ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA MAKALESİ

Sudden Chest Pain and Shortness of Breath in Emergency Department; Spontaneous Pneumothorax

Acil Serviste Ani Gelişen Göğüs Ağrısı ve Nefes Darlığı; Spontan Pnömotoraks

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ABSTRACT

Introduction: Spontaneous Pneumothorax (SP) is defined as the accumulation of free air in the pleural space. It should be considered as a priority in patients consulting the emergency service with sudden chest pain and shortness of breath. In our study, we aimed to emphasize the differential diagnosis of pneumothorax in patients coming to the emergency service with sudden chest pain and shortness of breath.
Materials and Methods: Thirty five cases of patients with SP admitted to the emergency room of Artvin State Hospital between January 2015 and March 2017 were retrospectively evaluated based on their demographic characteristics, radiological stage and treatment methods. Patients on follow-up with oxygen therapy and those treated with fine needle aspiration were excluded from the study. The pneumothorax evaluation detected in the postero-anterior chest radiographies were tested according to the measurement of American College of Clinical Pharmacy (ACCP) and were divided into two groups. Group 1 consisted of patients with pneumothorax where Apical > 3 cm (50% or more), and Group 2 consisted of patients with less than apical < 3 cm pneumothorax (less than 50%). After the grouping, the relationship between patients with primary and secondary spontaneous pneumothorax was evaluated by using regression and correlation tests.
Results: Thirty were male and 5 were female of the patients whose mean age was 45.8±5. Twenty-six patients had primary spontaneous pneumothorax, and nine had secondary spontaneous pneumothorax. In the statistical study based on double regression analysis, it was seen that the amount of pneumothorax measured on chest X-ray was dependent on the SP type by 84%. It was measured that the pneumothorax value measured over (p<0,01) 50% would support PSP with 87,3% sensitivity and 89,2% specificity (p<0,01). While 24 patients benefited from tube thoracostomy, open surgery or video-thorascopics method (VATS) and bulla ligation and pleural abrasion were conducted on 4 patients due to prolonged air leakage and 7 patients due to recurrent spontaneous pneumothorax.
Conclusion: Spontaneous pneumothorax should be considered in every patient admitted to the emergency department with sudden shortness of breath and chest pain. SP diagnosis through direct radiography and planning for the treatment are very important in hospitals where the patient population is low and medical facilities are limited. Tube thoracostomy is the primary treatment option in patients with spontaneous pneumothorax. However, in patients with prolonged air leakage and recurrent spontaneous pneumothorax, thoracotomy or video-thoracoscopic method may be necessary for surgical treatment.

