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# PNEUMOMEDIASTINUM AND PNEUMOPERICARDIUM DUE TO MACKLIN EFFECT – A CASE REPORT

***Shrinuvasan S., Chidambaram R and Jothibasu T**
*Department of Radiology, Sri Lakshmi Narayana Institute Of Medical Sciences, Puducherry, Affiliated to Bharath University, Chennai, India*
**Author for Correspondence*

## ABSTRACT
Pneumomediastinum (PM) with pneumopericardium and subcutaneous emphysema is an uncommon finding following blunt trauma to the neck or chest. Traumatic Pneumomediastinum occurs in 10% of cases of blunt trauma to chest. Most of the cases are due to alveolar rupture and leak of air from the pneumothorax, rest are due to Macklin effect. CT scan is the primary imaging modality to detect pneumomediasinum at an earlier stage that can be life threatening. We present here a case of 45 years old male with alleged history of road traffic accident with fracture first rib who developed pneumomediastinum, pneumopericardium and subcutaneous emphysema due to Macklin effect without associated pneumothorax which resolved spontaneously on conservative management.

***Keywords:*** *Pneumomediastinum, Pneumopericardium, Macklin Effect*

## INTRODUCTION
Pneumomediastinum (from Greek pneuma "air") also known as mediastinal emphysema can be divided into two groups: Spontaneous Pneumomediastinum described by Hamman (1939) and Secondary Pneumomediastinum, first described by Laennec (1819) in a case of chest trauma. Traumatic Pneumomediastinum occurs in up to 10% of cases of blunt chest trauma (Wintermark, 1999). The majority of traumatic PM results from medial tracking of air from a concomitant pneumothorax. The Macklin effect, of air tracking medially along peribronchial sheaths from alveolar rupture, is responsible for most other cases (Bergen, 2011). When there is fracture of ribs the cause for pneumomediastinum is usually due to tracking of air from pneumothorax. Pneumomediastinum and pneumopericardium due to Macklin effect without pneumothorax in a case of fracture first rib following blunt chest trauma is rare.

## CASES
A 45 years old male with alleged history of road traffic accident and fall from two wheeler presented with chest pain and breathlessness for two days. On examination was found to have crepitus over chest and neck.

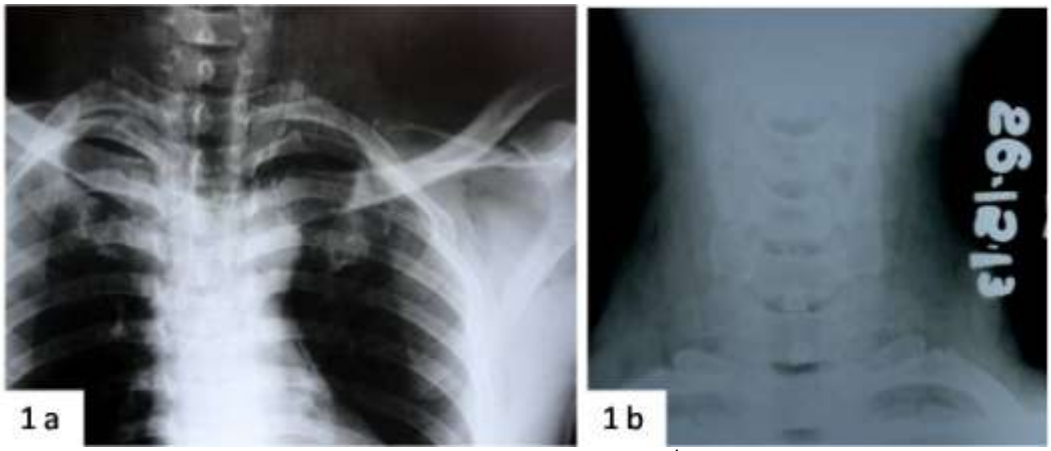


**Figure 1a: Radiograph chest (PA view) shows fracture left 1st rib with minimal displacement with air streaks in pulmonary hilar and left scapular region**
**Figure 1b: Radiograph soft tissue neck shows linear radiolucent areas suggestive of air streaks**

