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# Urgent Diagnosis and Management of PNEUMOTHORAX in Emergency Department: Overview

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***Abstract:*** **Pneumothorax is specified as the presence of air in the pleural cavity; the space between the chest wall and the lung itself. We aimed to overview the pneumothorax as it's an emergency condition that need urgent diagnosis and treatment in emergency medicine, we intended to evaluate the procedures that are available in ER to early diagnosis of Pneumothorax, and demonstrate some studies that are concerned with this topic. We conducted a comprehensive literature search of related studies to emergency management and diagnosis of pneumothorax, through database, PubMed (Midline) to the period of December 2016, using Mesh terms as following; Pneumothorax, spontaneous pneumothorax, emergency department, urgent treatment, early diagnosis. We tried to extract more studies from the references list of identified studies, to provide more supportive evidence for our study. Traditional techniques to the diagnosis and management of pneumothorax are being challenged, and physicians need to keep an open mind regarding brand-new approaches to this condition. As CT scans have actually become more affordable and more extensively utilized their role in detecting pneumothorax is likewise evolving and being more clearly defined. More cases of little pneumothorax are being identified, but management decisions are not always being changed. Less costly and less painful options (besides standard tube thoracostomy and admission) exist for lots of etiologies, and more patients are being discharged home than in the past. Comprehending these patterns is critical to supplying ideal take care of patients with pneumothorax.**

***Keywords:*** **PNEUMOTHORAX, PubMed.**

## 1. INTRODUCTION

Pneumothorax is specified as the presence of air in the pleural cavity; the space between the chest wall and the lung itself. It was first acknowledged pneumothorax in 1803, and Laennec himself explained the full clinical image of the condition. In the 2nd part of XIX century it was believed that tuberculosis was the main cause of pneumothorax given that it existed mostly in patients with tuberculosis. On the other hand, Forlanini (Europe, in 1882) and John B. Murphy (the USA, in 1898) mentioned the useful outcomes of pneumothorax in tuberculosis treatment (collapse treatment) [(1, 2)]. More than half of pneumothorax cases are spontaneous pneumothorax that occurs without any injury [(3,4,5)]. The pneumothorax developed without injury or lung disease is called main spontaneous pneumothorax (PSP), and occurred as a result of underlying lung disease such as persistent obstructive lung disease referred to as a secondary spontaneous pneumothorax (SSP) [(6,7,8)]. Those consisting of reasons such as thoracentesis, biopsies and main venous catheterization is called iatrogenic pneumothorax, and including post-traumatic factors such as chest trauma is called distressing pneumothorax [(5)].

Pneumothorax rate of all life-long smokers is roughly 12%, on the other hand 0.1% for non-smokers [(10)] In Karasu et al. [(11)] research study smoking rate was 86.9%. In the patients with PSP and SSP rate of smoking was 93.3% and 18.2%, respectively. In other study [(9)] 39.8% of spontaneous pneumothorax was cigarette smokers. 93.9% of cigarette smoker patients in the study were male, and it is a sign that men are more smoker than females. In this study the average size of

spontaneous pneumothorax, was significantly higher than the average size of terrible pneumothorax. According to Light index group portions of pneumothorax at spontaneous pneumothorax (76%) were higher than terrible pneumothorax (52%). Pneumothorax is typical and deadly scientific condition which may require first aid in Emergency Medicine Departments [9,10]. The patient's complaint is usually related to the area covered by pneumothorax and the patient's physiological reserve. Minor modifications in lung volume builds no symptoms and not have the ability to discover throughout the assessment. The medical diagnosis of pneumothorax has to do with lines were seen around the visceral pleura surrounding the collapsed lungs on PA chest X-ray. Emergency treatment of pneumothorax is bed rest, oxygen treatment, observation, simple aspiration, closed intercostal tube drainage and tube thoracostomy [9].

