Is the onset of spontaneous pneumothorax influenced by air pollution meteorological changes, or both?

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The deterioration of physical health due to changes in the weather conditions was suggested beginning from Hippocrates at the 5th century B.C. Climatic characteristics, such as rain, atmospheric pressure (AP), thunderstorms, temperature, weather phases and wind have been repeatedly implicated in the pathogenesis of many diseases such as rheumatoid arthritis, SLE,Behcet's disease Bell's palsy, sudden hearing loss, myocardial infarction, abdominal aortic aneurysm ruptures, asthma and some showed significant relationship (1). The clinical impression of many physicians is in the direction that occurrence of SP is not a random event. Similarly this relationship has been investigated for spontaneous pneumothorax (SP). The cause of the rupture of blebs or bullae causing SP remains unclear, but suggestions were concentrated over the presence of a substantial transpulmonary pressure gradient (2). The overexpansion of the alveoli due to the trapped air may trigger the occurrence of SP when the outer pressure falls (3). It has also been suggested in many series that SP admissions occurs in clusters (1,2,4,5,6).

Atmospheric pressure, temperature changes or correlation with specific weather phases, seasonal factors and storm were suggested to be precipitating factors in the development of SP (1,2,5,6,7). The results of some series do not support the premise that seasonal factors are involved in precipitating SP, although certain climatic parameters showed weak associations with the incidence of SP (8,9,10).

In this issue of the Journal of Thoracic Disease, Bertolaccini et al. report their results of the study examining the influence of standard meteorological parameter variations and concentrations of the major air pollutants on the incidence of SP in a highly developed industrial area (Turin, Italy) (11). Although the relation between SP and meteorological parameters were examined previously, this retrospective report is linking SP to atmospheric chemical parameters like atmospheric particles (eg. PM10), ozone and nitrogen dioxide levels. This original study by Bertolaccini et al. suggests that the occurrence of SP might be facilitated by higher and less dispersed values of daily mean nitrogen dioxide, by lower and more dispersed values of ozone, and by less dispersed temperature and wind speed values. The other examined correlations like, large carbon dioxide maxima and during cold and windy days, appeared less significant.

Their current retrospective study consisted of a total 591 SP admissions and, 363 days with admissions (19% of the total) to two hospitals between 2002 and 2007 in Turin, Italy. The patients with documented primary SP was included to the study where traumatic and secondary pneumothoraces were excluded. They took into account only the variables recorded one day before SP occurrence pointing that the nature of SP is severe and disabling. A pneumothorax patient may became symptomatic within several days and because of the retrospective character of the patient history study, the day that SP developed was not considered to be reliable enough, so other investigators compared the

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measured meteorological values of the 2 to 4 consecutive days prior to admission as well as the actual day of admission (1,5,6,9).

In the current study the climatic variable measurements were AP, temperature, relative humidity, wind speed, and as mentioned in the introduction section some atmospheric chemical parameters which were absent in the previous SP, but asthma exacerbations studies, were solar global radiation, precipitation, NO, NO2, SO2, PM10, C6H6, C7H8, ozone, carbon monoxide and carbon dioxide. Mean, maximum and minimum daily values, daily standard deviations, average daily anomalies and several daily variations were calculated. The study results are in agreement that SP patients are admitted in clusters, which strongly supports the hypothesis that the meteorological conditions could play a role in the mechanism responsible for development of SP (1,2,4-6). The incidence of SP had no seasonal or monthly correlation in this study. Similarly no seasonal or monthly predominance of clusters could be identified in some studies (1,2,5,6). Slight spring preponderance and a significant increase in the rate of SP in May and December and another one in summer and in July was demonstrated (9,12). In this study no correlations between SP and variations in AP was found. Alifano et al. found a significant correlation with wider differences in AP mean between the index day and the previous day and between the AP minimum and the AP maximum of the previous day (6). Bense found that a fall in AP of at least 10 millibars followed by increased SP admissions (7). Similarly in our study clusters of SP episodes were significantly associated with falls and wider differences in AP. We suggest that transpulmonary pressure gradient due to falls in AP may be enough to cause SP in some patients (1). Although the exact mechanism by which a fall in AP may cause SP remains unknown two suggestions are reasonable. First when the air inside the blebs or bullae is trapped due to bronchospasm, a rapid equilibration of the pressure gradient with the atmosphere could not be achieved, second like in asthma there may be a relation between inflammation and weather conditions; thus a check valve mechanism may result in SP (2,6). The authors mentioned that the only significant meteorological variable correlated with the onset of SP is the minimum wind speed.

In the current study, the results suggest that, occurrence of SP appears to be facilitated by higher and less dispersed values of daily mean nitrogen dioxide, by lower and more dispersed values of ozone and by less dispersed temperature and wind speed values. Other correlations, as those with large carbon dioxide maxima and during cold and windy days stated to appear less significant. This study shows unique external contributing factors for the onset of SP which are promising and warrant further investigation. Other population studies in different countries based on similar designs should be developed to further confirm and detail the influences of meteorological variables on SP occurrence. And limitations of the studies, the presence of comorbid illnesses or respiratory disease, cigarette smoking, different climatic conditions, nonhomogenous distribution of cases must be taken into account.

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