Spontaneous Pneumothorax in Pulmonary Emphysema*

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The combination of pneumothorax and pulmonary emphysema is a rather unusual occurrence. In contrast to the voluminous literature dealing with spontaneous pneumothorax in otherwise healthy individuals (pneumothorax simplex), there is only occasional mention of pneumothorax occurring in association with pulmonary emphysema. A recent survey at Charity Hospital in New Orleans over the past ten years (1951-1960) revealed 16 such cases. This is in comparison with 1714 diagnoses of pulmonary emphysema made at this institution over the same period of time, an incidence of pneumothorax occurring in 0.93 per cent of cases of pulmonary emphysema. These 16 cases are augmented by three cases of recent onset gathered from private hospitals in New Orleans, to make a total of 19 cases for study and these cases serve as the basis of this report.

The classification of chronic pulmonary emphysema used in this paper is the one propounded recently by Dr. Dickinson W. Richards* (Chart 1). He divides emphysema on an etiologic basis into three groups: (1) chronic bronchitis and emphysema, (2) pulmonary fibrosis and emphysema, and (3) nonobstructive bullous emphysema. The first two groups produce a diffuse type of emphysema in contrast to the third group listed which is the more localized bullous type of emphysema.

It was the impression of the investigators that pneumothorax occurring with pulmonary emphysema (in patients whose pulmonary reserve is already restricted) would be more severe, run a longer course and be more difficult to treat than the ordinary spontaneous pneumothorax. We attempted a partial answer to these and a few other questions.

Materials and Methods

At the outset, it should be stated that these cases of pneumothorax were all spontaneous except two which were traumatic. These two traumatic cases were included because they afforded further opportunity to study the effects of pneumothorax on the emphysematous lung. One case followed diagnostic needle aspiration of a lung mass, and the other occurred after thoracentesis for removal of pleural fluid.

The age of our patients ranged from 37 to 74 years with an average of 60 years. There were nine Negro and ten white patients. All were men except one. Two had recurrent episodes, and the right side was involved more often than the left (12 right pneumothoraces to seven on the left). Only four patients underwent open thoracotomy and definitive surgery to correct the underlying condition.

The roentgenographic criteria used for the diagnosis of pulmonary emphysema were presence of bullae, hyperillumination of the lung fields, loss of vascular markings on the x-ray film, depressed diaphragm and elongation of the cardiac silhouette. The lateral view is also of value when the emphysematous lung fills the retrosternal and retrocardiac area causing an increased an-

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tero-posterior diameter of the chest. The chest film was of prime importance for the
diagnosis of the bullous type of emphyse-
ma. Preceding symptoms of progressive
erctional dyspnea and cough were also
helpful, particularly in the diffuse type of
emphysema.

The initial symptoms of pneumothorax
were usually sharp, stabbing chest pain and
dyspnea, of sudden onset, and most often
occurring simultaneously or in close tem-
poral relationship to each other. In six
cases, pneumothorax was present for sev-
eral days before the patients sought med-
cal aid, but the onset in these cases was
with sudden pain and dyspnea which sub-
sided somewhat but nevertheless persisted
until the time of admission to hospital.
Four of these six cases had bullous emphy-
sema. The most frequent mistaken diag-
nosis was myocardial infarction, especially
in those who presented themselves in a
state of shock, complaining of chest pain
and dyspnea with cold clammy skin, low
blood pressure and tachycardia.

In most of the cases the diagnosis was
made after examination of the roentgen
film. It is difficult to detect pneumothorax
by physical examination, especially if it is
small and apically located or if diffuse
emphysema is also present. Because of the
lack of consistency of the classic signs, it
might be pointed out that some observers
have found the scratch sign useful.18 It is
eicited in the following manner: the
Bowles stethoscopic attachment is placed
at some mid-line position on the chest
(spine or sternum); at equidistant points
from the stethoscope, the skin is scratched
with a finger or blunt object, and the
sounds from similar areas on the two sides
are compared. A positive sign consists of a
considerably louder and harsher sound on
the side of the pneumothorax.

The degree of lung compression varied
from slight to almost complete. There were
only four with small pneumothoraces, most
patients' lungs being 60 to 70 per cent
compressed. Adhesions were seen by x-ray
or at operation in one-fourth of the cases.