**Objective:** We aimed to overview the pneumothorax as it's an emergency condition that need urgent diagnosis and treatment in emergency medicine, we intended to evaluate the procedures that are available in ER to early diagnosis of Pneumothorax, and demonstrate some studies that are concerned with this topic.

## 2. METHODS

We conducted a comprehensive literature search of related studies to emergency management and diagnosis of pneumothorax, through database, PubMed (Midline) to the period of December 2016, using Mesh terms as following; Pneumothorax, spontaneous pneumothorax, emergency department, urgent treatment, early diagnosis. We tried to extract more studies from the references list of identified studies, to provide more supportive evidence for our study.

## 3. RESULTS & DISCUSSION

***Classification of pneumothorax can help in urgent diagnosis:***

It is generally categorized on the basis of its causes. Pneumothoraces are classified as distressing and nontraumatic (spontaneous) [12]. Nontraumatic pneumothoraces are further partitioned into main (taking place personallies with no recognized history of lung disease) and secondary (happening in persons with a known history of lung disease, such as persistent obstructive lung disease) [13]. Pneumothoraces might likewise be further described as easy pneumothorax (no shift of the heart or mediastinal structures) or stress pneumothorax. It can also be categorized as open ("sucking" chest wound) and closed (undamaged thoracic cage) [12].

Inning accordance with aetiology pneumothorax is classified into terrible and spontaneous (**Table 1**) [14]. Spontaneous pneumothorax is additional classified into primary and secondary. Terrible pneumothorax might result from either blunt injury or penetrating injury to the chest wall. It can likewise be triggered by iatrogenic injuries [15]. This condition occurs in 7.4 to 18 per 100 000 males each year and 1.2 to 6 per 100 000 women each year. The incidence of secondary spontaneous pneumothorax is 6.3 per 100 000 guys each year and 2 per 100 000 females each year (16). Some British studies that have actually been done recently show the incidence of primary spontaneous pneumothorax of 24 per 100 000 in guys and 9.8 100 000 in females [17].

***Primary spontaneous pneumothorax (PSP):***

Primary spontaneous pneumothorax (PSP) commonly occurs in high, thin, adolescent men (male-female ratio 6:1). Smoking is connected with a risk of establishing pneumothorax in healthy smoking cigarettes guys [17]. Due to the fact that the gradient in pleural pressure is higher from the lung base to the lung apex in taller individuals, the alveoli at the lung apex are subjected to a greater mean distending pressure in taller people. Over a long period, this higher distending pressure could lead to the formation of subpleural blebs [18]. The ocurrence of PSP appears to be connected to the level of smoking. The relative risk of a pneumothorax is 100 times higher in heavy cigarette smokers (more than 20 cigarettes/day) than in nonsmokers [19]. Some research studies suggest that there is a familial propensity for the advancement of main spontaneous pneumothorax. In many cases of PSP the mode of inheritance for the propensity for main spontaneous pneumothorax is either autosomal dominant with insufficient penetrance or X-linked recessive [20]. Primary spontaneous pneumothoraces are believed to be the outcome of rupture of sub-pleural blebs [21]. Sub-pleural blebs and bullae are discovered in up to 90% of cases at thoracoscopy or thoracotomy and in approximately 80% on computerised tomography (CT) scanning of the thorax [22,23]. The pathogenesis of the blebs stays uncertain. There are tips that they might be hereditary or inflammatory in origin or the outcome of disruption of security ventilation [24]. According to some research studies, precipitating factors might be air pressure modifications, exercise, and exposure to loud music [25]. Sadikot et al, research study showed a reoccurrence rate of 39% throughout the first year [26]. It likewise suggested

that there was 54% risk of recurrence of pneumothorax in 4 years. According to their studies, factors that have actually been pro- positioned to predispose patients to main spontaneous pneumothorax (PSP) consist of smoking and patient's height. The peak age for the incident of main spontaneous pneumothorax is the early 20's and it seldom takes place after age 40. Primary spontaneous pneumothorax typically develops while the patient is at rest. Main signs are chest pain and dyspnea. This pain might be moderate or serious, sharp and steady ache in character, and typically resolves within 24 h despite the fact that pneumothorax still exists [27].

