ORIGINAL ARTICLE

Characteristics of the patients undergoing surgical treatment for pneumothorax: A descriptive study

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Abstract

Objective: To identify the characteristic features of pneumothorax patients treated surgically.

Methods: The retrospective study was conducted at Gazi Yasargil Education and Research Hospital Thoracic Surgery Clinic, Diyarbakir, Turkey and comprised records of pneumothorax patients from January 2004 to December 2014. They were divided into two groups as spontaneous and traumatic. Patients who had not undergone any surgical intervention were excluded. Mean age, gender distribution, location of the disease, type of pneumothorax, and treatment method were noted. Among patients with spontaneous pneumothorax, age and months distribution, smoking habits, pneumothorax size, and treatment method were assessed. The effect of gender, location, comorbid disease, smoking, subgroup of disease, and pneumothorax size on surgical procedures were also investigated.

Results: The mean age of the 672 patients in the study was 34.5±6.17 years. There were 611(91%) men and 61(9%) women. Disease was on the right side in 360(53.6%) patients, on the left side in 308(45.8%), and bilateral in 4(0.59%). Besides, 523(77.8%) patients had spontaneous, and 149(22.7%) had traumatic pneumothorax. Overall, 561(83.5%) patients had been treated with tube thoracostomy, whereas 111(16.5%) were treated with thoracotomy/thoracoscopic surgery. The presence of comorbid diseases, being primary, and being total or subtotal according to partial were found to create predisposition to thoracotomy/ thoracoscopic surgery ($p<0.05$ each).

Conclusion: In the case of pneumothorax being total, the presence of comorbid diseases, and the increase in pneumothorax size, thoracotomy or thoracoscopic surgery is preferred.

Keywords: Pneumothorax, Tube thoracostomy, Thoracotomy, Thoracoscopy. (JPMA 66: 554; 2016)

Introduction

Pneumothorax is the accumulation of air or gas in the pleural cavity after spontaneous or lung-chest wall trauma.[1] It has been reported that the rate of being bilateral is 5%, encountered with pleural effusion is 10%, and with haemothorax is 7%.[2] Pneumothorax is divided into two sections; spontaneous and traumatic. Spontaneous pneumothorax is sub-classified as primary and secondary.[3,4] Primary spontaneous pneumothorax (PSP) that results from spontaneous rupture of a subpleural bleb or bulla occurs predominantly in young, thin males without underlying lung disease. Secondary spontaneous pneumothorax (SSP) occurs in older people with underlying pulmonary diseases, such as emphysema, asthma, acute or chronic infections, lung cancer, congenital diseases, catamenial pneumothorax, lymphangioleiomyomatosis (LAM).[5-7] Traumatic pneumothorax is divided into three groups as blunt, penetrating, and iatrogenic pneumothorax.[8] Clinical findings in patients with PSP are local pleuritic chest pain accompanied by shortness of breath. In patients with tension pneumothorax, there is severe shortness of breath and sign of shock. It is a situation that requires immediate intervention.[1] Diagnosis is usually made by chest X-ray and clinical findings. Computed tomography (CT) scans can be used to detect patients with small pneumothorax and the number, size, location of bullae or blebs. Therefore, pleural adhesion, pleural fluid and underlying pulmonary diseases are detected with CT scans.[7] Patients with PSP are treated with surgical or non-surgical procedures. While surgical procedures are tube thoracostomy, thoracotomy and thoracoscopy, non-surgical procedures are oxygen supplementation and observation.[9]

The current study was planned to identify the characteristic features of patients admitted to hospital due to pneumothorax and who were treated surgically.

Patients and Method

The retrospective study was conducted at Gazi Yasargil Education and Research Hospital Thoracic Surgery Clinic, Diyarbakir, Turkey and comprised records of pneumothorax patients from January 2004 to December 2014. They were divided into two groups as spontaneous (primary and secondary) and traumatic (blunt, penetrating, iatrogenic). Patients who had not undergone

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any surgical intervention were excluded.

After obtaining approval from the Ethics Committee of Dicle University of Medicine, pneumothorax rate was determined by using chest radiography and rhea. Patients with pneumothorax rates up to 20% were considered minimal. Those between 20-39% were accepted as partial, between 40-59% subtotal, and over 60% were classified as having total pneumothorax.

Mean age, gender, location of the disease, type of pneumothorax, and efficient treatment methods of all patients were determined. Age and month distribution of patients with pneumothorax, smoking habits, pneumothorax size, and efficient methods of treatment were investigated. Moreover, the effect of gender, location, comorbid disease, smoking, subgroup of the disease, and pneumothorax size on the surgical procedures performed were examined. The rate of concomitant diseases of the patients with SSP were identified. In addition, mortality and morbidity rates were evaluated.