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Chart 2

The type of emphysema most often asso-
ciated with spontaneous pneumothorax
was bullous emphysema (Chart 2). In our
group of emphysema cases with pneumo-
thorax, eight were of the bullous type, six
of the fibrosis and emphysema type and
five of the bronchitis and emphysema type.
It may be added that there were cases
where two types of emphysema coexisted
in the same patient, usually identified as
bullous and diffuse emphysema. There
were only a few such cases in our group.

RESULTS AND CASE REPORTS

The form of therapy was either (1) bed
rest with spontaneous re-expansion, (2)
nneedle aspiration with or without water
trap, (3) catheter drainage and suction,
or (4) open thoracotomy and definitive
surgery (Chart 3). Only four patients
were treated with bed rest alone, four had
definitive surgery and the majority under-
grew either needle aspiration or insertion of
an intrapleural tube (catheter) with suc-
tion drainage of the pleural cavity, or one
procedure followed by the other. In the
ey early cases (up to 1955), intubation of the
pleural space was done infrequently (only
one case). During the last five years, in-
trapleural intubation has been employed more
often and at an earlier stage, without pre-
liminary needle aspiration.

In summary then, the therapy in cases
of small pneumothorax and minimal sym-
ptoms was simple bed rest and supportive
therapy. Needle aspiration with attached
water trap or negative suction was em-
ployed for a large pneumothorax (50 per
cent or more compression) in the period from 1950-1955. Later (1956-1960), the procedure most often used was prompt intrapleural intubation with negative suction. The cases requiring surgery had recurrent or chronic pneumothorax in the presence of bullous emphysema.

The length of time for re-expansion of the lung varied with the type of therapy employed, being shortest with intrapleural catheter and negative suction (average 3.6 days), longer with needle aspiration (average 7.5 days) and longest with bed rest alone (24 days) (Chart 4). The advantages of intrapleural catheter drainage and suction are obvious from these figures and consist of: (1) more rapid re-expansion of the lung, (2) shorter hospital stay, (3) earlier return to work, and (4) fewer complications.

Three cases were selected for illustrative purposes.

**Case 1**

A 49-year-old white man had sudden onset of dyspnea and tightness in the left anterior chest region on June 1, 1960, one week prior to admission to hospital on June 7. He had no previous cough or exertional dyspnea. He was in moderate respiratory distress, and became dyspneic on the slightest exertion. He had needle aspiration of the left pleural space daily on four occasions with removal of 600 to 1200 ml of air each time with only slight re-expansion of the

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**Figure 1:** Initial x-ray film, Case 1, with marked left pneumothorax. **Figure 2:** Postoperative x-ray film (six weeks), Case 1. Resection of bullae of left apex, lingula and left lower lobe.
left lung (Fig. 1). There was 80 per cent compression of the left lung and multiple blebs over its surface. On June 20, left open thoracotomy was done with resection of eight or nine large bullae involving the left apex, the lingula and lower lobe. The lung was decorticated and a partial parietal pleurectomy was done apically and laterally. He made a satisfactory recovery in three weeks and has since returned to his usual occupation.

Comment: This patient's lung failed to re-expand after four needle aspirations; underwent surgical removal of bullae of the left lung and the remaining normal lung has filled the left hemithorax postoperatively (Fig. 2). He returned to work three weeks postoperatively, and remains in good health. This is an example of the good result following surgical extirpation of bullae in a case of bullous emphysema.

CASE 2

A 65-year-old white man was admitted to a private hospital for investigation of a mass in the left upper lobe of three and one-half years' duration. His complaint was increasingly severe left parascapular pain with radiation to the left parasternal region. Needle biopsy of the mass in the left upper lobe was done and on the same day he developed severe dyspnea from left traumatic pneumothorax (Fig. 3). The dyspnea was extremely severe and required oxygen therapy. A Potter needle connected to a water-seal drain was begun on the same day (November 4, 1960) with great relief and removed the next day (November 5) when the lung was re-expanded. He became dyspneic again on November 6 and 10 per cent compression of the lung was detected by x-ray examination and an intrapleural catheter was inserted and connected with a water-seal drain. The tube was removed three days later (November 9) when the lung was completely expanded. He has remained free of recurrence of pneumothorax up to present date.

