PNEUMOMEDIASTINUM- CAUSE AND CONSEQUENCE

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ABSTRACT

BACKGROUND

Pneumomediastinum is a rare condition with diverse aetiologies which is defined by presence of air in the mediastinum. We performed a retrospective analysis of 15 patients with pneumomediastinum. The purpose of our study was to report our experience in the management of pneumomediastinum of varied aetiologies.

MATERIALS AND METHODS

Patients who were diagnosed to have pneumomediastinum on chest radiograph between 1991 to 2001 were included in the study. The presence of associated subcutaneous emphysema was noted. History combined with appropriate investigations to establish the etiology. No specific treatment was given for subcutaneous emphysema. Patients who had associated pneumothorax had intercostal tube drainage while the rest were managed conservatively. The treatment outcome was analysed.

RESULTS

Of the 15 cases of pneumomediastinum, age groups ranging from 14 to 70 years there were 13 males and 2 females. 9 patients presented with subcutaneous emphysema and 8 had associated pneumothorax. Pneumomediastinum was spontaneous in 10 cases, following blunt trauma in 3, post tracheostomy and oesophagoscopy in 1 patient each. Intercostal drains (ICD) were inserted in 8, as there was an associated pneumothorax, whereas 7 patients were treated conservatively. The average duration of drain was 11.6 days while there was spontaneous resolution of pneumomediastinum by the 5th day in the conservatively treated patients without pneumothorax. 2 patients succumbed, one patient being case of traumatic pneumothorax due to associated lung contusion and the other was a case of complications related to pulmonary tuberculosis and human immunodeficiency virus co-infection.

CONCLUSIONS

Pneumomediastinum should be managed conservatively irrespective of subcutaneous emphysema and intercostal drainage must be instituted only when there is an associated pneumothorax.

KEYWORDS

Spontaneous Pneumomediastinum, Benign, Pneumothorax.

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BACKGROUND

Pneumomediastinum (Mediastinal emphysema) is an uncommon condition caused due to air or gas outside the normal confines of the respiratory or gastrointestinal tract. A continuum of facial planes connects cervical soft tissues with the mediastinum and retro peritoneum, permitting aberrant air arising in any of these areas to spread elsewhere.

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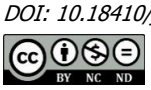

The aetiology is multifactorial. Common aetiologies of pneumomediastinum are soft tissue infection, traumatic disruption of mucosal barrier and spontaneous alveolar rupture. Pneumomediastinum is classified as follows.[1,2]

Spontaneous

a) Primary pneumomediastinum in the absence of predisposing disease usually seen in previously healthy males.
b) Secondary pneumomediastinum due to leakage of gas from recognizable coexisting structural abnormality in lungs or mediastinum. Pneumomediastinum occurs due to damage to alveoli and bronchioles causing air to leak along bronchovascular bundle towards the mediastinum and mediastinal sepsis from gas forming organisms introduced from infected soft tissues commonly head and neck.

Traumatic which may be iatrogenic or non-iatrogenic associated with blunt force or penetrating trauma occurring in endobronchial or oesophageal procedures, chest surgeries or mechanical ventilation.

Diagnosis[3] is made clinically if patient presents with substernal pain, aggravated by movement, dyspnoea and dysphagia. Physical examination reveals swelling and subcutaneous emphysema on neck, face, axilla and chest, virtually all patients have crepitations in neck. Hamman's sign (a crunching sound synchronous with the heart beat) is heard over the pericardium. ECG may show ST-T changes or ST elevation. Chest radiograph in posterior-anterior view (CXR PA view) shows characteristic 'streaks' of gas density in the subcutaneous tissues due to subcutaneous emphysema, radiolucent lines along the left cardiac border, 'Highlighting' of aortic knuckle and presence of air below the lower heart borer causes the 'continuous diaphragm sign'. The lateral radiograph may show out lining of aorta and other mediastinal structures, associated pneumothorax may show out lining of aorta and other mediastinal structures, associated pneumothorax may be seen. Computerized Tomography (CT) thorax is helpful when chest radiographs are normal. Complications of pneumomediastinum[1] include pneumothorax due to rupture of mediastinal pleura, tension pneumomediastinum due to compression of the heart and tamponade effect, air block-splinting action of air in connective tissue of lung promoting further alveolar hyperinflation, or rarely impedance of pulmonary vascular flow by air with in the vessel sheaths compromising cardiac output. Pneumomediastinum is often treated over zealously with prophylactic intercostal drains, incisions on the chest wall or surgical intervention. Spontaneous absorption of the air from the mediastinal planes is the rule. Intervention is needed only in cases with associated pneumothorax, patients on intermittent positive pressure respirator and those with cardio-respiratory embarrassment.

