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Does Acute Aortic Dissection Display Seasonal Variation?

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ABSTRACT

Background: The relation between cardiovascular diseases and the seasons is well known; however, only a few reports have addressed the seasonal aspects of acute aortic dissections. We investigated whether presentation of acute aortic dissection has monthly/seasonal variations.

Methods: From February 1985 to January 2006, 165 consecutive patients with aortic dissection admitted to our institution were reviewed. During this period, regional monthly atmospheric pressure data were supplied by the state's meteorological service. The mean and SD of atmospheric pressure data were analyzed statistically.

Results: The frequency of acute aortic dissection was found to be significantly higher during winter versus other seasons (P = .041). A relatively high positive correlation was found between the incidence of acute aortic dissection and the mean atmospheric pressure (P = .037). The study confirmed monthly variation with a peak in January. In winter, the frequency of acute aortic dissection was higher in male than in female patients.

Conclusions: This study demonstrates that the occurrence of acute aortic dissection has significant seasonal/monthly variations. Thus, these observations may be a guide for prevention of acute aortic dissections by structuring treatment approaches with consideration given to the times of the year that patients are most vulnerable.

INTRODUCTION

Many cardiovascular conditions, such as acute myocardial infarction [Kono 1996], supraventricular tachycardia [Manfredini 1995], stable angina [Taylor 1989], cerebrovascular accidents [Manfredini 1997], and spontaneous rupture of abdominal aortic aneurysm (AAA) [Manfredini 1999] have been reported to display a rhythmic variation. Little additional evidence from the literature, however, indicates that acute aortic dissection (AAD) of the ascending aorta would be subject to cyclic variations throughout the year, although daily clinical practice suggests such seasonal variability in the occurrence of aortic dissection [Mehta 2002; Repanos 2005; Lasica 2006]. Therefore, we analyzed patients who were admitted to our institution with AAD to examine whether there was any association between atmospheric pressure and the presentation of aortic dissection.

MATERIALS AND METHODS

We analyzed all 165 patients who underwent aortic repair for AAD between 1985 and January 2006 at Kosuyolu Heart and Research Hospital. All relevant data were gathered from the hospital records. Only patients from Istanbul, the city where our hospital is located, were included in the analysis. Atmospheric pressure data recorded from a nearby regional weather station for this time period were obtained from the state's meteorological service. For each month in the study period, based on 24-hourly readings, the mean sea-level atmospheric pressure (in millibars), the minimum pressure, and the maximum pressure were provided. AAD was defined as a dissection presenting within 14 days of onset of initial pain. The time of symptom onset of the AAD was as noted on the data-entry forms. Precise time of symptom onset was available from hospital records for almost all patients. These patients with precise time data were included in the analysis evaluating monthly and seasonal rhythmicity. For this analysis the date of symptom onset was taken into account, rather than the hospital admission date. All patients were categorized into groups based on twelve 1-month periods. For the purpose of seasonal analysis, patients were divided into 4 groups according to the season during which symptom onset occurred (spring, summer, autumn, or winter).

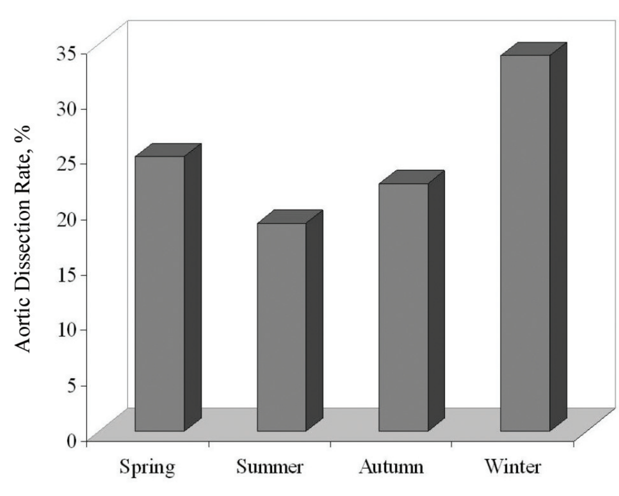

Figure 1. The rates of acute aortic dissection admitted by season.