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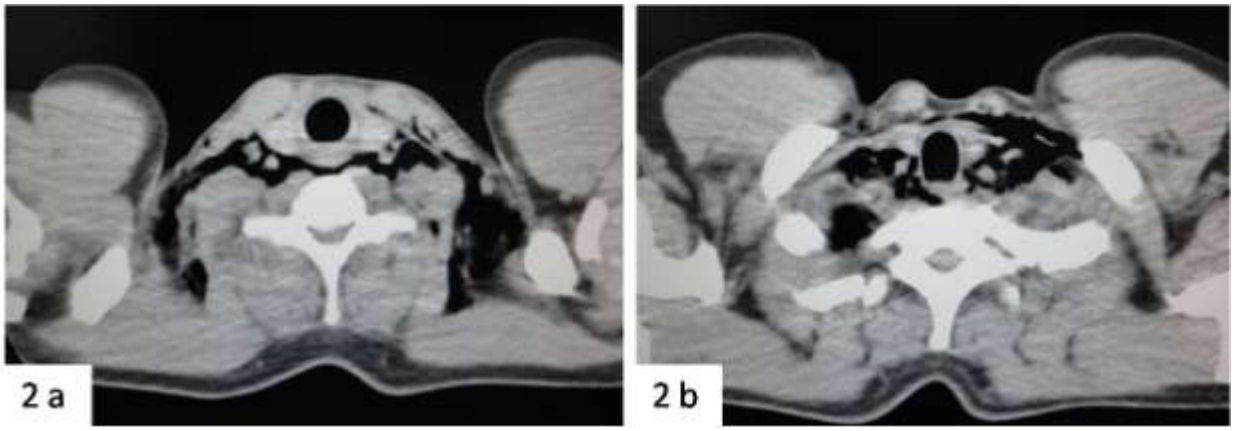


**Figure 2a, 2b**: **Non-enhanced Axial Sections of CT neck soft tissue window shows extension of air into the neck and prevertebral space**

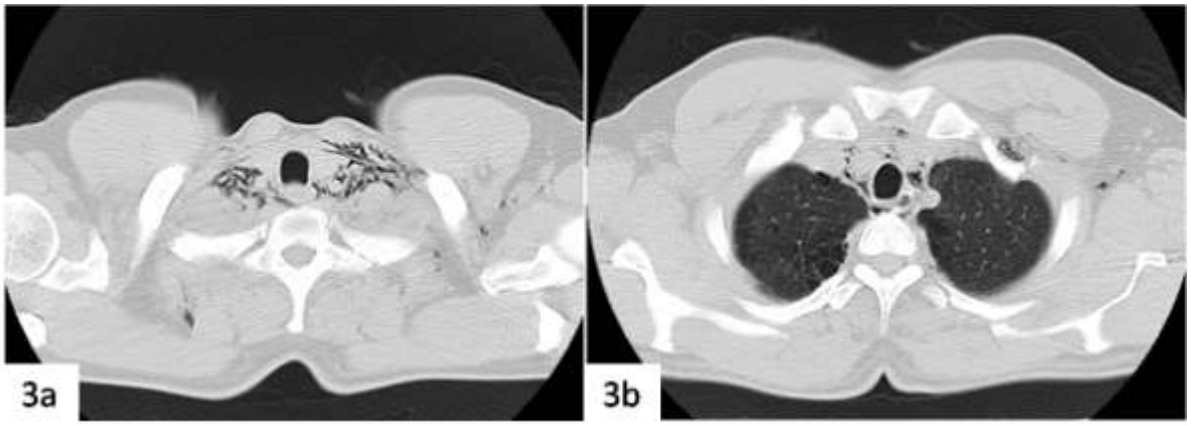


**Figure 3a**: **Non-enhanced Axial Sections of CT thorax lung window shows streaks of air surrounding vessels of neck and thyroid**
**Figure 3b: Fracture of left 1st rib with minimal displacement showing air pockets adjacent to it and around the trachea and vascular structures**