Key words: Dyspnea, pleura, pneumothorax, spontaneous

ÖZET

Giriş: Spontan Pnömotoraks(SP) plevral boşlukta serbest hava birikimi olarak tanımlanır. Ani göğüs ağrısı ve nefes darlığı şikayetiyle acil servise başvuran hastalarda öncelikli olarak akla gelmelidir. SP'ın en önemli tedavi yöntemi cerrahidir. Çalışmamızda acil servise ani göğüs ağrısı ve nefes darlığı ile başvuran hastalarda pnömotoraks ayırıcı tanısını vurgulamayı ve cerrahi yöntemle tedavi edilen SP' lı olgularımızın değerlendirilmesini amaçladık.
Materyal ve Metod: Ocak 2015 ile Mart 2017 tarihleri arasında Artvin Devlet Hastanesi acil servisine başvuran 35 spontan pnömotoraks olgusu demografik özellikleri, radyolojik evre ve tedavi yöntemlerine göre retrospektif olarak incelendi. Oksijen tedavisi ile takip edilen ve iğne aspirasyonu ile tedavi edilen hastalar çalışma dışı bırakıldı. Hastaların postero-anterior akciğer grafilerinde tespit edilen pnömotoraks değerlendirmesi, American College of Clinical Pharmacy (ACCP)'nin belirlediği ölçüme göre yapılarak 2 gruba ayrıldı. Grup 1; Apikal > 3 cm'den fazla pnömotoraks olan (%50 ve daha fazla) hastalar, Grup 2; apikal < 3 cm'den az pnömotorakslı (%50' den az) hastalar oldu. Gruplama sonunda primer ve sekonder spontan pnömotorakslı hastalar arasındaki ilişki regresyon ve korelasyon testleri kullanılarak değerlendirildi.
Bulgular: Yaş ortalaması 45,8±5 olan hastaların 30' u erkek 5' i kadındı. 26 hasta primer spontan pnömotoraks, 9 hasta sekonder spontan pnömotorakstı. İkili regresyon analizine göre yapılan istatistiksel incelemede akciğer grafisinde ölçülen pnömotoraks miktarının, SP tipine %84 oranıyla bağlı olduğu anlaşıldı.(p<0,01) %50' den fazla ölçülen pnömotoraks değerinin %87,3 sensitivite ve %89,2 spesifite ile PSP lehine değerlendirileceği ölçüldü. (p<0.01) 24 hasta tüp torakostomiden fayda görürken, 4 hastaya uzamış hava kaçağı nedeniyle ve 7 hastaya rekürren spontan pnömotoraks nedeniyle açık cerrahi veya video-torakoskopik yöntem (VATS) ile bül ligasyonu ve plevral abrazyon yapıldı.
Sonuç: Ani gelişen nefes darlığı ve göğüs ağrısı şikayetiyle acil servise başvuran her hastada spontan pnömotoraks akla gelmelidir. Hasta popülasyonunun az olduğu, tıbbi imkanların sınırlı olduğu hastanelerde, direk radyografi ile SP' a tanı konulması ve tedavi planlaması çok önemlidir. Spontan pnömotorakslı hastalarda primer tedavi seçeneği tüp torakostomidir. Ancak uzamış hava kaçağı olan ve rekürren spontan pnömotorakslı hastalarda torakotomi yada video-torakoskopik yöntem, cerrahi tedavi için gerekli olabilir.

Anahtar: Kelimeler: Dispne, plevra, pnömotoraks, spontan

Received: January 14, 2019 Accepted: March 26, 2019

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Atıf için/Cited as: Gurz S, Gundogdu H, Mehmetoglu SS. Sudden Chest Pain and Shortness of Breath in Emergency Department; Spontaneous Pneumothorax. Anatolian J Emerg Med 2019;2(2); 5-9

Introduction

Spontaneous pneumothorax (SP) is defined as the spontaneous free accumulation of air in the pleural space. According to its etiology, it is classified under two headings as primary and secondary SP. If it develops in patients without any underlying lung pathology, it is called Primary SP (PSP), and if it develops on a disease background (chronic obstructive pulmonary disease (COPD), Tuberculosis or Lung cancer, etc.), it is called Secondary SP (SSP)[1,2] The approach for patients who consult the ER with sudden chest pain and shortness of breath is to categorize the disease using the diagnostic methods, to correct the patient's clinical picture, to take out the free air in the thorax, and to prevent its recurrence. The most important treatment modality to heal the patient's symptoms is surgery. In our study, we aimed to retrospectively evaluate the SP cases which came to our emergency room, and to emphasize the importance of differential diagnosis of pneumothorax in chest pain and dyspnea symptoms frequently encountered in the ER.

Materials and Methods

In this study, 35 cases of SP who applied to Artvin State Hospital between January 2015 and March 2017 were retrospectively analyzed according to their demographic features, complaints on admission, radiological stage and treatment methods. The pneumothorax evaluation spotted in the postero-anterior chest radiographies was divided into two groups following the measurement of American College of Clinical Pharmacy (ACCP) (Figure 1).

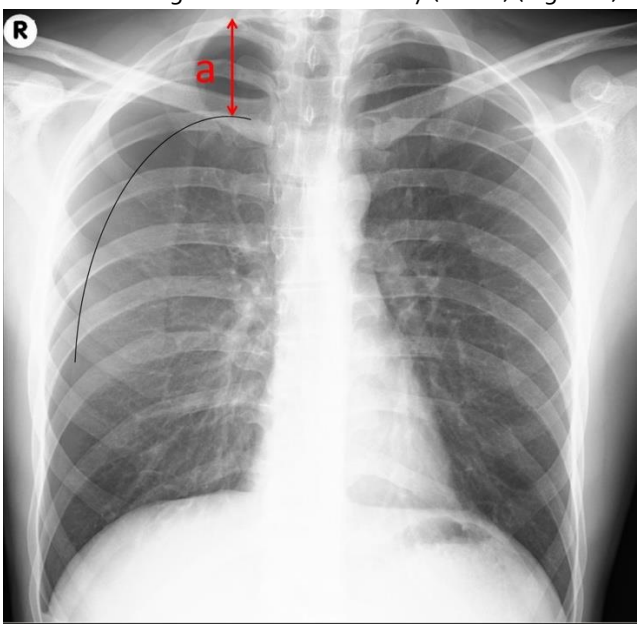

Figure 1. Measurement technique of spontaneous pneumothorax recommended American College of Clinical Pharmacy

