

DO METEOROLOGICAL FACTORS HAVE AN EFFECT ON THE DEVELOPMENT OF PNEUMOTHORAX? 1 YEAR EXPERIENCE IN TURKEY

METEOROLOJİK FAKTÖRLERİN PNÖMOTORAKS GELİŞİMİ ÜZERİNE ETKİSİ VAR MI? 1 YILLIK TÜRKİYE DENEYİMİ

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SUMMARY

Introduction: Spontaneous pneumothorax (SP) is a respiratory disease that can be severe. In some studies in the literature, it has been suggested that seasonal changes and meteorological factors may affect the incidence of SP. In our study, the relationship between spontaneous pneumothorax formation and changes in meteorological parameters (seasons, average temperature, atmospheric pressure, relative humidity, sunshine duration, wind) in adult patients in Turkey over a 1-year period was investigated.

Materials and Methods: We examined the patients who were transferred to the emergency room with the diagnosis of pneumothorax between January 2019 and January 2020. Patient data were analyzed with meteorological data such as mean daily temperature in degrees (°C), mean relative humidity (%), mean sunshine duration (hours), mean atmospheric pressure (hPa), wind speed (m/s).

Results: The total number of patients in our study group was 35.699. Spontaneous pneumothorax took the first place with 23.489 patients. Secondary pneumothorax was present in 8.632 patients, and traumatic pneumothorax in 3.578 patients, respectively. When the patients were evaluated in terms of the effect of seasonal effects on the percentage of pneumothorax, pneumothorax was observed significantly more in autumn than in other seasons (p:0.014). A significant effect of mean atmospheric pressure, temperature, wind speed values and changes in the meteorological data on the formation of pneumothorax was not detected in our study (p:0.149).

Conclusion: PSP tends to cluster seasonally and no significant relationship was found between meteorological factors such as average temperature, daily average sunshine duration, humidity percentage and PSP formation. Since more spontaneous pneumothorax is seen seasonally in autumn, it should be considered in hospital study planning. We considered that the different results of some literature studies with our study can be explained by the differences between regions in terms of climatic characteristics and meteorological conditions.

ÖZ

Giriş: Spontan pnömotoraks (SP) şiddetli olabilen bir solunum yolu hastalığıdır. Literatürdeki bazı çalışmalarda mevsimsel değişikliklerin ve meteorolojik faktörlerin SP insidansını etkileyebileceği öne sürülmüştür. Çalışmamızda Türkiye'deki erişkin hastalarda 1 yıllık sürede spontan pnömotoraks oluşumu ile meteorolojik parametrelerdeki (mevsimler, ortalama sıcaklık, atmosfer basıncı, bağıl nem, güneşlenme süresi, rüzgar) değişimler arasındaki ilişki araştırılmıştır.

Gereç ve Yöntem: Ocak 2019-Ocak 2020 tarihleri arasında pnömotoraks tanısı ile acil servise sevk edilen hastalar incelendi. Hasta verileri, derece cinsinden ortalama günlük sıcaklık (°C), ortalama bağıl nem (%), ortalama güneşlenme süresi (saat), ortalama atmosfer basıncı (hPa), rüzgar hızı (m/sn) gibi meteorolojik verilerle analiz edildi.

Bulgular: Çalışma grubumuzdaki toplam hasta sayısı 35.699 idi. Spontan pnömotoraks 23.489 hasta ile ilk sıradaydı. Sırasıyla 8.632 hastada sekonder pnömotoraks, 3.578 hastada travmatik pnömotoraks görüldü. Mevsimsel etkilerin pnömotoraks yüzdesine etkisi açısından değerlendirildiğinde, pnömotoraks sonbaharda diğer mevsimlere göre anlamlı olarak daha fazla gözlemlendi (p: 0.014). Çalışmamızda ortalama atmosferik basınç, sıcaklık, rüzgar hızı değerleri ve meteorolojik verilerdeki değişikliklerin pnömotoraks oluşumuna önemli bir etkisi tespit edilmemiştir (p:0.149).