Continuous variables of statistical analysis were described as mean ± standard deviation, while categorical variables were expressed as frequency and percentage. Significance was assessed using Chi-square test or Fisher's exact test while P value was set at <0.05.

Results

The mean age of the 672 patients in the study was 34.5±6.17 years. There were 611(91%)men and 61(9%)women. Disease was at the right side in 360(53.6%) patients, on the left side in 308(45.8%), and bilateral in 4(0.59%). Besides, 523(77.8%) patients had spontaneous, and 149(22.7%) had traumatic pneumothorax. Of the patients with spontaneous pneumothorax, 402(77%) had PSP and 121 (23%) had SSP. Among those who had traumatic pneumothorax, there were 46(31%) blunt, 90(60.4%) had penetrating, and 13(8.6%) iatrogenic. Besides, 214(41%) of spontaneous pneumothorax patients were partial, 105(20%) subtotal,

Table-2: Surgical indications for Partial and Secondary pneumothorax.

	Psp		Ssp	
	n	%	n	%
Prolonged air leak/ Expansion defect	24	22	26	24
2.Attacks	45	42	5	5
3.Attacks	5	4	3	3

PSP: Primary spontaneous pneumothorax
SSP: Secondary spontaneous pneumothorax.

Table-3: Analysis of patients with spontaneous pneumothorax undergoing surgery.

Variable	Outcome	Tubethoracostomy/ Thoracotomy-Vats	P value
Sex			
Male	480	381/99	>0.999
Female	43	34/9	
Location			
Right	298	233/65	0.5129
Left	225	182/43	
Associated diseases			
Present	121	87/34	0.0289
Not present	402	328/74	
Smoking			
Present	409	329/80	0.2418
Not present	114	86/28	
Sugroups of disease			
Primary	402	328/74	0.0289
Secondary	121	87/34	
Pneumothorax Rates			
Partial	214	188/26	0.0311
Subtotal	105	82/23	
Pneumothorax Rates			
Partial	214	188/26	0.0001
Total	204	145/59	
Pneumothorax Rates			
Subtotal	105	82/23	0.2212
Total	204	145/59	

VATS: Video-assistedthoracoscopic surgery.

Table-1: Surgical procedures performed on patients with pneumothorax.

Pneumothorax	n	%	Tube thoracostomy	Thoracotomy/Vats
Primary pneumothorax	402	60	328	74
Secondary pneumothorax	121	18	87	34
Traumatic pneumothorax	149	22	146	3
Partial SP (%20-39)	214	41	188	26
Subtotal SP (%40-59)	105	20	82	23
Total SP (%60 and ?)	204	39	145	59

VATS: Video-assistedthoracoscopic surgery
SP: Spontaneous pneumothorax.

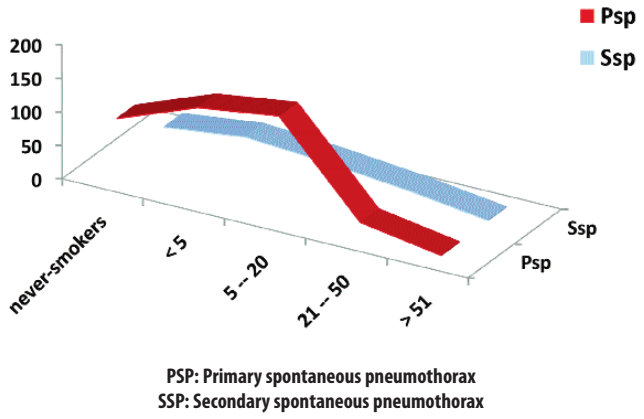

Figure-1: Smoking distribution in patients with spontaneous pneumothorax.

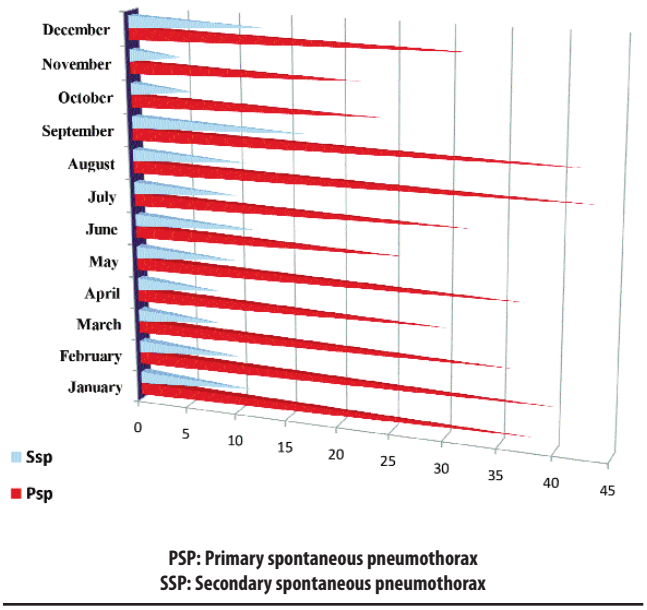

Figure-2: Annual distribution of spontaneous pneumothorax.

and 204(39%) total. Spontaneous pneumothorax was most frequent in the 21-30 and 31-40 age groups ($p<0.05$).