Comment: This is an example of traumatic pneumothorax following diagnostic needle aspiration of lung tissue. It brings out the severity of the symptoms of even a small pneumothorax on a diffusely emphysematous lung, and the desirability of prompt relief in such cases, preferably by intubation and negative suction.

CASE 3

A 44-year-old Negro was known to have had bullous emphysema since 1952, four years prior to his first episode of spontaneous pneumothorax which occurred on December 10, 1956. Pulmonary function studies done seven days later revealed VC 2571 ml.; 3 sec., VC 2260 ml.; MBC 56.5 L./min. and interpreted as indicating severe ventilatory dysfunction of mixed obstructive and restrictive types. ECG showed low T1; high notched P waves in Leads II and III, V4 and V5; deep S in V2 and V3 and suggestive of chronic pulmonary disease. This patient, from the lung studies and ECG, had diffuse emphysema as well as bullous emphysema and was symptomatic before the spontaneous pneumothorax occurred (exertional dyspnea, wheezing and cough) (Fig. 4). He had right open thoracotomy with excision of the bullae of right upper lobe and closure of the leaks in the lung tissue. There were several adhesions between the right upper lobe and chest wall.

He was later diagnosed as having schizophrenia by the psychiatry department, and although possibly needing further surgery on the opposite side, it was decided to defer this indefinitely.

Comment: This case is one of bullous emphysema with diffuse emphysema as well, whose first spontaneous pneumothorax was in 1956, was operated on and obtained satisfactory expansion of the remaining right lung. He still has bullae of the left lung and remains symptomatic, having a productive cough, exertional dyspnea and wheezing. He is being followed in the medical clinic and is on several medicines. He is as limited in his activities now as he was before the operation, which did not help his clinical condition.

DISCUSSION

The effect of pneumothorax on a lung which is previously compromised by em-
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MBC, 15 L./min. and the ratio BR/MBC was 41 per cent. This patient was dyspneic at rest.

Although the pneumothorax is seldom massive, conservative therapy is rarely applicable because of limited pulmonary reserve. Prompt aspiration and suction is advisable for the relief of symptoms, the reduction of hospitalization and the prevention of complications. The intercostal catheter is preferred over the indwelling needle since its lumen is larger and it is easier to control. Because of the diseased fabric of the lung and slow healing of the pleural defect, active catheter suction is indicated to expand the lung and to help fix it to the chest wall.

It is the policy on our service at present to intubate these patients as quickly as possible and to apply continuous negative suction. The type tube used is a soft rubber French catheter of large bore with multiple openings to evacuate the air as rapidly as possible and allow the leak in the lung to seal. After roentgenograms of the chest have revealed re-expansion of the lung, the rubber tube is then clamped and additional chest films taken after several hours have elapsed. If the lung remains expanded after the tube has been clamped for several hours, removal of the tube is then considered. Usually, the tube is left in place for an additional 48 to 72 hours to provide enough pleural irritation for promotion of pleural symphysis. Doughtry and Chesney
in 1952 stated that the average time required for re-expansion of the lung in pneumothorax simplex was 26 days in patients treated by bed rest and intermittent needle aspiration, whereas it was about three days in patients for whom closed drainage with an intrapleural catheter was used. In our cases, the average time with catheter drainage was 3.6 days.

If re-expansion does not occur promptly, it is usually due to: (1) intrabronchial obstruction (requiring bronchoscopy), (2) persistent bronchopleural fistula or (3) a lung encased in fibrous bands, the latter two possibilities usually requiring eventual surgical intervention.

**Conclusions**

1. Pneumothorax in association with pulmonary emphysema is a serious complication, causing marked disability and requiring prompt and diligent therapy.

2. The patients are usually in the older age group and frequently have other diseases of the lungs or heart.

3. The clinical classification of emphysema may be used as a guide for surgical intervention. The best results from surgical treatment were in the groups of patients who had bullous emphysema without diffuse emphysematous involvement.

4. The type of therapy providing the most rapid re-expansion of the lung is the most desirable and in our cases has been intrathoracic intubation with continuous suction.