Sonuç: PSP mevsimsel olarak kümelenme eğilimindedir ve ortalama sıcaklık, günlük ortalama güneşlenme süresi, nem yüzdesi ve PSP oluşumu gibi meteorolojik faktörler arasında anlamlı bir ilişki bulunamamıştır. Spontan pnömotoraks sonbaharda mevsimsel olarak daha fazla görüldüğünden hastane çalışma planlamasında göz önünde bulundurulmalıdır. Çalışmamız ile bazı literatür çalışmaları arasında farklı sonuçların bulunmasının bölgeler arası iklim özellikleri ve meteorolojik koşullar açısından farklılıklar ile açıklanabileceğini düşünmekteyiz.

INTRODUCTION

Spontaneous pneumothorax (SP) is common and its incidence is increasing. It is a respiratory disease that can be severe (1, 2). Pneumothorax is defined as the entry of air into the pleural space. Spontaneous pneumothorax may be a disease that occurs as a complication of primary or secondary lung disease occurring in patients without clinically evident lung disease (3). Its exact pathogenesis is partially known. Spontaneous pneumothorax may occur due to rupture of an emphysema bulla located in the bleb or visceral pleura (4). Air sac rupture occurs when there is a transpulmonary pressure gradient (5, 6). However, there is not enough information about the factors affecting bleb and bulla rupture in SP. In some studies in the literature, it has been suggested that seasonal changes and meteorological factors may affect the incidence of SP. While some studies have found a relationship between atmospheric pressure and decreasing humidity and an increase in the incidence of SP, some studies have reported that there is no relationship between the formation of SP and climatic conditions such as changes in atmospheric pressure, temperature, and humidity (5, 6). Some studies have highlighted the influence of other factors, such as scuba diving or exposure to loud music (7). There are studies in the literature showing that climatic changes in atmospheric pressure, temperature or humidity may affect the incidence of pneumothorax (8).

In our study, the relationship between spontaneous pneumothorax formation and changes in meteorological parameters (seasons, average temperature, atmospheric pressure, relative humidity, sunshine duration, wind) in adult patients in Turkey over a 1-year period was investigated.

MATERIALS AND METHODS

We retrospectively reviewed the patients who were referred to the emergency department with the diagnosis of pneumothorax between January 2019 and January 2020, with local ethics committee approval (No: E1-20-824). Patient data were obtained from the Ministry of Health with the approval for use. Meteorological data were obtained from the national meteorological institute. Patients with spontaneous, idiopathic, secondary, or recurrent pneumothorax diagnosed in all emergency departments across the country and in the official records of the Ministry of Health were included in the study. Patients with lack of data and definitive diagnosis were not included in the study. Medical data such as pneumothorax occurrence and daily number of pneumothorax patients, gender, age, smoking status were included in the study. Patient data, meteorological data such as average daily temperature in degrees (°C), average relative humidity (%), average sunshine duration (hours), average atmospheric pressure (hPa), wind speed (m/s) were used in the study. Patient demographic data were analyzed. Evaluation and

analysis were made on the effects of meteorological events and seasonal dates on the occurrence of pneumothorax.

Statistical Analysis

Data were evaluated using Statistical Package for the Social Sciences 23.0 (SPSS), IBM, USA. Data are presented in mean ± Standard Deviation (SD) or n (%), where appropriate. Comparison of the categorical data between groups was used chi-square test. Analysis of variance (ANOVA) was used for comparing normally distributed continuous data of more than two groups. Correlations between continuous variables were tested using Spearman's rho. P < 0.05 was considered as statistically significant.

RESULTS

Patients with diagnosis of pneumothorax admitted to hospitals in Turkey between January 2019 and January 2020 were evaluated retrospectively. The total number of patients in our study group was 35.699. Of these patients, 31.425 were male and 4.274 were female (Table1). The mean age was 32,8 years. When

the patients with pneumothorax who admitted to the hospital were evaluated; spontaneous pneumothorax was in the first place with 23.489 patients. Secondary pneumothorax was seen in 8.632 patients, and traumatic pneumothorax in 3.578 patients, respectively.

Considering the meteorological data, the 1-year mean temperature was 13.7 °C. The mean humidity percentage was 57.2%. The mean pressure was 913.3 hPa. The average daily total sunshine duration throughout the year was 6.8. The 1-year mean wind speed was 1.9 m/s (Table1). When the patients were evaluated in terms of the effect of seasonal effects on the percentage of pneumothorax, pneumothorax was observed significantly more in autumn than in other seasons (p:0.014). It was followed by spring, winter and summer seasons, respectively. Traumatic pneumothorax patients were most frequently seen in the summer and later in the spring. A significant effect of mean atmospheric pressure, temperature, wind speed values and changes in the meteorological data on the formation of pneumothorax was not detected in our study (p:0.149).

