RECURRENT PNEUMOTHORAX: MANAGEMENT AND OUTCOME

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OBJECTIVES:
To demonstrate the efficacy of different treatment modalities and evaluate the outcome in patients with recurrent spontaneous pneumothorax.

STUDY DESIGN:
A prospective observational study.

PATIENTS & METHODS:
This study was conducted at the Department of Cardiothoracic Surgery, Postgraduate Medical Institute, Lady Reading Hospital, Peshawar from March 1998 to April 2001. One hundred and ten patients presenting with spontaneous pneumothorax were included. There were 82 (74.5%) males and 28 (25.5%) were females. Male: female ratio was 2.9:1. The mean age of the patients were 35 years (range 10 years to 50 years). Ninety percent of the patients complained of chest pain while 45% experienced dyspnea. Chest radiograph was obtained in all while CT thorax was obtained in 20 (18.1%) patients. The magnitude of pneumothorax and associated pathology was determined radiologically. Tube thoracostomy was the initial line of management in patients who presented with first episode of pneumothorax. The episode, side of pneumothorax and duration of air leak all were recorded. Patients in whom pneumothorax failed to resolve with chest tube placement and suction, were treated with either chemical or surgical pleurodesis. Indications for surgery included recurrent pneumothorax, persistent air leak, non-expansion of the lung, complicated pneumothorax and suspicion of bulla.

RESULTS:
Tube thoracostomy and low pressure suction was usually the first therapeutic step in 80 (72.7%) patients with an early success rate of 75.5% at the first admission while chemical pleurodesis was done in 40 (36.3%) patients. Success rate for chemical pleurodesis was (65%). Out of 110 patients, 28 (25.5%) required surgery. The mean operative time was 68 (± 40) minutes. Surgical indications included recurrences 18 (64.2%), persistent air leak (18.5%) non-expansion of the lung 3 (10.7%). Twenty two (78.5%) patients under went bullectomy / wedge resection, over sewing and ligation was done in 6 (21.4%) while pleurectomy was done in all these patients There were no operative deaths. Over all 2 (7.1%) patients had postoperative air leak. The 18 months of follow-up has shown no recurrence and no significant impairment of postoperative pulmonary function tests.

CONCLUSION:
Due to higher recurrence rate with chemical pleurodesis, the indications for early surgical pleurodesis in recurrent pneumothorax are an underlying pathology that indicates surgery alone, the second recurrence or an air leak that has persists for more than 7 days..

Key Words: Recurrent pneumothorax, management, outcome

INTRODUCTION

Pneumothorax is classified aetiologically into primary spontaneous pneumothorax (PSP), secondary spontaneous pneumothorax (SSP) and traumatic pneumothorax. Primary spontaneous pneumothorax is a disease of young adults; the peak incidence is usually in the third decade. Primary spontaneous pneumothorax results from rupture of pulmonary blebs, which occurs due to congential weakness in the connective tissue at lung apices. The mechanisms of development of sponta-

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neous pneumothorax are the following (1). Visceral pleural tear form rupture of a subpleural bleb (congenital or acquired) or due to a necrotizing parenchymal process (2) dynamic bronchiolar obstruction resulting in a check-valve hyperinflation of the distal airways with subsequent rupture[1]. The epidemiology of spontaneous pneumothorax is of historical interest. Two time periods are of significance[2]. The French era began in 1803 when Itard, a student of Laennec, first coined term pneumothorax in his doctoral thesis. Later Biach reported in 1880 that 78% of 916 patients with spontaneous pneumothorax had tuberculosis, emphasizing the importance of pleural plaques and cavitary lung disease in the etiology of spontaneous pneumothorax. The Swedish era began in 1932 with Kjaergaard's study emphasizing the primary importance of subpleural bleb disease[3]. Pneumothorax in one of the main complications of pulmonary tuberculosis. It may develop following rupture of subpleural focus or cavity[4]. Pulmonary tuberculosis still remains the commonest cause of secondary spontaneous pneumothorax in third world countries[5]. While chronic obstructive pulmonary disease (COPD) is significant etiologically in the west[6]. Other rare causes include interstitial lung disease (IDL) and Staph. Aureus pneumonia. Small uncomplicated pneumothorax may be observed. Tube thoracostomy is, however, the usual initial treatment in first episode and has been successful in most patients. Pleurodesis is effective in a limited number of patients only if complete lung expansion can be accomplished[7]. As many as 25% of patients may eventually require surgical treatment. The indications for surgical intervention have included recurrent pneumothorax, prolonged bronchoplueral fistula and failure to re-expand the lung with chest tube drainage of the pleural space[8]. Standard surgical intervention had been by axillary or lateral thoracotomy through, which blebectomy, bullectomy and pleurectomy are performed and has demonstrated recurrence rate usually between 0% and 3%[9,10]. The purpose of our study was to evaluate different lines of management and outcome for recurrent pneumothorax in our circumstances.