**Table 1. Classification of pneumothorax**

| |
|---|
| **Spontaneous** |
| ***Primary*** *(a rupture of a subpleural bleb)* |
| ***Secondary*** |
| Chronic obstructive pulmonary disease (COPD) |
| Cystic fibrosis |
| Bronchial asthma |
| Connective tissue diseases (Marfan Syndrome) |
| Interstitial lung diseases (*Eosinophilic granuloma*) |
| Pneumocystis carinii pneumonia (in AIDS patients) |
| Pneumonia with lung abscess |
| Pulmonary hydatid disease |
| Lung cancer (metastatic sarcoma) |
| Esophageal perforation |
| Catamenial pneumothorax |
| Neonatal pneumothorax |
| **Traumatic** |
| ***Iatrogenic*** |
| Central venous catheter insertion |
| Pacemaker implantation |
| Transthoracic needle biopsy |
| Transbronchial needle aspiration |
| Thoracocentesis |
| Laparoscopic surgery |
| Barotrauma |
| ***Blunt trauma*** |
| Road traffic accident trauma, falls, sports injuries |
| ***Penetrating trauma*** |
| Shot wounds, stab wounds |

***Tension pneumothorax:***

Tension pneumothorax develops when an interruption involves the visceral pleura, parietal pleura, or the tracheobronchial tree. The disturbance happens when a one-way valve kind, enabling air inflow into the pleural area, and restricting air outflow. The volume of this non-absorbable intrapleural air boosts with each motivation [28,29]. As a result, pressure increases within the affected hemithorax; ipsilateral lung collapses and triggers hypoxia. Additional pressure causes the mediastinum shift towards the contralateral side and compresses both, the contralateral lung and the vasculature entering the right atrium of the heart. This causes intensifying hypoxia and compromised venous return. Scientists still are debating the exact mechanism of cardiovascular collapse but, usually the condition might establish from a mix of hypoxic and mechanical effects. The mechanical effects manifest as compression of the remarkable and inferior vena cava because the mediastinum deviates and the intrathoracic pressure increases. Hypoxia leads to increased lung vascular resistance through vasoconstriction. If without treatment, the hypoxemia, metabolic acidosis, and decreased heart output result in cardiac arrest and death [28,29].

***Traumatic pneumothorax:***

A traumatic pneumothorax can arise from either permeating or nonpenetrating chest injury. With permeating chest trauma, the wound allows air to go into the pleural area directly through the chest wall or through the visceral pleura from the tracheobronchial tree [3]. With non-penetrating injury, a pneumothorax may develop if the visceral pleura is lacerated secondary to a rib fracture, dislocation. Sudden chest compression quickly increases the alveolar pressure, which might trigger alveolar rupture. When the alveolus is ruptured, air gets in the interstitial space and dissects towards either the

visceral pleura or the mediastinum. A pneumothorax develops when either the visceral or the mediastinal pleura ruptures, allowing air to go into the pleural area [3].

***Diagnosis with imaging techniques (Chest X-ray, CT, and ultrasonography):***

**Chest X-ray;** It is diagnostic in bulk of the findings and cases are classical (**Figures 1, 2**) In some patients, it may be more effective to radiologically localize and confirm stress pneumothorax before subjecting the patient to prospective morbidities arising from decompression. However, this consideration needs to be limited to patients who are awake, stable, not in advanced phases of tension and when an immediate chest movie can be acquired, with facilities to perform urgent decompression if needed [30]. In assessing the chest radiograph, impressions of pneumothorax size can be misleading. To assist in figuring out the size of pneumothorax on the radiograph, a 2.5-cm margin of gas peripheral to the collapsing lung corresponds to a pneumothorax of about 30%. Complete collapse of the lung is a 100% pneumothorax.