Table 1. Epidemiological characteristics of our study group data

Number of Totally Patients	N (Patients)		
		Male	31.425
	Female	4.274	
Pneumothorax Type	1.	Spontaneous	23.489
	2.	Secondary	8.632
	3.	Traumatic	3.578
Ranking of pneumothorax according to seasons	1.	Autumn	
	2.	Spring	
	3.	Winter	
	4.	Summer	
Meteorological data:	<ul style="list-style-type: none"> • Considering the meteorological data, the 1-year mean temperature was 13.7 °C. • The mean humidity percentage was 57.2%. • The mean pressure was 913.3 hPa. • The average daily total sunshine duration throughout the year was 6.8. • The 1-year mean wind speed was 1.9 m/s. °C: Celsius hPa: hectopascal m/s: meter per second		

DISCUSSION

In our study, the frequency of days with primary spontaneous pneumothorax (PSP) during the observation period was %5.7, and the age-adjusted incidence rates of PSP were 16.4 and 3.1 per 100,000 person-years in men and women, respectively. Significant seasonal changes were observed in the frequency of PSP days, peaking in the fall. No significant correlation was observed between maximum wind speed and PSP days. Similar results were obtained when early recurrent PSP episodes were excluded (9).

PSP incidence rates in the literature are 6.4-25.1 per 100,000 person-years in men and 1.4-9.6 per 100,000 person-years in women (10). These data in the literature were in line with our results and showed little difference in the incidence of PSP between countries.

Despite the evidence in the literature showing seasonality in PSP occurrence, our study found that PSP occurs more frequently in autumn (11). Seasonal differences in PSP occurrence may be related to climate change or recurrence of respiratory infections. The inconsistency of PSP seasonality between our results in our study and some articles in the literature may be due to meteorological, environmental and geographical differences between studies (4, 6).

There are few studies in the literature showing a positive relationship between wind speed and PSP formation (12). This positive relationship was thought to be due to the instability of atmospheric pressure (13). However, as in the literature, no significance was found in the relationship between atmospheric pressure, wind speed and PSP in our study (14). Atmospheric pressure change was not considered to be an effective factor for PSP (15). Conversely, an increase in wind speed can result in increased respiratory exposure to pollen, allergens, and air pollution (16), but through a check valve mechanism can cause bronchiolar spasms and air trapping in bullae (17). Instability in wind speed rather than wind speed causes aerosol dispersion (18). In our study, it was considered as the reason for associating changes in wind speed with PSP. The association between

changes in wind speed and PSP remained significant in smokers, whereas the incidence of PSP was decreased in non-smokers. The reason for this heterogeneity is that smokers are more sensitive to the effects of changes in wind speed on the PSP than non-smokers because smoking causes bullous diseases (19).

On the other hand, no significant relationship was found between meteorological factors such as average temperature, daily average sunshine duration, humidity percentage and PSP formation. Since epidemiological studies show that climate change is a risk factor for the development of PSP, these associations need to be evaluated further (20).

Our study has several strengths, including the high accuracy of PSP diagnoses obtained by examining each patient's medical records, and the use of meteorological data from the National Meteorological Institute with various factors to evaluate detailed local climate changes. However, there are some limitations to consider. Since our study was designed as a single country-centered analysis, our results may not be generally accepted in the literature. A prospective multicenter cohort study should be planned to overcome these limitations and validate the current findings.

CONCLUSION

PSP tends to cluster seasonally and no significant relationship was found between meteorological factors such as average temperature, daily average sunshine duration, humidity percentage and PSP formation. Since more spontaneous pneumothorax is seen seasonally in autumn, it should be considered in hospital study planning. In our study, it may resolve PSP better, but prospective studies are needed to elucidate the etiology of bulla or bulla rupture causing PSP. In summary, we concluded that there is no significant relationship between PSP formation and some meteorological parameters, except for the seasons. We considered that the different results of some literature studies with our study can be explained by the differences between regions in terms of climatic characteristics and meteorological conditions.

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