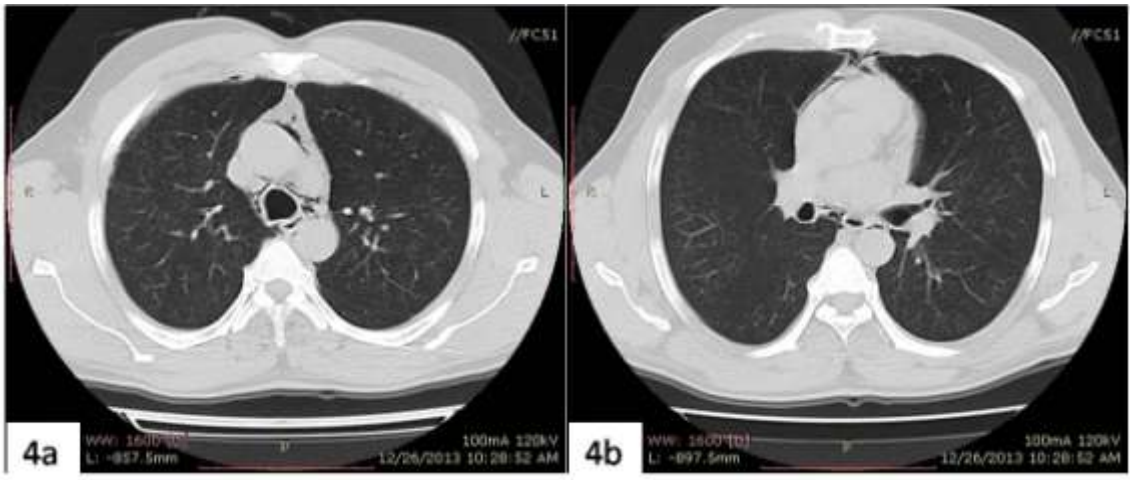


**Figure 4a,4b**: **Non-enhanced Axial Sections of CT Thorax Lung Window Shows air surrounding trachea, oesophagus, ascending aorta and pulmonary vessels (Ring around the Artery Sign) with extension of air into Pericardium**

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Chest X ray revealed oblique fracture of left 1st rib with minimal displacement and linear radiolucent areas of air streaks noted in soft tissue neck, pulmonary hilar and left scapular region (Figure 1 a, b).
CT scan was performed immediately. Non-enhanced Axial Sections of CT Neck/Thorax mediastinal window showed presence of air in the mediastinum with extension to neck (Figure 2 a, b). Non-enhanced Axial Sections of CT thorax lung window showed streaks of air surrounding vessels of neck, thyroid, trachea, oesophagus and ascending aorta with extension of air into pericardium (Figure 3, 4).The patient was put under close observation with symptomatic treatment in ICU for two weeks. After close monitoring for 2 weeks CT Thorax lung showed spontaneous complete resolution of pneumomediastinum, pneumopericardium and subcutaneous emphysema (Figure 5 a, b).

**DISCUSSION**

Pneumomediastinum is due to breach of an air-containing mediastinal structure. Chest pain is the most common symptom, and air crepitus is the most common sign. Hoarseness, dyspnea, persistent lung collapse or air leak should increase suspicion for aerodigestive injury.
Traumatic rupture or penetration of the alveoli, pleurae by fractured ribs and tracheobronchial tears may cause pneumothorax, as well as pneumomediastinum. Pneumothorax occurs when the tracheobronchial lesion lies distal and pneumomediastinum occurs when the lesion lies medial to the pulmonary ligament. Most of the cases of PM are due to alveolar rupture and leak of air from the pneumothorax, rest are due to Macklin effect,where the air leaks from the lumen of the lung and then travels along the peribronchovascular sheaths, dissecting in a medial direction and resulting in mediastinal air(Wicky,2000; Macklin,1939). Only 1-6% of cases result from rupture of the larynx, trachea, bronchi or oesophagus (Bergen, 2011)
This patient developed pneumomediastinum and pneumopericardium due to Macklin effect with no evidence of any airway injury or associated pneumothorax. Macklin effect is once again the major cause for pneumopericardium. It is most likely that air enters the pericardial sac along the venous sheaths, where the collagenous support of the pericardial reflections is weaker.
Macklin effect is observed usually in patients under 60, mainly in healthy young men. It is described that increased stiffness of the pulmonary interstitium in the elderly may prevent tissue dissection of air along bronchovascular sheaths. (Wintermark, 2001)
There are only few cases of Pneumomediastinum due to Macklin effect reported in literature. Sakellaridis *et al.,* (2009) reported a case of subcutaneous emphysema, pneumomediastinum and pneumoperitoneum following ERCP. Assenza *et al.,* (2012) reported two cases of Pneumomediastinum and Pneumoperitoneum following Blunt Chest Trauma. Konijn *et al.,* (2008) reported a case of pneumopericardium, as well as pneumomediastinum and bilateral pneumothorax with severe lung contusion and haemothorax following blunt chest trauma.

