PNEUMOMEDIASTINUM
“Mediastinal Emphysema”

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PNEUMOMEDIASTINUM

Presence of air within the mediastinum

Laennec (1819): Traumatic

Hamman (1939): Spontaneous
PNEUMOMEDIASTINUM
CLASSIFICATION

SPONTANEOUS
- Asthma
- COPD
- Interstitial lung disease
- Child birth
- Malignancy
- Physical activity/sports
- Cough/emesis
- Recreational drug use

SECONDARY
- Blunt trauma
- Penetrating trauma
- Iatrogenic
- Hollow viscus perforation
PATHOPHYSIOLOGY

- Pneumothorax (51%)
- Macklin effect (39%)
- Hypopharyngeal or laryngeal injury
- Gastrointestinal tract injury
- Mediastinal organ injury:
  - Tracheobronchial tree (<10%)
  - Esophagus (1-2%)
MACKLIN EFFECT (1939)

- Alveolar rupture due to increase intrathoracic pressure
- Air dissects through the peribronchovascular sheaths towards the pulmonary hilum
- Air extends into the mediastinum

Pulmonary Pressure > Mediastinal Pressure

AND

Facilitated by pumping action of breathing
SYMPTOMS

TRIAD

Hamman’s Sign
Thoracic Pain
Dyspnea

OTHER

Cough
Fever
Dysphagia
Dysphonia
Odynophagia
The Evaluation of Pneumomediastinum in Blunt Trauma Patients

Dissanaike S, et al.  
J Trauma, 2008

- Mechanism:
  - MVC: 58%
  - Fall: 21%
  - MCC/ATV: 13%

- Crepitus: 35%
  - Chest pain: 24%
  - Dyspnea: 15%
  - Hoarseness: 8%

- Associated injuries:
  - Pneumothorax: 68%
  - Hemothorax: 16%
  - Sternal fracture: 6%
  - Airway injury: 6%
  - Esophageal injury: 1.5%
The Evaluation of Pneumomediastinum in Blunt Trauma Patients

Dissanaike S, et al.

J Trauma, 2008
Pneumomediastinum in Blunt Trauma: A Review

Bergen V, et al.

Trauma, 2011

- Imaging studies:
  - CXR: 13% sensitivity
  - CT scan: 100% sensitivity

- CT scan for detecting mediastinal organ injuries:
  - 100% sensitivity
  - 85% specificity
Uncommon finding after blunt trauma

Usually benign

~6% have aerodigestive injury

Hoarseness, dyspnea, or persistent lung collapse/air leak increases suspicion for injury to the larynx, trachea, bronchi or esophagus

CT scan is the 1st line study

Bronchoscopy & Esophagram selectively
  - Clinical &/or CT findings
To identify predictive factors of mediastinal organ injury in patients with pneumomediastinum
Mediastinal Injury: Trauma (279)

- No aerodigestive injury: 266
- Airway injury: 10
- Esophageal injury: 3
Mediastinal Injury: Non-Trauma (64)

- Spont PTX: 36
- Esophageal injury: 17
- Pneumothorax: 9
- Airway injury: 2
Airway Injury

Trauma (13)
- Airway (10)
  - Stab wound: 3
  - GSW: 2
  - MVC-2
  - Traumatic intubation: 2
  - Crush injury to neck: 1
- Esophageal (3)
  - SW: 1
  - GSW: 1
  - MVC: 1

Non-trauma (19)
- Esophageal (17)
  - Boerhaave’s syndrome: 11
  - EGD: 4
  - Cervical fusion: 2
- Airway (2)
  - Intubation: 2
Pneumomediastinum: Etiology & A Guide to Diagnosis & Treatment

Banki F, et al

- Esophageal injury:
  - Instrumentation (OR: 46)
  - Pleural effusion (OR: 11)
  - Vomiting (OR: 9)

- Airway injury:
  - Instrumentation (OR: 9)

- Pneumothorax:
  - A strong negative indicator (OR: 0.06) of esophageal injury
  - Not associated with airway injury
Pneumomediastinum: Etiology & A Guide to Diagnosis & Treatment

Banki F, et al

- Most do not have aerodigestive injuries
- Pneumomediastinum is of no clinical significance
- Patients should be treated on their overall clinical findings, associated injuries & imaging
- Mediastinal organ injury should be detected based on H&P with a focus on:
  - Recent instrumentation of esophagus or airway
  - History of vomiting
  - Presence of a pleural effusion
## Other Studies

<table>
<thead>
<tr>
<th>Blunt Trauma (n)</th>
<th>Pneumomediastinum</th>
<th>Aerodigestive Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>9,946</td>
<td>2.6% (258)</td>
<td>1.6% (4)</td>
</tr>
<tr>
<td>2,052</td>
<td>2.7% (55)</td>
<td>0% (0)</td>
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<tr>
<td>1,364</td>
<td>5.2% (71)</td>
<td>10.3% (8)</td>
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<tr>
<td>897</td>
<td>6.5% (58)</td>
<td>0% (0)</td>
</tr>
<tr>
<td>3,327</td>
<td>2.2% (72)</td>
<td>NA</td>
</tr>
</tbody>
</table>
UMC El Paso
(2000 - 2015)

- 102 patients
  - 0.3% all admissions
- 89% blunt mechanism
- 75% male
- Mortality: 3.9%

- Mean age: 36.5
- Mean ISS: 21.6
- Mean LOS: 9.6 days
- Mean vent. days: 3.5
UMC El Paso
(2000 - 2015)

n = 102

- MVC: 41%
- Fall: 16%
- Aped: 12%
- MCC: 13%
- GSW/SW: 10%
- Other: 8%

Bar graph showing percentages:
- Pneumothorax: 53%
- Esophagus: 4%
- Trachea: 3%
- Bronchus: 0%
- Larynx: 0%
To characterize CT findings associated with mortality in blunt trauma patients with pneumomediastinum.
Computed Tomographic Findings & Mortality in Patients with Pneumomediastinum from Blunt Trauma

Lee W, et al.
JAMA Surg, 2015

- Pneumomediastinum size was not associated with mortality (P=.22)

- Posterior mediastinum
  - Mortality: 25% (7 of 28 pts; P = .007)

- All mediastinal compartments
  - Mortality: 40% (4 of 10 patients; P = .01)

- Hemothorax
  - Mortality: 22% (8 of 36 pts; P = .01)

CT Scan: A triage tool to alert the trauma surgeon to a potentially lethal injury
MANAGEMENT

- Conservative
  - Analgesia
  - Rest
  - Avoid maneuvers that increase pulmonary pressure
    - Valsalva
    - Cough or emesis
    - High PEEP or high tidal volume
  - High concentration of oxygen
- Identify & treat
  - Uncommon mediastinal organ injury
  - Rare tension pneumomediastinum or tension pneumopericardium
SUMMARY

Aerodigestive injuries uncommon

CT scan as screening tool

History & Physical Exam

Selective use of bronchoscopy or esophagram