PATIENTS AND METHODS

We studied 110 patients with spontaneous pneumothorax. Patients under 10 years and those over 50 years of age were excluded. Only patients with no evidence of trauma or iatrogenic causes were included in order that only those cases truly designated spontaneous could be studied.

All these patients were admitted to the hospital and after immediate emergency management, history and examination was conducted. The diagnosis was made by plain chest radiographs in all instances. The extent of pneumothorax as estimated grossly from the radiographs, averaged 45%. Computerized tomography (CT) was performed in twenty patients who had suspicion of bulla on chest radiograph.

Asymptomatic stable patients with pneumothorax less than 20% of total lung capacity were treated with oxygen and observation. Patients with pneumothorax greater than 20% were initially treated with (32 Fr) plastic intercostal tubes connected to an underwater seal and low-pressure suction (15 - 20cm H_2O). Patients in whom pneumothorax failed to resolve completely with simple chest tube were treated either by chemical pleurodesis (with tetracycline solution via the chest tube) or operative therapy. Complete lung expansion with an intercostal chest drain was a prerequisite for chemical pleurodesis. The indications for chemical pleurodesis at our institute were a second recurrence, a persistent air leak, or the underlying disease. Tetracycline hydrochloride (20 mg / kg body weight) was mixed with saline (50 ml) and injected through the chest tube into the pleural space. The solution was retained in place for 24 hours. Indications for surgery were recurrence, persistent air leak for more than 7 days, inability to achieve an expanded lung, failure of chemical pleurodesis and complicated pneumothorax (haemothorax, empyema). The operation was performed through a posterolateral thoracotomy. The skin incision was small, no more than 15 cm in length. Once the pleural space was entered, the whole lung was inspected. In younger patients; the most common abnormality was a group of small bulla, incorporated in thickened pleura at the apex. These were either oversewn using a fine suture material or ligated with a suture at the base. For multiple large bulla, wedge resection of pulmonary parenchymal at the base of the bulla was accomplished. Parietal pleurectomy was performed in all patients. Starting at the margins of the incision a plane of cleavage was establised between the parietal pleura and the inner chest wall. The

pleura was then stripped off and excised from all areas except the mediastinum and the diaphragm. Prior to closing the chest, the lung was ventilated, Ringer's solution was instilled into the pleural cavity and leaks were sought by dipping progressive lung portions under water. After hemostasis and check for large parenchymal leaks, an air drain (28 Fr) and a fluid drain (32Fr) were placed through separate incisions. The tips of the drains were placed towards the apex and into the costodiaphragmatic recess gently by positive pressure. The lung was re-expanded gently by positive pressure ventilation and chest closed. Postoperative complications, analgesic requirement, duration of chest tube placement and length of hospitalization and follow-up were all recorded.

RESULTS

In our study there were 82 (74.5%) males and 28 (25.5%) females with a male to female ratio of 2.9:1. Seventy two percent of the patient were in their 3rd and 4th decade of life the youngest being of 10 years and the oldest being 50. (Table-I).

TABLE 1:
Incidence of spontaneous pneumothorax by age (n=110)

Age (Years)	No. of Patients	% Age
10-20	11	10
21-30	20	18.1
30-40	40	36.2
40-50	39	35.4

The presenting symptoms were chest pain 90%; 45% had shortness of breath and only three had cough at the time of initial examination. An underlying cause for pneumothorax was sought. In 60 (54.5%) tuberculosis; 28 (25.5%) COPD and in 4 (3.6%) patients history of staphylococcal pneumonia was obtained while 18 (16.3%) had primary spontaneous pneumothorax (Table-II).

TABLE 2:
Factors contributing to spontaneous pneumothorax (n=110)

Cayse	No. of Patients
Primary Spontaneous	18 (16.3%)
Tuberculosis	60 (54.5%)
C. O. P. D.	28 (25.5%)
Infections	4 (3.6%)

Success rates with differing modalities of therapy are shown in Table-III.