Group 1 consisted of patients with pneumothorax where apical > 3 cm (50% or more), and Group 2 consisted of patients with less than apical < 3 cm pneumothorax (less than 50%). Patients who were followed up with oxygen therapy and given fine needle aspiration treatment were excluded from the study. For thoracostomy, chest tube (Thoracic Catheter, 32CH, Bıçakcılar, Turkey) was used. Patients requiring advanced surgery were administered bulla ligation and pleural abrasion by using video-thoracoscopic method (VATS) or by thoracotomy under general anesthesia. Numerical data were presented as mean values and standard deviation (median and range). The statistics were organized by using SPSS statistical software (SPSS version 15.0 for Windows; SPSS; Chicago, IL, USA). The compatibility of the variables to normal distribution was evaluated by Kolmogorov-Smirnov test. Pearson or Spearman correlation test was used for the correlations. The significance between two category-variables was tested by ANOVA (Analysis of Variance). The values where p value was below 0.05 were considered to be statistically significant.

Results

Of the patients whose mean age was 45.8±5, 30 were male and 5 were female. 26 patients had primary spontaneous pneumothorax, and 9 had secondary spontaneous pneumothorax. The most common symptom was sudden onset of dyspnea [62,86% (n = 22)], and the second most common symptom was chest pain [25,71% (n = 9)]. Except for one patient, all patients had a smoking history (Table.1).

	PSP	SSP	*p*
Sex			**<0,01**
M	21	9	
F	5	-	
Age	24,04±6,72	66,5±8,63	
Smoking	25	9	**<0,01**
Symptom (%)			
Dyspnea	48,57	14,28	
Chest Pain	20	5,71	**0,035**
Others	5,71	5,71	
Treatment			0,63
Thoracostomy	18	6	
Thoracotomy	6	3	
VATS	2	-	
Complications	2	-	

Table.1 Distribution of variables according to diagnosis
PSP: Primary spontaneous pneumothorax, SSP: Secondary spontaneous pneumothorax.

Considering the ACCP evaluation; 67.1% (n = 23) of the patients were classified as Group 1, while 34.29% (n = 12) were classified as Group 2. 69.23% (n = 18) of the patients with PSP were in Group 1, while 30.77% (n = 8) were in Group 2. (p = 0.02) 55.5% (n = 5) of the patients with SSP were in Group 1, and 44.5% (n = 4) were in Group 2 (Table.2). In the statistical study based on paired regression analysis, it was seen that the amount of

pneumothorax measured on chest X-ray was related to the type of pneumothorax with a rate of 84% (p <0,01). Based on Pearson correlation analysis, a strong relation was detected between the SP type and pneumothorax amount (p <0.05). The pneumothorax value, which was measured to be higher than 50%, was evaluated in favor of PSP with 87.3% sensitivity and 89.2% specificity. (P <0.01)

	Group 1(n) %	Group 2(n) %	*p*
PSP	18 (51,42)	8 (22,86)	**0,02**
SSP	5 (14,28)	4 (11,43)	0,67

Table.2 Distribution of ACCP measurement according to diagnosis and groups

68% (n = 24) of the patients benefited from tube thoracostomy administered under local anesthesia in the emergency room. The symptom of shortness of breath improved in all patients. Nasal oxygen and analgesic support were given to the patients who underwent tube thoracostomy. Complications were seen in two patients who were administered tube thoracostomy. A re-expansion edema without a clinical reflection was detected in the radiography (Figure 2). The patients who underwent tube thoracostomy were discharged in an average of 8 ± 0.98 (6-10) days.

