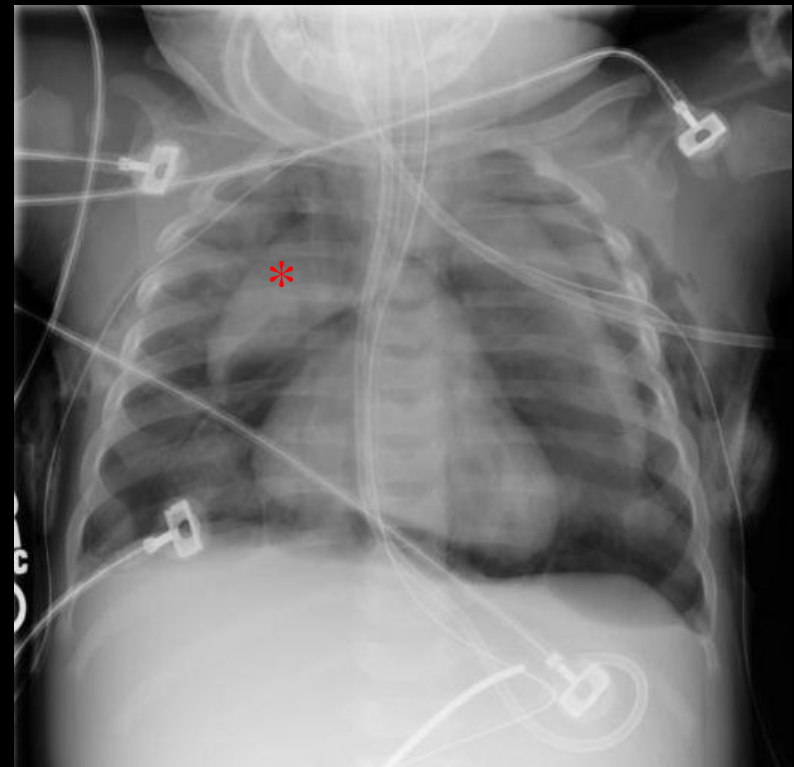




COMPANION CASE 3: Spinnaker Sign on CXR

In infants:
Mediastinal air causes elevation of the thymus
producing an appearance similar to that of a
windblown spinnaker sail.

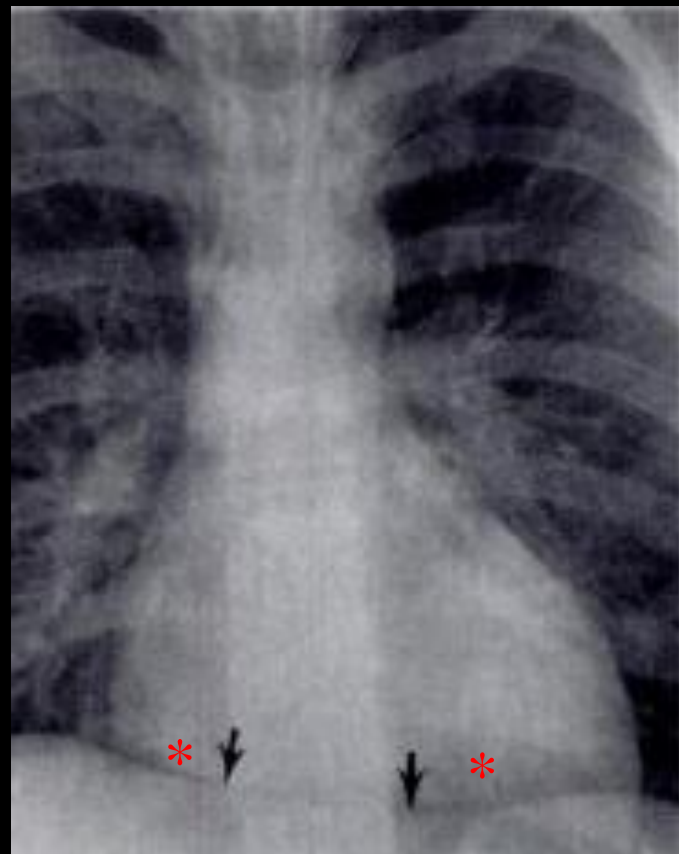
What is a Spinnaker?





COMPANION CASE 4: Continuous Diaphragm Sign

Thin band of gas between heart and diaphragm, making diaphragm visible where it is normally silhouetted out by heart.