Among the patients, 313(77.86%) with PSP, and 96(79.3%) with SSP were smokers. A total of 409(78.20%) with spontaneous pneumothorax were smokers (Figure-1).

PSP was observed mostly in the months of August and September, while SSP was seen in September and December (Figure-2).

Further, tuberculosis 64 (53%) and chronic obstructive pulmonary disease (COPD) 32 (27%), were identified as the most common underlying diseases for patients with SSP. Other underlying diseases were bullous emphysema 17 (14%), malignancy 3 (2%), cystic fibrosis 3 (2%) and lymphangio leiomyomatosis 2 (2%).

Overall, 188(88%) patients with partial pneumothorax were applied tube thoracostomy, and 26(12%) had thoracotomy/thoracoscopic surgery; 82 (78%) subtotal pneumothorax patients were treated with tube thoracostomy; 23(22%) had thoracotomy/thoracoscopic surgery; 145(71%) total pneumothorax patients got tube thoracostomy, and 59(29%) underwent thoracotomy/thoracoscopic surgery, 143(98%) patients with a traumatic pneumothorax had tube thoracostomy, and 3(2%) had thoracotomy. All 3(100%) traumatic pneumothorax patients got posterolateral thoracotomy; 40(54%) patients with PSP received thoracotomy, and 34(46%) had video-assisted thoracoscopic surgery (VATS). Among SSP patients, 24(71%) received thoracotomy, and 10(29%) had VATS (Table-1).

Thoracotomy/VATS indications in spontaneous pneumothorax patients were identified as prolonged air leak and expansion defect in 50(46%) patients, the second attack in 50(46%), and the third attack in 8(8%) patients (Table-2).

Gender, localisation, smoking, and whether the disease was subtotal or total did not influence thoracotomy/VATS application. However, it was clearly seen that the presence of PSP and concomitant diseases (for secondary spontaneous pneumothorax) (p=0.0289) being subtotal (p-0.0311), and total (p=0,0001) compared to partial had a substantial effect on the implementation of thoracotomy/VATS according to the treatment with tube thoracostomy (Table-3).

Discussion

Pneumothorax is a disease of the lung. Most cases of pneumothorax occur spontaneously. A spontaneous pneumothorax can be defined as primary or secondary. In PSP, the pneumothorax occurs spontaneously in the absence of a known underlying disease. In SSP, pneumothorax is caused by an underlying disease like COPD, cystic fibrosis, tuberculosis or interstitial lung disease. Traumatic pneumothorax is iatrogenic or due to a blunt and penetrating trauma.[10]

If air is present in the pleural space, one of three events must have occurred: communication between alveolar spaces and pleura; or direct or indirect communication between the atmosphere and the pleural space; or presence of gas-producing organisms in the pleural space.[11,12]

The incidence of PSP is estimated at 18-28/105/year for men and 1.2-6/105/year for women. It tends to occur more often in tall and thin patients. The peak incidence is between 20 and 25 years of age.[10] In our study, PSP was most commonly seen between the ages of 21-30 and the rate of male patients was 12.4 times (male/female: 372/30) for PSP.

The most common cause of PSP is rupture of blebs and bullae.[13] In some studies, risk factors are described as genetic predisposition, being tall, and smoking. For some of the patients, autosomal dominant heredity plays a role and is reported to be higher in men. There is a family history in about 10% of cases.[10,14] In terms of genetic predisposition in patients with spontaneous pneumothorax, A study reported that there is a relationship between spontaneous pneumothorax and HLA haplotype A2, B40, alpha 1antitrypsin phenotype M1M2.[15] In our study, there was a positive family history in 9 PSP patients.

SSP is defined as a pneumothorax that occurs as a complication of underlying lung disease. The most common cause of SSP is COPD and tuberculosis.[16] The most frequent underlying disorders are COPD with emphysema, cystic fibrosis, tuberculosis, lung cancer and human immunodeficiency virus (HIV)-associated pneumocystis carinii pneumonia, followed by more rare but "typical" disorders, such as lymphangioleiomyomatosis and histiocytosis X. Because lung function in these patients is already compromised, SSP often presents as a potentially life-threatening disease, requiring immediate action, in contrast with PSP, which is more of a nuisance than a dangerous condition. The general incidence is almost similar to that of PSP. The peak incidence is between 60 and 65 years of age.[11] In our study, SSP was observed commonly in patients aged 45 years or more.