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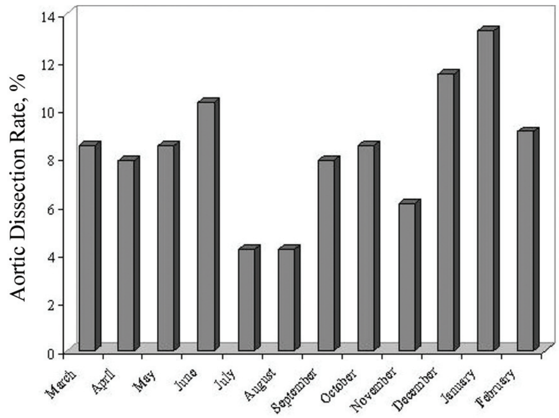

Figure 2. The rates of acute aortic dissection by month.

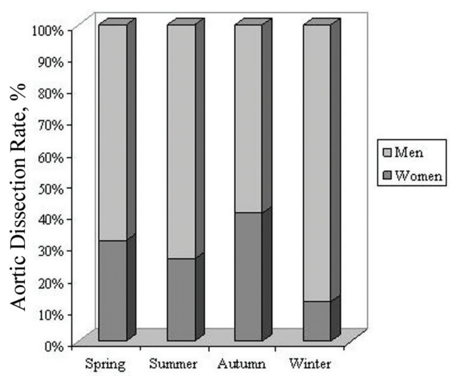

Figure 3. Frequency of acute aortic dissection in male versus female patients during the seasons.

All statistical analyses were carried out by using the commercial statistics software SPSS 15.0. Descriptive statistics were presented as mean (±SD) and frequency distribution. Quantitative data showing normal distribution (seasonal atmospheric pressures) among groups were compared using 1-way ANOVA test with post-hoc Tukey's HDS test. Qualitative data were compared using the χ^2 test. Monthly and seasonal incidence of AAD and mean atmospheric pressure were compared by using Pearson and Spearman correlation tests. Statistical significance was expressed as $P < .05$ within a confidence interval of 95%.

RESULTS

A total of 165 patients met the inclusion criteria, of whom 74% were male and 26% were female. Mean age was 51.9 years, ranging from 18 to 80 years.

A statistically significant seasonal variation occurred in the frequency of aortic dissections ($P = .041$), with the highest frequency during winter (33.9%) (Figure 1). The peak month of admission for AAD was January (13.3%), and the lowest number of admissions was during July and August (4.2% for both) (Figure 2). In winter, the frequency of aortic dissection in men was statistically greater than that observed in women ($P = .018$) (Figure 3).

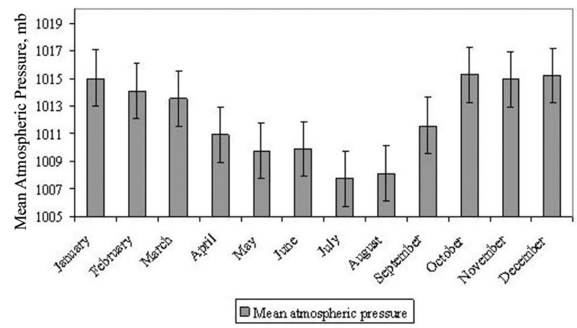

Figure 4. Mean atmospheric pressures (in millibars [mb]) of each month.

Almost 39% of the patients had an aneurysm pattern. Incidence of AAD with respect to presence of aneurysm did not differ among the seasons ($P > .05$).

In our study, a relatively high positive correlation was found between the incidence of AAD and the mean atmospheric pressure (Pearson coefficient, $r = 0.605$; $P = .037$). An increased incidence of AAD was observed during the months with higher atmospheric pressures (Figure 4).

