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# Childhood Pneumothoraces: A Preventable Cause of Mortality in the Third World

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**Abstract:** Pneumothorax is an often easily managed medical condition mostly diagnosed by clinical evaluation and plain chest radiograph rather than exotic, often expensive and non readily available medical equipment. However, a rather unfortunate outcome of childhood pneumothoraces is observed in our environment mainly due to the effect of poverty, social disadvantage and ignorance. To highlight the effect of these factors on the morbidity and mortality of childhood pneumothoraces, we present 2 cases representing the secondary spontaneous and indirect traumatic types and also did a review of literature.

**Key words:** Childhood, pneumothorax, digonosis, mortality, radiological

## INTRODUCTION

Pneumothorax is a common condition affecting all age groups (Dov *et al*., 2000). It is often associated with morbidity and sometimes mortality especially in children if not promptly diagnosed and treated. It is classified according to aetiology into spontaneous, traumatic or iatrogenic and can easily be managed if presented promptly, assessed clinically and evaluated radiologically.

## CASE REPORTS

**Case 1:** A 1.5 year old girl who presented with 3 weeks history of persistent high grade fever and cough. There was associated loss of apetite and difficulty with breathing but no history of vomiting, loss of consciousness or convulsive episode. The difficulty in breathing became worse about 4 h before presentation. The mother, a divorcee in whose care and custody the child had been, though noted the illness but never had the money and time to seek appropriate medical treatment as she went out daily hoping to get menial labour to provide food for the girl and her 5 siblings. She however instructed the eldest child to administer palmoil and a local concotion made of humam urine orally.

Clinical examination revealed a febrile (38°C), dyspnoec, tachypnoiec (Respiratory rate 50 Cyc $min^{-1}$), semi conscious patient with tachycardia. She was not pale and anicteric but cyanosed. There was a resonant percussion note and reduced air entry in the right (Rt) lung field.

The Central Nervous, Cardiovascular and Abdominal examination were normal.

A diagnosis of Right Bronchopneumonia with associated pneumothorax was made. Resuscitative measures which included Simple aspiration were immediately instituted before the planned tube thoracostomy but the patient started gasping and died few minutes after admission despite resuscitative measures.

The Chest radigraph (Fig. 1) revealed a Right sided large area of luscency, devoid of lung marking and compression of the ipsilateral underlying lung medially. The Right costophrenic sulcus is blunted suggestive of minimal effusion. There is contralateral shift of the

Fig 1: Showing a Rt sided tension pneumothorax with collapsed of the ipsilateral lung

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mediastinum. Little streaky opacity are seen in the left lung field. The left pleural recesses and bony thorax are normal.

A diagnosis of Right Complete tension pneumothorax was confirmed.

**Case 2:** A 5 year-old girl who presented at the E.N.T. clinic 2 h after swallowing a foreign body (doll's valve) with difficulty with breathing. Clinical examination revealed a mildly dyspnoiec and anxious patient; not pale, anicteric, afebrile.

Laryngoscopy revealed a foreign body in the upper respiratory tract.

She was to be taken to the theatre immediately for removal.

However, the mother, an illiterate widow, absconded with the patient because of the risk of surgery and the lack of fund for the procedure.

She presented 2 weeks later after attempted removal by traditional doctors with severe breathlessness.

On reassessment, she was mildly pale, febrile, severely dyspnoiec, tachypnoeic with tachycardia and central cyanosis.

Chest radiograph (Fig. 2) revealed a normal cardiac size with linear luscencies extending to both hili from the medial portions of the lung apices, worse in the right: These are in keeping with pneumomediastinum. There are associated pneumopericardium and a right pneumothorax. Patchy opacities are seen in the right lung field. The bony thorax is normal but multiple linear luscencies are seen in the overlying soft tissues and in the neck. The aspirated foreign body was not seen.

A diagnosis of pneumopericardium; pneumomediastinum; pneumothorax and soft tissue emphysema as complications of foreign body aspiration was made.

Fig. 2: Showing subcutaneous emphysema (arrow heads, pneumopericardium (arrow and penumomediastium)

Computerized Tomography was requested for. However, the patient's condition was bad at presentation and she died before the Computerized Tomography Scan could be done.

## DISCUSSION

The term pneumothorax was first coined by Itard, a student of Laennec in 1803 and Laenec himself described the clinical features of pneumothorax in 1819 (Henry *et al*., 2003).

Pneumothorax is defined as air in the pleural space that is between the lung and the chest wall (Light *et al*., 1995). It can also be defined as presence of air in the pleural cavity with secondary lung collapse.

Pneumothorax can be classified into [a] spontaneous, occurring without a preceding event; [b] traumatic due to direct or indirect trauma and [c] iatrogenic, though categorized by some investigator as a subdivision of traumatic pneumothorax (Schramel *et al*., 1997; Light *et al*., 1983).