TABLE 3:
Success rates of differing therapeutic modalities

Modality	Success Rate*	% Successful
Chest Tube with Low Pressure Suction	56 / 80	70
Pleurodesis	26 / 40	65
Operative	28 / 28	100

* First number of ratio refers to the number of patients with successful treatment. The second number of ratio refers to the number of patients undergoing treatment.

The average time for any form of therapy was 16 days, with a range of 2 to 30 days. Out of 110 patients with spontaneous pneumothorax 28 (25.5%) required surgical therapy for resolution. The time of recurrence was noted, 52% of the recurrences occurred 6 months from the previous episode and 72% presented with in the first year.

A total of 28 parietal pleurectomies combined with either bullectomy or oversewing of bulla were carried out during this study period (Table-VI). We have found it to be a relatively safe procedure with minimal complications. In 2 (7.1%) patients bronchopleural fistula developed postoperatively which settled with low-pressure suction in 3 days.

TABLE 4:
Surgical Proceedures (n=28)

Procedures	No. of Patients
A. Over Sewing/Ligation (Subpleural Bleb)	6 (21.4 %)
B. Bullectomy/Wedge Resection	22 (78.5 %)
Pleurectomy combined with A or B	28 (100. %)

DISCUSSION

Before planning treatment of a patient with pneumothorax several questions should be answered. Some of them are related to pathology and pathogenesis: Is there an underlying chronic lung disease or other pulmonary disorder or idiopathic. How extensive is the lung alteration? Is it a recurrent pneumothorax? The last question is of vital importance since the risk of relapsing pneumothorax amounts to 21% if the initial episode was treated by simple drainage only and the menace of recurrence further increased with the

number of incidents[11,12].

Primary spontaneous pneumothorax is a disease of young adults the peak incidence is usually in the 3rd decade[12], Our study shows that pneumothorax was primary in only 18 (16.3%) cases while COPD was responsible for 25.5% and pulmonary tuberculosis as a cause of secondary spontaneous pneumothorax in 54% of cases (Table-II). Pulmonary tuberculosis still remains the commonest cause of secondary spontaneous pneumothorax[4,6]. The main presenting symptoms were chest pain, shortness of breath and cough and most patients were males. CT thorax is often recommended in the preoperative workup of spontaneous pneumothorax[13], was performed in 20 patients and showed apical pulmonary bulla in 15 patients.

The objectives of treating spontaneous pneumothorax are relief of symptoms by rapidly reexpanding the affected lung and prevention of recurrences. Insertion of a chest tube is usually the first therapeutic step[14]. In our series 80 (72.2%) patient were treated with chest tube drainage who presented with first episode of pneumothorax. For the first event and the first ipsilateral relapse of spontaneous pneumothorax simple insertion of a chest drain is generally recommended although the recurrence rates are still high (20%). However in patients with a contralateral or with higher grade ipsilateral recurrences, an approach that is more invasive than tube thoracostomy is widely accepted[15,16]. Knowledge of the time course of air leak and healing rates with simple suction therapy is necessary when to intervene invasively[14]. In our patients the chest tubes were in place for a maximum of 7 days to allow for resolution of pneumothorax. If an air leak or pneumothorax persisted after 7 days surgical intervention was undertaken. This is comparable to observation by others[17,14]. Surgery for recurrence was offered to 18 (66.6%) of our patients. Indications for chemical pleurodesis were a second recurrence, persistent air leak or the underlying disease. Results for chemical pleurodesis vary but most investigators have reported failure rates that range from 20% to 30%[18]. In our study failure rate was 30%. Surgical pleurodesis is now more useful and can be performed either as an open procedure or under thoracoscopic control by mechanical abrasion[20].

Surgical pleurodesis has a significantly lower recurrence rate usually between 0% and 4%[21,22]. Twenty five percent of our patients ultimately required a thoracotomy (Table III, IV). In accordance with others[21,22] we believe that wedge resection (bullectomy) combined with parietal pleurectomy is sufficient therapy. The procedure was performed in 22 (78.5%) of our patients (Table IV). Both short term and long term morbidity were low.

The follow-up period was between 13 and 18 months with an arrange of 15.5 months. During this interval no relapse of pneumothorax was observed and pulmonary function tests showed significant improvement.

CONCLUSION

Based on our study we propose an early invasive treatment after first recurrence of primary spontaneous pneumothorax and in patients with secondary spontaneous form due to chronic obstructive pulmonary disease if the air leak persists for more than 7 days with chest tube and low-pressure suction. Surgical pleurodesis has far more convincing results than chemical pleurodesis in terms of recurrence. Shorter in-patient care as well as lower relapse rates may result.

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