For the AAD cases with aneurysm patterns, a weak correlation was found between the incidence of monthly AAD and low mean atmospheric pressure, but this finding was not statistically significant (Pearson coefficient, $r = –0.114$; $P = .724$). Likewise, for these patients, there was a moderate correlation between the incidence of seasonal AAD and low mean atmospheric pressure, but it was not statistically significant (Spearman's coefficient, $r = –0.447$; $P = .553$).

DISCUSSION

In our study the most significant result showed a seasonal increase in the rate of aortic dissections in winter, particularly in men. Several investigators have demonstrated that there is an increased incidence of acute aortic tears during the winter months. The study by Sumiyoshi et al found a winter peak, with a trough in summer, and monthly distribution showed a higher frequency of cases in December, January, and March [Sumiyoshi 2002]. Likewise, in the present study the highest frequency was seen in January. A chronobiological study by the International Registry of Acute Aortic Dissection Investigators confirmed the seasonal variation, with a higher frequency of events in winter, peaking in January, and a trough in summer [Mehta 2002]. Kobza et al found the same seasonal pattern in occurrence of acute aortic type A dissections [Kobza 2002]. Additionally, the same seasonal variation has been noted in several studies for ruptured AAA), with an increase in incidence in winter [Sterpetti 1995; Ballaro 1998]. In 1 study the rupture of AAA was found to be correlated with the mean atmospheric pressure. In that study, Bown and coworkers observed that low atmospheric pressure was associated with increased rate of AAA rupture [Bown 2003]. In contrast to this study, we did not find any statistically significant correlation between mean atmospheric pressure and the incidence of seasonal AAD in patients with aneurysms. However, there have also been reports of modest correlations between high atmospheric pressure and the risk of rupture of subarachnoid aneurysms [Buxton 2001] and spontaneous cervical artery dissection [Schievink 1998]. Similar to those studies, we have observed a significantly increased incidence of AAD through the winter months, which have higher atmospheric pressures than those of other seasons.

Seasonal changes in blood pressure have been documented [Minami 1996], but no relationship between atmospheric pressure and blood pressure has been reported. The only physiological parameter positively associated with atmospheric pressure is arterial blood gas concentrations [Burnett 1989]. Based on this knowledge, it can be speculated that reduced arterial oxygen tension may cause rupture of aortic aneurysms.

Pathophysiologically, many studies have shown that seasonal variations, especially during the winter months, might be due to several mechanisms such as cold exposure determining increased sympathetic activity [Hata 1982], blood pressure [Kunes 1991], increased platelet count and volume, red blood cell count, blood viscosity [Keatinge 1984], and clotting activity [Bull 1979]. In addition, fibrinogen levels demonstrate wide seasonal variation, increasing up to 23% during the colder months [Woodhouse 1994]. Furthermore, hypertensive effects of low temperatures are well known; an increase in arterial pressure during mild surface cooling has been reported [Kunes 1991]. Peripheral vasoconstriction might lead to an increase in systolic blood pressure rather than diastolic pressure; thus, pulse amplitude is generally increased. This phenomenon enhances the forces that act to produce wall deformation, and increases friction and shear stress on the internal surface that might result in arterial dissection or rupture of the aorta [Wilmshurst 1994].

In our study, subgroup analysis suggested that monthly/seasonal patterns were more evident in hypertensive patients and in male patients, but not among normotensive and female patients. These data indicate that this monthly/seasonal variation has a more complex effect on the development of AAD.

The main limitation of this study was that only patients who had surgery were included, not others who either did not survive long enough to have surgery or who were managed without surgery.

We conclude that like many other cardiovascular conditions, AAD exhibits a significant monthly/seasonal variation in its frequency of occurrence. This study also demonstrates that hypertensive and male patients are at higher risk of aortic rupture in winter. The present study may have implications for tailoring medical treatment to ensure maximal benefit during these particularly vulnerable time periods.

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