Smoking increases the risk for pneumothorax by at least nine-fold.[10] In our study, smoking rate in PSP patients was 3.51 (use/not use: 313/89), and in SSP patients it was 3.84 (use/not use: 96/25) respectively.

In some studies, it was reported that spontaneous pneumothorax was more common in spring and autumn.[17] In our study, PSP was frequently seen in August and September, while SSP was observed in September and December. Spontaneous pneumothorax is more commonly seen in the right hemithorax compared to the left for unknown reasons.[17] It was seen more often in the right hemithorax in our study.

A traumatic pneumothorax can result from either penetrating or non-penetrating chest trauma. With penetrating chest trauma, the wound allows air to enter the pleural space directly through the chest wall or through the visceral pleura from the tracheobronchial tree.[2] In our study, traumatic pneumothorax was seen as blunt 46 (31%), penetrating 90(60%)and iatrogenic 13(9%).

The majority of patients will present with sudden onset of chest pain, dyspnoea or both. SSP patients in general have more symptoms than PSP patients. In majority of patients, the symptoms will occur during rest. PSP hardly ever occurs during exercise.[10] In our study, the most common complaints were chest pain and dyspnoea for all patients with pneumothorax.

The diagnosis of pneumothorax can approximately be provided by means of history, physical examination and back-to-front chest X-ray. In suspected cases, expirium and contralateral lateral decubitus films, in which the problematic area should be in the upper part, help in the diagnosis. However, in cases where discrimination of pneumothorax and bullae remains unclear, correct diagnosis can be established by using thorax computed tomography.[5] In our study, the diagnosis was usually done on the basis of chest radiograph. In some cases, computed tomography was the other method used to distinguish between blisters and pneumothorax.

The main determinant factor in the treatment of PSP is the degree of pneumothorax. Minimal pneumothorax cases which are below 20% are clinically asymptomatic. The degree between 20-39% is considered partial pneumothorax, 40-59% is subtotal pneumothorax, and 60% and above is total pneumothorax. In minimal pneumothorax, observation oxygen therapy is sufficient. About 1.25% of the air in the pleural cavity is absorbed in every 24 hours. Aspiration with thoracentesis is a treatment method that can be used in small-scale phenomena. However, the preferred method for overall spontaneous pneumothorax is tube thoracostomy. Additionally, tube thoracostomy is usually applied from fifth and sixth intercostal space in the mid-axillary line. In the case of not developing expansion for 7-10 days after tube thoracostomy, surgical procedure is carried out. Some other publications recommending surgery in the case of not being expanded following 3-4 days after tube thoracostomy are also available. Other surgical indications are prolonged air leakage, non-expanded lung, bilateral pneumothorax, professional reasons, haemothorax development, tension and total pneumothorax.[18]

In the surgical approach, bullae resection, standard

thoracotomy, axillary thoracotomy and thoracoscopic surgery can be applied. Today, mostly stapler, blebectomy and pleural abrasion are preferred because of the low complication risk.[19] In our study, pneumothorax rates of spontaneous pneumothorax patients were partial for 214 (41%) patients, subtotal in 105(20%), and total in 204(39%). Besides, 188 (88%) patients with partial spontaneous pneumothorax were applied tube thoracostomy, 26 (12%) of them were treated via thoracotomy/VATS. On the other hand, 82 (78%) subtotal spontaneous pneumothorax patients were treated with tube thoracostomy, 23(%22) had thoracotomy/VATS. In addition, 145(71%) patients with total spontaneous pneumothorax had tube thoracostomy, and 59(29%) underwent thoracotomy/VATS. The application rate of tubethoracostomy for all patients was 83% (n = 561), and the rate was 17% (n = 111) for thoracotomy/VATS.

For patients with traumatic pneumothorax, the application rate of thoracotomy/vats was identified as 3/0, whereas it was 40/34 for PSP, and 24/10 for SSP. Indications of thoracotomy/VATSin patients with spontaneous pneumothorax were prolonged air leak and expansion defect in 50(%46%), the second attack for 50(46%) and the third attack in 8(8%). The main surgical procedures usually performed on patients with spontaneous pneumothorax were bullae excision and pleurectomy. However, the pleural abrasion and pleurodesis were the other treatment methods to be applied even if they were performed in relatively small numbers.

The most common complication encountered was empyema. No mortality was seen, and the mean length of stay was 8±2.19 days.

Conclusion

Pneumothorax is a chest surgery pathology which is common, and its treatment is not difficult. With appropriate treatment, the chance of success of treatment is very high. Tube thoracostomy is the primary and effective method for the treatment. However, in the case of the disease being total, the presence of comorbid diseases, and the increase in pneumothorax size, thoracotomy or thoracoscopic surgery is preferred.

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