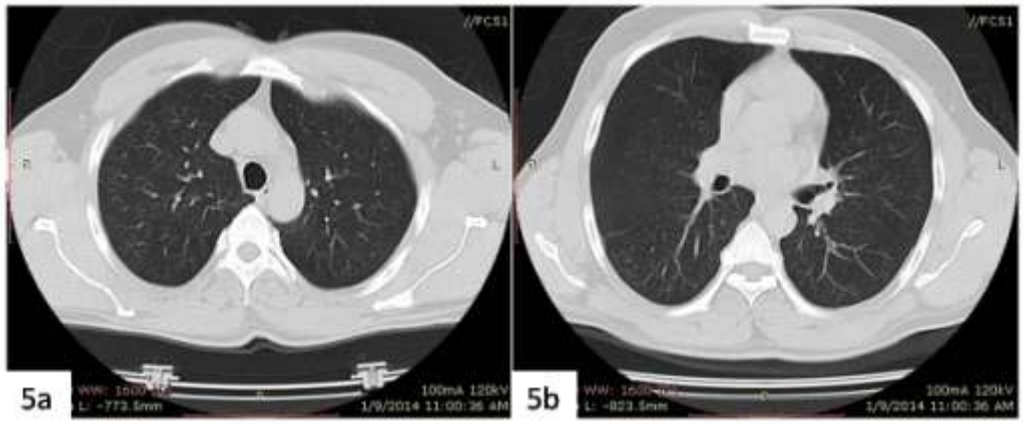


**Figure 5a,5b: Non-enhanced Axial Sections of CT thorax Lung Window after close monitoring shows spontaneous complete resolution of Pneumomediastinum**

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Although chest radiography plays significant role for rapid triage, CT is a more accurate technique for better characterization of thoracic injuries. In the Macklin effect, an accurate and early CT examination can show the air dissecting the bronchovascular sheaths and finally spreading into the mediastinum and can help to identify those that require surgical correction(Wintermark,1999). High suspicion for aerodigestive injury based on clinical and/or CT findings should prompt diagnostic bronchoscopy and/or oesophagram.

Wintermark and Schnyder (2001) showed simultaneous tracheal injury and Macklin effect to cause PM.Thus, identification of a Macklin effect should not prevent the patient from undergoing a bronchoscopy.

The majority of PM will resolve spontaneously, and requires no specific intervention. Repeated chest x-rays should be done to rule out progression of pneumothorax/ PM. If perforation is demonstrated in the imaging studies, surgical repair is indicated.

***Conclusion***

This is a rare case of pneumomediastinum and pneumopericardium following blunt chest trauma with fracture of first rib without associated pneumothorax. Chest trauma with bone fractures should raise the suspicion of intrathoracic organ lesions. CT scan should be performed at an early stage to exclude pneumothorax, pneumomediastinum, pneumopericardium, haemothorax and lesions of any intrathoracic structures and to decide upon the treatment.

**REFERENCES**

**Assenza M, Passafiume F, Valesini L, Centonze L and Romeo V *et al*., (2012).** Pneumomediastinum and Pneumoperitoneum after Blunt Chest Trauma: The Macklin Effect. *Journal of Trauma and Treatment* **1** 107.

**Bergen VV, Dissanaike S and Jurkovich G (2011).** Pneumomediastinum in blunt trauma: A review. *Trauma* **13** 199-211.

**Hamman L (1939).** Spontaneous mediastinal emphysema. *Bulletin of the Johns Hopkins Hospital* **64** 1-21.

**Konijn AJM**, **Egbers PHM and Kuipe MA (2008).** Pneumopericardium should be considered with electrocardiogram changes after blunt chest trauma: a case report. *Journal of Medical Case Reports* **2** 100.

**Laennec RTH (1819).** *A Treatise on Diseases of the Chest and on Mediate Auscultation,* 2nd edition, London, UK.

**Macklin CC (1939).** Transport of air along sheaths of pulmonic blood vessels from alveoli to mediastinum. Clinical implications. *Archives of Internal Medicine* **64** 913-926.

**Sakellaridis KAT**, **Sikalias N**, **Karanikas I**, **Economou N and Antsaklis G (2009)**. Subcutaneous emphysema, pneumomediastinum and pneumoperitoneum after unsuccessful ERCP: a case report. *Cases Journal* **2** 120

**Wicky S, Wintermark M, Schnyder P, Capasso P and Denys A (2000).** Imaging of blunt chest trauma. *European Radiology* **10** 1524-1538.

**Wintermark M and Schnyder P (2001).** The Macklin effect: a frequent etiology for pneumomediastinum in severe blunt chest trauma. *Chest* **120** 543-547.

**Wintermark M, Wicky S, Schnyder P and Capasso P (1999).** Blunt traumatic pneumomediastinum: using CT to reveal the Macklin effect. *American Journal of Roentgenology* **172** 129-130.