MATERIALS AND METHODS

This study was a retrospective analysis of 15 adult cases of pneumomediastinum diagnosed on chest radiographs. Case records were analyzed for demographic data, , history including that of trauma, examination findings and investigations, etiology, pre-existing lung disease, precipitating factors, treatment outcome and complications. Sputum examination for acid-fast bacilli (AFB) was done in two cases of pulmonary tuberculosis.

Spirometry was performed in two cases having associated airway disease, bronchial asthma and chronic obstructive pulmonary disease. Other investigations were laryngoscopy in three cases of laryngeal carcinoma, computerized tomography (CT) chest and bronchoscopy in one case of lung cancer and barium study with oesophagoscopy in one case of oesophageal carcinoma done. All cases were analyzed for mechanism (traumatic or spontaneous), etiology, associated factors particularly pneumothorax, and complications. Seven cases that did not have associated pneumothorax were treated symptomatically with analgesic and antitussives, while cases with associated pneumothorax were treated with intercostal tube drainage along with symptomatic treatment as above. In addition, specific treatment for underlying disease was given in form of anti-tuberculosis drugs in two cases, nebulized bronchodilators with oral followed by inhaled corticosteroids in one case of asthma and nebulized followed by oral bronchodilators in one case of COPD. No specific treatment was given for subcutaneous emphysema. Number of days for resolution of pneumomediastinum and treatment outcome with intercostal tube drainage was also analysed.

RESULTS

There were 15 patients, age ranging from 14 to 70 years, of which 13 were males and 2 females. The pneumomediastinum was detected by chest roentgenogram in all the cases. The common presenting symptoms were chest pain in 12 (80%), dyspnea in 9 (60%), and cough in 6 (40%). Nine patients (60%) presented with subcutaneous emphysema. Pneumomediastinum was spontaneous in 10/15 (67%) cases, following blunt chest trauma in 3, post tracheostomy and oesophagoscopy in 1 patient each (Table 1). Eight (53.3%) of the cases had associated pneumothorax (5 on right and 3 on the left). Intercostal drains (ICD) were inserted in 8 (53.3%) while 7 (46.7) patients were treated conservatively. The average duration of drain was 11.6 days while there was spontaneous resolution of pneumomediastinum with subcutaneous emphysema by the 5th day in the conservatively treated patient. 2 patients (13%) expired, 1 was a case of traumatic pneumothorax due to associated lung contusion and the other was a case of pulmonary tuberculosis with coexistent human immunodeficiency virus infection.

No.	Age	Sex	CXR		ICD	Resolution Days	Mechanism	Aetiology	Complications
			PNT	SE					
1	35	M	R	+	+	15	SP	BA	
2	28	M		+		10	SP	Primary PM	
3	70	M				9	SP	Ca Larynx	
4	65	M				14	SP	Ca Larynx	
5	45	F	L	+	+	8	SP	Ca Larynx	
6	60	M				17	Traumatic	Blunt Trauma	Death
7	30	M	R	+	+	10	SP	Tracheostomy	
8	26	F	R	+	+	11	SP	PTB	
9	70	M				8	SP	Ca lung	
10	50	M	R	+		12	Traumatic	Retching	

11	14	M	R	+	+	11	SP	COPD	
12	29	M				15	Traumatic	Blunt Trauma	
13	40	M				12	Traumatic	Oesophagoscopy	
14	44	M	L	+	+	10	SP	PTB with HIV+	Death
15	26	M	L	+	+	12	Traumatic	Blunt Trauma	