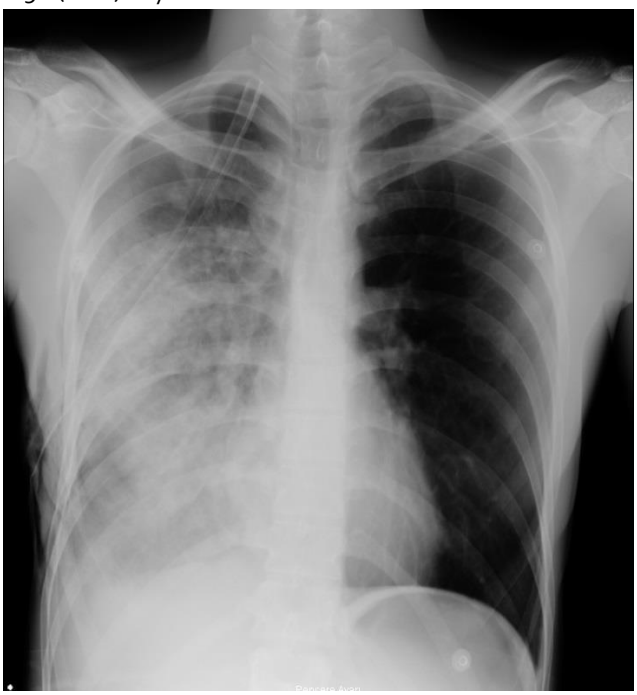

Figure.2 Radiological appearance of re-expansion edema after tube thoracostomy

32% (n = 11) of the patients were treated by using advanced surgical procedures. Surgery was performed on four patients due to prolonged air leakage, and on seven patients due to recurrent SP. Axillary mini-thoracotomy was performed in 9 patients who underwent advanced surgery, and bulla ligation and pleural abrasion were administered to two patients with VATS (dual-port) (Figure 3). The patients who underwent surgical treatment were discharged in an average of 4 ± 0.82 (3-6) days. No recurrence was observed in the patients who underwent surgery. Morbidity and mortality did not develop.

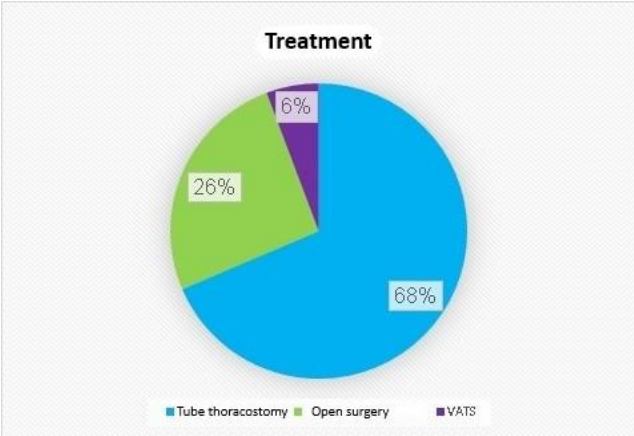

Figure.3 Distribution of surgical treatment methods for SP
SP:Spontaneous pneumothorax

Discussion

SP is defined as the accumulation of free air in the pleural space. Etiologically, it is categorized into two: Primary SP and Secondary SP. Primary SP is a condition that develops without any underlying cause. Unlike primary SP, secondary SP is associated with an underlying lung disease. (3) In more than 90% of the PSP cases, subpleural blebs and bullae are detected in the lung apex through thoracoscopy and CT scan.[4,5] Negative pleural pressure gradient increases from the base of the lung towards the apex, therefore the alveoli in the lung apex of tall individuals are exposed to a significantly higher extension pressure than the alveoli in the lung base, and from a theoretical perspective, these accelerations predispose the formation of apical subpleural bullae.[6] 74,3 of the patients included in our study had PSP, while 25,7% had SSP. All patients with SSP developed pneumothorax on the foundation of COPD.

While smoking habit is associated with the risk of developing a pneumothorax to 12% in healthy males who smoke, this rate is 0.1% in non-smokers. (5) With isolated risk factors such as smoking, height and age >60, the recurrence risk of PSP reaches 54% in the first four years.[6] 97.14% of the patients included in our study had a smoking history (p <0.01).