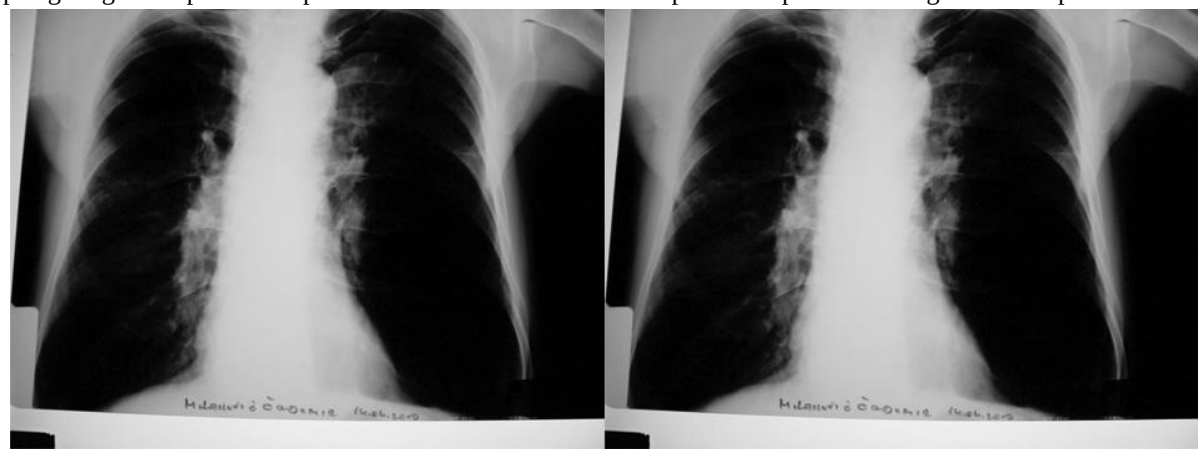

**Figure 1. 1a Spontaneous pneumothorax in the left lung; 1b Bilateral pneumothorax [14]**

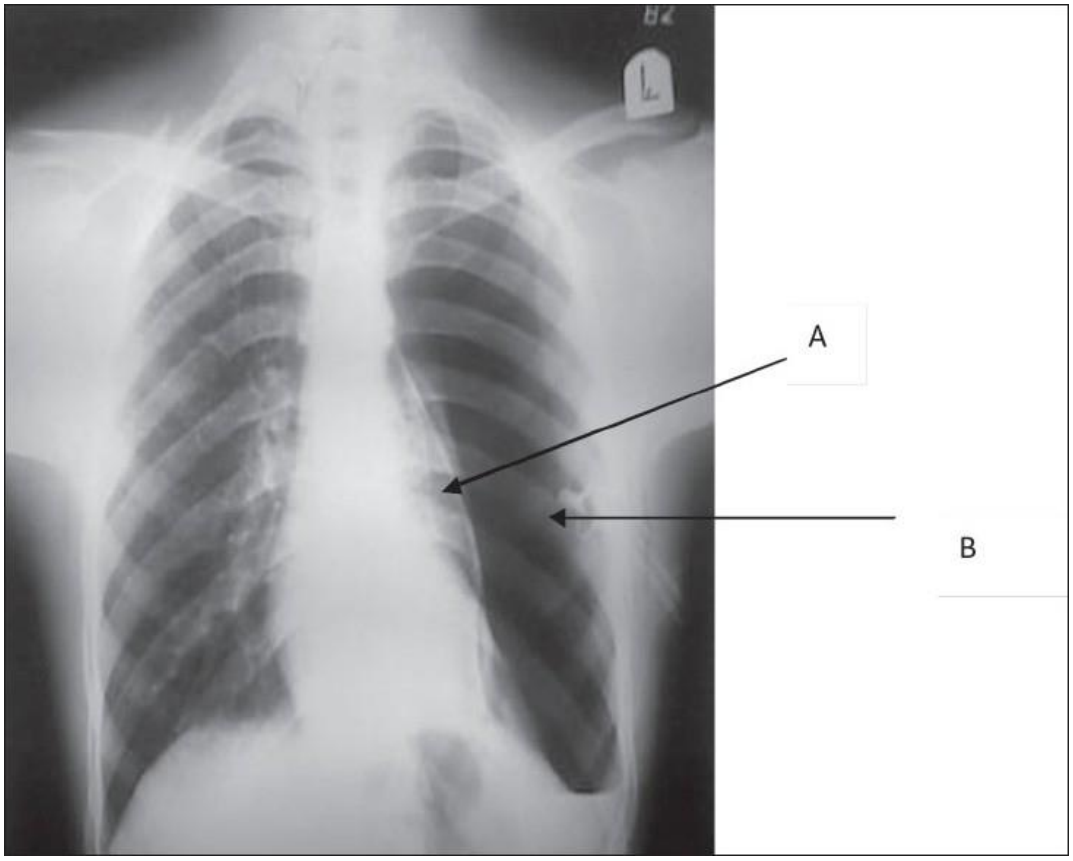


**Figure 2: Chest X-Ray showing pneumothorax secondary to blocked chest tube. A. Pleural white line B. Blocked chest tube [30]**

**Chest CT scanning;** A CT scan is more delicate than a chest radiograph in the evaluation of little pneumothoraces and pneumomediastinum, although the scientific significance of these occult pneumothoraces is uncertain, especially in the stable nonintubated patient [31]. The occult pneumothorax is being identified more regularly as methods of diagnosing and assessing injury patients become more sensitive. At present, CT scan is the gold requirement for discovering occult traumatic pneumothorax not obvious on supine chest X-ray radiograph [32].

**Ultrasonography;** Use of bedside ultrasonography in the medical diagnosis of pneumothorax is a fairly recent advancement. In some trauma centers, pneumothorax detection is consisted of as part of their focused stomach sonography for injury (FAST) examination [33]. Ultrasonographic functions used in the diagnosis of pneumothorax consist of absence of lung moving (high level of sensitivity and uniqueness), absence of comet-tail artifact (high level of sensitivity, lower specificity), and presence of lung point (high uniqueness, lower level of sensitivity). In a study, ultrasonography performed on patients with blunt thoracic trauma had 94% level of sensitivity and 100% specificity for pneumothorax detection compared with spiral CT scanning [34,35].

***Urgent Treatment of Pneumothorax:***

The objective in dealing with a pneumothorax is to remove the air from the pleural space, to enable lung to re-expand, and to prevent reoccurrences. The very best method for achieving this depends on the intensity of the lung collapse, the kind of pneumothorax, patient's overall health and on the risk of complications.There are numerous restorative possibilities in medical practice.

Observation is suggested for patients with PSP inhabiting less than 15% of the hemithorax. Just like these patients, observation stays the first-line treatment in patients with pneumothoraces of less than 1 cm depth or separated apical pneumothoraces [36]. The rate of air absorption is 1, 25% every 24 hours. Supplemental oxygen can be administered to increase the rate of pleural air absorption. Asmall number of patients is treated this way [27].

Goal may be the initial treatment for the patients with main pneumothorax. It might also be considered for patients below 50 with secondary pneumothorax of moderate size (air rim 1-- 2 cm). Percutaneous needle goal leads to complete lung re-expansion in 59 to 83% patients with PSP and in 33 to 67% patients with SSP. Recurrence rate of pneumothorax after the exsufflation is practically the same as the one after the chest tube drainage [36].