Case 1 is a spontaneous type of pneumothorax while Case 2 is an indirect traumatic type of pneumothorax.

Spontaneous pneumothorax comprises the largest group and it is Subdivided into Primary Spontaneous (PSP) and secondary spontaneous (SSP) pneumothorax. PSP occurs in young patients without obvious underlying disease and is usually caused by the rupture of a subpleural bleb which may be congenital especially in young males. Such blebs are usually in the lung apex and may be bilateral. SSP occurs as a complication of an underlying lung disease for example ruptured pneumatocoele (tension cyst) in staphylococcus pneumonia especially (in children), subpleural pulmonary tuberculous focus, cavitating subpleural metastasis, subpleural tension cyst in carcinoma of the bronchus and others which include Chronic Obstructive Pulmonary Disease (COPD) and interstitial pulmonary fibrosis (cytic fibrosis, histiocytosis, tuberous sclerosis, sarcoidosis and some pneumoconiosis).

Cases 1 is a secondary spontaneous pneumothorax since they occur as a complication of bronchopneumonia. Spontaneous pneumothorax is said to occur bilaterally in 5% of patients. It may coexists with pleural effusion in 10% of patients and with haemothorax in 7% (Cortes *et al*., 1997). Tension pneumothorax occurs in 1 to 3% of spontaneous pneumothoraces. Minimal right sided pleural effusion as evidenced by blunting of the costophrenic sulcus is seen in Case 1.

Traumatic pneumothorax occurs in penetrating chests wound, closed chest trauma (e.g ruptured bronchus in road traffic accidents), rib fracture etc.

Traumatic pneumothorax may also occur as a complication of pneumomediastinum which causes may include foreign body aspiration in children, perforation of esophagus, trachea, bronchus and extension from retroperitoneal space in perforated abdominal viscus. The second casehad pneumopericardium, pneumo-mediastinum, pneumothorax and subcutaneous emphysema as a result of aspirated foreign body.

Pneumothorax from diagnostic procedures like pleural biopsy, aspiration lung biopsy, esophagoscopy, positive-pressure ventilation and surgical procedures like mediastinal operation, nephrectomy are classified as Iatrogenic or sometimes traumatic by some authors (Schramel *et al*., 1997; Light *et al*., 1983).

Air is said to enter the pleural cavity through a defect in either the parietal or the visceral pleura. Such defects are either as the result of a lung pathology or trauma, respectively giving rise to spontaneous or traumatic pneumothrax.

Case 1, which is spontaneous, is likely to be due to defect in visceral pleura while Case 2, a traumatic pneumothorax from foreign body aspiration is due to a defect in parietal pleura. In Case 2, the aspirated foreign body would have pierced the trachea, entered the mediastinum and created a defect in the parietal pleural before causing pneumomediastinum and pneumothorax. In Case 1, the pneumothorax occured as a result of lung diseases, therefore air would have escaped from the lung through the visceral pleural.

Pneumothorax may be localized if pleural adhesion is present or otherwise generalized. It can be described as open if air can move freely in and out of the pleural space, or closed, if there is no free movement of air. Valvular pneumothorax in which air enters the pleural space on inspiration and does not leave on expiration usually leads to tension pneumothorax as typified by Case 1.

There is controversy concerning the pathogenesis of pneumothorax. It is often assumed that exertion could promote onset of pneumothorax (De Vries and Wolf, 1980). However, Dov and Refaely (2000) found out that 90% of spontaneous pneumothorax occur at rest while only 10% had their onsets at the time of physical effort; even in these patients, the causative effects of exertion cannot be proven.

Schramel *et al*. (1997) found blebs and bullae during thoracotomy or thorascopy in 48-79% of patients developing pneumothorax with no underlying pulmonary disease. They therefore concluded that blebs and bullae apparently play a role in the pathogenesis of pneumothorax. According to a study, PSP (80%) is commoner than SSP (20%). The first case is however secondary spontaneous (SSP).

About 30% of patients with spontaneous pneumothorax may not have clinical features of pneumothorax i.e., decreased chest wall movement, hypersonance to percussion and decreased or absent breath sound (Dov and Refaely, 2000).

Case 1 at presentation had decreased chest wall movement, hyperesonant percussion note and reduced air entry which made the clinical diagnosis of pneumothorax easy before subsequent confirmation with radiograph. Clinical history is also not a reliable indicator of pneumothorax and its severity. Radiologic evaluation remains the only way of making a definite diagnosis (Dov and Refaely, 2000; Henry *et al*., 2003).

Frontal and lateral radiographs are usually sufficient (Dov and Refaely, 2000; Henry *et al*., 2003). Lateral radiograph provides added information to frontal radiographs in up to 14% of cases (Glazer *et al*., 1989).