Symptoms may be very low or absent in primary SP. On the contrary, there are more symptoms in Secondary SP, although the size of the pneumothorax is comparatively smaller. The presence of shortness of breath affects the treatment strategy. In our study, the most common symptom of SP patients was a suddenly developing dyspnea [62,86% (n = 22)], and the second most common

symptom was chest pain [25,71% (n = 9)]. In all patients, the symptoms were relieved after tube thoracostomy.

The diagnosis of pneumothorax is usually confirmed by imaging techniques, which also informs about the size of the pneumothorax.[3] In determining the size of the pneumothorax, plain PA chest X-rays are generally used. A CT scan is recommended as the best method for determining the size of a pneumothorax. Patients with an underlying pulmonary disease are less able to tolerate pneumothorax. For this reason, a distinction must be made between Primary SP and Secondary SP at the time of diagnosis in order to select an appropriate treatment. There are different guidelines which determine the amount of pneumothorax. A study by Kelly and Druda in 2008 compared the guides of ACCP, British Thoracic Society, and Belgium Society of Pulmonology and found no significant difference.[7] In our study, the grouping based on the measurement by ACCP revealed that a meaningful amount of pneumothorax exceeded 50% in PSP cases (p = 0.02). It was found that the amount of pneumothorax measured in chest X-ray was related to the type of SP to 84% (p <0.01). It was seen that the pneumothorax value measured at more than 50% would be evaluated in favor of PSP with 87.3% sensitivity and 89,2% specificity (p <0.01) These data were interpreted to be a result of PSP, which develop especially in young people without an underlying lung pathology, as they have a good tolerance level for dyspnea until the amount of pneumothorax increases. In patients with SSP, which is a lung pathology similar to COPD, symptoms are more evident with a small amount of pneumothorax due to low respiratory capacity. However, no statistically significant results were seen in patients with SSP with regard to pneumothorax measurement.

The aim of the treatment is to restore the clinical picture, to empty the pneumothorax, restoring the re-expansion of the lung, and to prevent the recurrence of the pneumothorax.[5] The treatment method to be preferred in a minor SP with no apparent shortness of breath are oxygen support and observation.[8] Shortness of breath points out to the need for interventional procedures in addition to supporting treatment (including oxygen). Whether primary or secondary, the patients should be given active intervention regardless of the size of the pneumothorax, Tube thoracostomy is the most important treatment model in SP. In patients who do not respond to tube thoracostomy or where severe air leakage persist, surgical intervention with thoracoscopy or thoracotomy may be required. However, in recurring cases, sclerosant agent applied via tube thoracostomy (pleurodesis) and video-assisted thoracoscopic intervention are the recently accepted methods.[9] In our study, 68% of patients benefited from tube thoracostomy, however 32% were treated by using advanced surgical methods.

There are two main objectives in the surgical repair of permanent air leakage due to pneumothorax and prevention of recurrence. The first target is to resect the visible bullae and blebs on the visceral pleura, as well as to obliterate emphysema-like changes[5] or the pores beneath the visceral pleural surface[10]. The second target is to ensure the fusion of two pleural sheets as an aid to prevent relapse. In the past, some surgeons have favored surgical pleurodesis in addition to pleural abrasion, while others emphasized the importance of various pleurectomy levels in the prevention of recurrence.[11-13] Although pleurectomy has some superiority over pleural abrasion[11] more generally, the combination of the two is used.[14-16] Unfortunately, there are very few good comparative case-controlled studies in this area 17,18. Recently, less invasive procedures with the use of VATS have become more popular; these have a lower morbidity rate but a higher recurrence rate.

Study Limitations

The retrospective data analysis is the main limitation of our study. Another limitation is that it involves a low number of patients in a place with a low regional population.

Conclusion

In conclusion, SP should be considered in every patient which come to the emergency room with symptoms of a suddenly developing chest pain and shortness of breath. The treatment option should be planned according to clinical and radiological situation of patients with SP. It should be remembered that the SP type affects treatment planning. In SSP, supporting therapy should be administered for the underlying disease as well. The primary treatment option for patients with SP is tube thoracostomy. However, thoracotomy or VATS may be required in patients with prolonged air leakage and recurrent SP.

Acknowledgement

Our study was presented in the 9th National Thoracic Surgery Congress of Turkish Thoracic Surgery Society.

Conflict of interest

All authors have no conflict of interest to disclose.

Financial Disclosure

The authors declared that this study has received no financial support.

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