5. Surgical procedures must be employed in cases of recurrent pneumothorax and bullous emphysema, and partial parietal pleurectomy deserves more widespread application.

**Resumen**

1. El neumotórax que se asocia al enfisema pulmonar es una complicación seria que causa marcada incapacidad y que requiere inmediato tratamiento.

2. Los enfermos son habitualmente de edad avanzada y frecuentemente tienen otras enfermedades del pulmón o del corazón.

3. La clasificación clínica del enfisema puede usarse como guía para la intervención quirúrgica. Los mejores resultados del tratamiento quirúrgico se obtuvieron en los grupos que tenían enfisema buloso con invasión difusa del enfisema.

4. El tipo de tratamiento que proporciona la re-expansión rápida del pulmón es el más desejable y en nuestros casos ha sido la entubación intratorácica con succión continua.

5. Se deben emplear procedimientos quirúrgicos en los casos de neumotórax recurrente y en el buloso. La pleurectomía parcial merece un empleo más extenso.

**Resumen**

1. Le pneumothorax associé à l’emphysème pulmonaire est une complication grave provoquant une incapacité sérieuse et nécessitant un traitement rapide et diligent.

2. Les malades appartiennent habituellement au groupe des personnes âgées et ont fréquemment d’autres affections des poumons ou du cœur.

3. La classification clinique de l’emphysème peut être utilisée comme guide pour l’intervention chirurgicale. Les meilleurs résultats obtenus par le traitement chirurgical se furent sur les groupes de malades qui avaient un emphysème bulleux sans atteinte emphysémateuse diffuse.

4. Le type de traitement fournissant la ré-expansion la plus rapide du poumon est le plus souhaitable, et dans les cas de l’auteur ce fut la mise d’une sonde intrathoracique avec aspiration continue.

5. Des moyens chirurgicaux doivent être utilisés dans les cas de pneumothorax récurrent, et d’emphysème bulleux, et la pleurectomie pariétale mérite une plus large application.
ZUSAMMENFASSUNG

1. Der Pneumothorax in Verbindung mit Lungenemphysem ist eine ernsthafte Komplikation und verursacht ein ausgesprochen schweres Krankheitsbild, das eine rasche und sorgfältige Therapie erfordert.

2. Die Patienten befinden sich gewöhnlich im höheren Alter und haben häufig noch andere Herz- oder Lungenerkrankungen.


4. Die Art der Therapie, die die schnellste Wiederaufladung der Lunge gewährleistet, ist auch die erstrebenswerteste; in unseren Fällen war dies die intrathorakale Intubation mit fortlaufender Absaugung.

5. Chirurgische Maßnahmen muß man anwenden in den Fällen von sich wiederholendem Pneumothorax mit bulösem Emphysem, wobei eine teilweise parietale Pleurektomie sich am meisten empfiehlt.

References


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NEW OXYGENATOR

Results of experimental studies with the disposable oxygenator in ten dogs are presented and the problems encountered are discussed. The combination of a disposable bubble oxygenator with the concept of hemodilution makes an emergency cardiac pulmonary bypass apparatus available to the average operating room. The disposable oxygenator can be adapted, at low cost, to standard heart-lung machines already available and can be assembled at very short notice for use in cardiac resuscitation and unanticipated open heart operations, or in overcoming complications following elective cardiac procedures.


OPEN-LUNG Biopsy

Open-lung biopsy was performed in 105 patients with diffuse, miliary lung disease at an average of one and fifty-three-tenths years after first notice of abnormal chest film. There was one operative death and two complications of any consequence. From the technical standpoint, the importance of general anesthesia, of tube drainage and of fixation of the specimen in an inflated state are emphasized. One-third of the patients proved to have diseases entirely confined to the lungs and not productive of characteristic secretions, such as various fibroses, hemosiderosis, eosinophilic granulomas and pulmonary alveolar proteinosis. Half had conditions that may require lung biopsy for diagnosis, particularly the granulomatoses, pneumoconioses, and neoplastic diseases. Disorders that ordinarily do not require biopsy for diagnosis, largely the chronic infections, accounted for 11 per cent. In five patients, lung biopsy did not result in a specific diagnosis. The first clinical diagnosis proved to be in error in 56 patients, and the correct diagnosis was unsuspected in 36.