Tube thoracostomy is the most frequently carried out surgical procedure in thoracic surgery. Thoracostomy tube placement is indicated for the PSP and symptomatic patients, as well as for the symptomatic SSP, iatrogenic and terrible pneumothorax [36]. The general objestive of chest-tube therapy is to promote lung reexpansion. The chest tube is inserted via a cut at the 4th or 5th intercostals area in the anterior axillary or mid-axillary line. It can likewise be placed through 2nd midclavicular intercostal space (**Figure 3**) [37]. It is inserted near the upper border of the rib. There are 3 techniques most frequently utilized to put a chest tube: using the trocar, associated with a greater rate of intrathoracic organ injury, blunt dissection after skin incision (less comfy but with lower risk of complications) (**Figure 4**) [27].


**Figure3: Figure 8. Thoracic trocar drainage in the right lung**

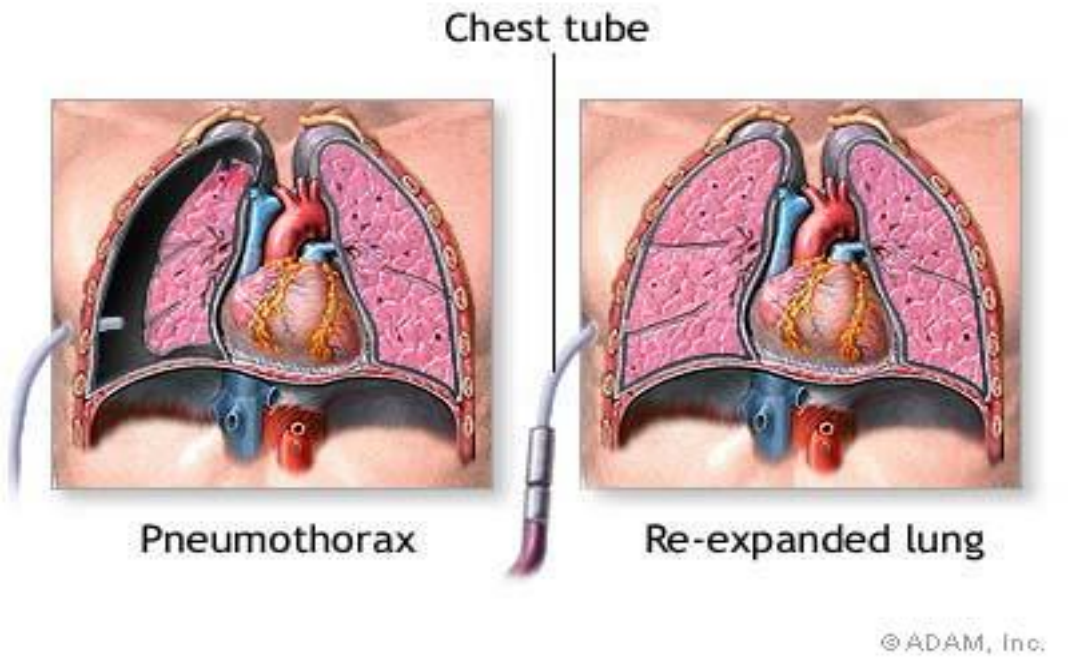


**Figure 4: Tube thoracostomy drainage**

## 4. CONCLUSION

Pneumothorax is defined as the existence of air in the pleural area. It is triggered by a rupture in visceral or the parietal pleura.Pnemothoraces can be divided into spontaneous pneumothoraces and distressing pneumothoraces. Spontaneous pneumothoraces are additional divided into primary and secondary spontaneous pneumothoraces. Traumatic pneumothorax may result from either blunt trauma or penetrating injury to the chest wall. Different methods for the diagnosis and treatment are encouraged from time to time. Traditional techniques to the diagnosis and management of pneumothorax are being challenged, and physicians need to keep an open mind regarding brand-new approaches to this condition. As CT scans have actually become more affordable and more extensively utilized their role in detecting pneumothorax is likewise evolving and being more clearly defined. More cases of little pneumothorax are being identified, but management decisions are not always being changed. Less costly and less painful options (besides standard tube thoracostomy and admission) exist for lots of etiologies, and more patients are being discharged home than in the past. Comprehending these patterns is critical to supplying ideal take care of patients with pneumothorax.

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