DIFFERENTIAL DIAGNOSIS OF PNEUMOMEDIASTINUM

The Three Places Air Can Arise From:

Inside

Outside

Gas Producing Organisms



CAUSES OF PNEUMOMEDIASTINUM: Inside

Alveolar Rupture

Esophageal

Head and neck

Abdominal or retroperitoneal



INSIDE CAUSES OF PNEUMOMEDIASTINUM: Alveolar Rupture

Alveolar Rupture = Most common cause

Mechanism

Increased Alv Pressure → Alveolar Rupture → leads to pulmonary interstitial emphysema → gas travels centrally along the bronchovascular interstitial sheaths → enters the mediastinum



INSIDE CAUSES OF PNEUMOMEDIASTINUM: Increased Alveolar Pressure

Airway Obstruction

Asthma; foreign body; acute obstructive laryngitis; congenital stenosis

Valsalva maneuver

Weight lifting; Heimlich maneuver; defecation; parturition; inhalation of nitrous oxide, marijuana, or cocaine

Mechanical ventilation

General anesthesia; positive end-expiration pressure

Vomiting

Diabetic ketoacidosis; anorexia nervosa

Deep respiratory maneuvers

Strenuous activity; vital-capacity maneuvers; acidosis (Kussmaul respiration)

Change in atmospheric pressure

Caisson disease; rapid change in altitude



INSIDE CAUSES OF PNEUMOMEDIASTINUM: Alveolar Rupture

Alveolar rupture due to alveolar disease

Infection

- measles, influenza, smallpox, chickenpox,
mycobacteria (tuberculosis)

Emphysema

Interstitial lung disease

-Sarcoidosis; silicosis

Adult respiratory distress syndrome



INSIDE CAUSES OF PNEUMOMEDIASTINUM: Esophageal

Esophageal

Perforation due to:

Vomiting

Iatrogenic injury

Trauma (penetrating)

Neoplasm



INSIDE CAUSES OF PNEUMOMEDIASTINUM: Head and Neck

Compromise due to:
Perforation of nasopharynx
Facial fractures or surgery
Dental procedures
Neck surgery



INSIDE CAUSES OF PNEUMOMEDIASTINUM: Abdominal or retroperitoneal

Due to:

Bowel perforation

Diverticulitis

Hernia

Ulcer

Trauma

Rectosigmoid surgery



CAUSES OF PNEUMOMEDIASTINUM: Outside

Trauma

- Rib Fractures
- Gunshot/Knife
- Rupture of trachea or mainstem
bronchus
- Trauma to the neck
- Boerhaave's Syndrome
- Barotrauma

Iatrogenic

- Instrumentation
- Mediastinoscopy
- Mediastinal surgery
- Bronchoscopic biopsy
- Head and neck surgery
- Thyroidectomy
- Tonsillectomy

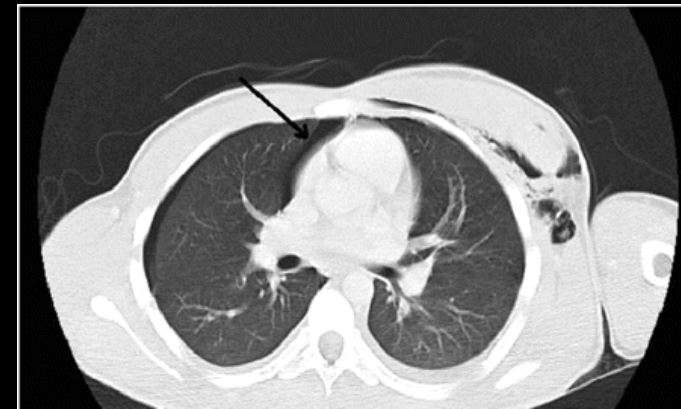


COMPLICATIONS OF PNEUMOMEDIASTINUM

Mediastinal Communications:

The mediastinum communicates with the:

- submandibular space
- retropharyngeal space and
- vascular sheaths within the neck
- retroperitoneum via sternocostal attachments to the diaphragm
- periaortic fascial
- periesophageal fascial planes



Because of these communications

- Subcutaneous Emphysema
- Deep Cervical Emphysema
- Pneumopericardium
- Pneumothorax
- Pneumoretroperitoneum



TREATMENT

Treatment depends upon severity

Often managed conservatively with analgesia, rest, and avoidance of maneuvers that increase pulmonary pressure

- Valsalva
- forced expiration
- spirometry

More severe cases will require intervention.

- Mediastinoscopy to alleviate life-threatening pneumomediastinum.
- Percutaneous placement of mediastinal drains.
- Chest tube in coexisting pneumothorax
- Bronchoscopy if tracheobronchial perforation is suspected
- Esophagoscopy if an esophageal perforation is suspected



PATIENT J.K. CONCLUSION

- Managed Conservatively
- Discharged on HD2 with no evidence of subcutaneous emphysema or dyspnea

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