Table 1. Summary of 15 Cases of Pneumomediastinum

DISCUSSION

The entity pneumomediastinum or mediastinal emphysema was first elucidated by Laennec in 1819. It is a relatively uncommon condition however the actual prevalence could be higher than that reported in literature due to underdiagnosis.[4] Pneumomediastinum can be produced in general by three different mechanisms (1) gas forming organisms present in an infection of the mediastinum or adjacent areas (2) rupture of mucosal or cutaneous barriers as occurring in oesophageal or tracheobronchial perforation (3) The Macklin effect based on the inter alveolar and lung interstitial pressure gradient. Increased intrathoracic pressure leads to dissection of air along the bronchovascular sheath into the mediastinum causing pneumomediastinum and into the subcutaneous tissue causing subcutaneous emphysema. It can be classified into spontaneous and traumatic. Spontaneous variety is further divided into primary or secondary depending on the presence or absence of any underlying lung disease. Primary spontaneous pneumomediastinum is an uncommon entity more commonly encountered in young men in the 2nd to 4th decade of life and is benign in its course. Secondary spontaneous Pneumomediastinum can occur subsequent to underlying lung diseases like asthma, emphysema or interstitial lung diseases and bronchiectasis. In our study, secondary spontaneous pneumomediastinum was the predominant variety, with an underlying aetiology of bronchial asthma, chronic obstructive pulmonary disease (COPD) and pulmonary tuberculosis. Certain precipitating factors like emesis, retching, cough, exacerbation of airway diseases, physical exercise, labor, upper respiratory infection and defecation may trigger the development of pneumomediastinum due to increase in the intrathoracic pressure. There are several reports of pneumomediastinum during exacerbations of asthma the underlying mechanism being alveolar rupture either due to increased intra-alveolar pressure or reduced interstitial pressure[5,6] Spontaneous pneumomediastinum following rupture of lower oesophagus due to retching (Boerhaave syndrome) has been reported before.[6] Other causes seen in our study were malignancy of lung and larynx. Only one patient had primary pneumomediastinum where no cause was found. 3 cases were related to injuries like blunt chest trauma, one patient developed pneumomediastinum following tracheostomy and in one patient each post oesophagoscopy and post bronchoscopy. Iatrogenic causes like oesophagoscopy, bronchoscopy with trans bronchial biopsy[7] have been previously reported.

The clinical course of pneumomediastinum is heterogeneous and largely determined by pre-existing lung disease and presence of concomitant pneumothorax. In our series the most common clinical manifestations were chest pain, dyspnea and cough which is consistent with that reported in literature. Subcutaneous emphysema is the most commonly encountered clinical sign with a reported prevalence of 40 to 100 percent. In our series 9 out of 15 i.e. 60 percent patients had subcutaneous emphysema. The diagnosis of pneumomediastinum can be confirmed by radiographic assessment. The radiographic signs of pneumomediastinum depend on the delineation of normal anatomic structures that are outlined by air as it leaves the mediastinum. Plain CXR PA and lateral view may be sufficient for diagnosis in majority of the cases and CT is usually not needed. Meticulous examination of chest radiograph may reveal findings like double bronchial wall sign, continuous diaphragm sign, thymic tail sign, extrapleural sign tubular artery sign and ring around the artery sign.[8] CT Chest is of utility in cases of diagnostic uncertainty on clinical assessment and CXR. It can detect even very small amount of air in the mediastinum. However, in our study, CXR could detect pneumomediastinum in all cases and CT Chest was not required for confirmation. So, emphasize that CXR still remains the investigation of choice in scenarios of clinical suspicion of pneumomediastinum especially in resource poor or peripheral setups and CT may be indicated in a very small percentage of cases. Although pneumomediastinum often presents with bewildering symptoms like acute onset chest pain and visually frightening subcutaneous emphysema, the course is generally benign. The recommended management options encompass close observation, simple therapeutic measures like oxygen, analgesics along with a meticulous patient counselling and reassurance. Antibiotics are generally used whenever there is a suspicion of mediastinitis. Cases with coexistent pneumothorax are the only candidates for an intercostal drainage. In our study group, out of 15 patients, 7 (46.7%) responded to conservative management and treatment of underlying cause. 8 (53.3%) cases required intercostal drains due to associated pneumothorax. Prophylactic use of intercostal tube drainage is not required.[9] Skin incision of subcutaneous emphysema to release subcutaneous air causes discomfort and is unnecessary and dangerous.[1] Decompression of anterior mediastinum is of questionable value,[10] but if retroperitoneal air is complicated by pneumomediastinum continuous decompression using peritoneal dialysis catheter has been tried.[11] Pneumomediastinum is generally self-limiting with infrequent complications. Occasional reported complications include tension pneumomediastinum and tension pneumothorax. These need to be tackled with emergency chest drain placement.

CONCLUSION

In conclusion, pneumomediastinum is an uncommon and generally benign condition. Clinical history and examination

coupled with chest radiography is usually sufficient to reach a diagnosis. Most cases are of the spontaneous variety due to an underlying cause and can be managed conservatively with good outcome. Intercostal drainage needs to be instituted only if there is an associated pneumothorax. A high index of clinical suspicion and a rational approach to management are the keys to prevent associated morbidity and mortality.

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