Erect lateral chest or lateral decubitus radiograph is clinically helpful where findings on erect PA radiograph are unclear (Henry *et al*., 2003). or in moderately sized pneumothorax missed on a supine radiograph of severely ill patients. In the 2 Cases presented, the findings on frontal radiographs were definite and there was no need for lateral views.

Lateral decubitus radiograph is superior to the erect or supine chest radiograph and is felt to be as sensitive as CT scanning in detection of pneumothorax (Carr *et al*., 1992). While, small pneumothoraces may not have much clinical relevance in patients without underlying lung disease; in patients with suspected secondary pneumothoraces, small pneumothoraces have significant implications. Though Expiratory radiographs are not neccessary for routine diagnosis of pneumothorax, they may be useful in some cases in which diagnosis is not certain by comparing with inspiratory films; an end expiratory radiograph usually accentuates pneumothorax.

Computerized Tomography scan is the most sensitive diagnostic tool. Even the smallest pneumothorax or frontal pneumothorax overlapping the lung that may not be apparent on a PA radiograph will be detected by CT scan. (Dov and Refaely, 2000). CT also helps to detect small subpleural blebs, early emphysematous changes and to differentiate severe bullous changes from pneumothoraces. CT scan is also very useful in traumatic pneumothorax.

Computerized Tomography (CT) Scan was not done in Case 1 because the diagnosis and cause were evident on the frontal radiograph. In Case 2, the traumatic type,

CT scan was requested for and was to be done free since the patient could not afford it but the patient died before CT was done.

Radiology, apart from its sensitivity in detecting pneumothorax also helps in assessment of volume of air in the pleural space. Though this is an approximate evaluation, it is nevertheless helpful in management.

The previously used classification of Pneumothoraces (Miller and Harvey, 1993) on posterior-anterior Chest radiograph defined [a] small pneumothorax as a small rim of air around the lung, [b] Moderate pneumothorax as a volume of air that is enough to cause a collapse of the lung halfway towards the heart border and [c] Complete pneumothorax as a large volume of air resulting in a airless lung, separate from the diaphragm.

This classification; however tend to grossly underestimate the volume of pneumothorax (Henry *et al.,* 2003). The new guidelines divided the size of pneumothorax into small or large depending on a visible rim of <2 cm or ≥2 cm between the lung and the chest wall[11]. Since the volume of a pneumothorax approximates to the ratio of the cube of the lung diameter to that of the hemithorax diameter, a pneumothorax of 1 diameter on the PA chest radiograph occupies about 27% of the hemithorax: Volume of the lung is 9 cm in diameter and the hemithorax 10 cm: $(10^3\text{-}9^3/10^3 = 27\%$. Similarly, a 2 cm radiographic pneumothorax will occupy about 49% of the hemithorax (Miller and Harvey, 1993).

Computerized Tomography scan however gives more accurate estimation of the size (Engidahl *et al.*,1993).

For pneumothorax <20% of the pleural space (about 1 cm) no treatment is required because the lung surface is close to the chest wall and might easily be injured by sharp needle. Also the air eventually get absorbed at the rate of about 1.25% (50-75 mL/day) (Deslauriers *et a.*, 1988).

Pneumothorax greater than 20% (>2 cm) or which is increasing in size or is associated with pleural effusion or breathlessness will require intercoastal drainage.

Management of pneumothoraces includes ordinary observation, simple aspiration, tube thoracostomy, pleuroscopy with diathermy chemical pleurodesis and surgical intervention (Henry *et al.*, 2003).The first case was having a simple aspiration (of the tension pneumothorax) when she had cardiac arrest and eventually died despite adequate resuscitative measure. The second patient died before definitive management was instituted. Treatment will depend on clinical condition of the patients, volume of air in the pleural space, associated complication and cause of pneumothorax. Complications of pneumothorax include hypotension, peripheral cyanosis, trachea deviation and death in untreated or unrecognized tension pneumothorax (Despars *et al.*, 1994). Other complications include loculation or encysted pneumothorax, hemopneumothorax, pyopneumothorax and collapse or consolidation of a lobe or lung. Case 1 had reduced lung volumes (collapse) and central cyanosis. Persistent pneumothorax which is defined as drainage lasting more than 10 days without suction is another complication.

Also unilateral pulmonary edema may follow rapid expansion of a lung that has collapsed for several days this complication is more likely to occur following application of negative pressure to the pleural drain. Hypoxia, hypotension and even death may occur from these complications of management of pneumothorax (Light, 1983).

## CONCLUSION

Cases of secondary spontaneous pneumothorax and traumatic pneumothorax secondary to pneumomediastinum from foreign body aspiration have been discussed. The outcomes of these 2 Cases typified the effect of late presentation and or ignorance on an otherwise easily manageable condition.

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