Research Article

Meteorological Impact on the Incidence of Acute Aortic Dissection

Abstract

Objectives: There is still much controversy about whether meteorological conditions influence the occurrence of acute aortic dissection (AAD). The aim of the present study is to investigate the possible correlation between atmospheric pressure, temperature, lunar cycle and the event of aortic dissection in our patient population.

Methods: The clinical data of 348 AAD patients (73% Stanford A) were confronted with the meteorological data provided by the Cologne weather station over the same period.

Results: There were no statistically significant differences between meteorological parameters on days of AAD events compared to control days. Logistic regression model showed that air pressure (OR 1.004, 95% CI 0.991-1.017, p=0.542), air temperature (OR 0.978, 95% CI 0.949-1.008, p=0.145), season (p=0.918) and month of the event (p=0.175) as well as full moon (OR 1.579, 95% CI 0.763-3.270, p=0.219) were not able to predict AAD events. Also, no predictive power of meteorological data and season was found analyzing their impact on different types of AAD events.

Conclusion: Our study could not reveal any dependence of atmospheric pressure, air temperature or the presence of full moon on the incidence of different types of acute aortic dissection.

Introduction

Acute aortic dissection (AAD) is a medical emergency and should be treated as soon as possible. The International Registry of Acute Aortic Dissection (IRAD) reported at 2015 a total mortality of 24.4% in type A dissection and 10.7% in type B dissection [1]. Some studies reported a relationship between meteorological factors and AAD [2-6]. Nevertheless, the results of the studies are different and one study didn’t find any relationship between weather condition and acute aortic dissection [7]. The aim of the present study is to investigate the possible correlation between atmospheric pressure, temperature, lunar cycle and the event of aortic dissection.

Materials and Methods

The study design was a retrospective review of prospectively collected data. The Institutional Review Board of Cologne University approved this study and waived the need for individual patient consent. Cologne, located in Germany, has its highest point at 118m and lowest point at 37.5m above sea level. The needed meteorological information was extracted from the Cologne weather station. All consecutive patients admitted to our institution with the diagnosis of an acute aortic dissection Stanford A and B during the time period from January 2006 to July 2015 were included and analyzed with regard to chronobiological variations in the timing of occurrence of aortic dissections. Meteorological data, such as air pressure and air temperature, seasonal differences as well as the presence of full moon were documented for each day within the study period and evaluated for potential predictive power of clinical events of interest. A total of 3499 days were analyzed in terms of association of meteorological and seasonal factors with the incidence of AAD. Along with the analysis of AAD in general, subgroup analyzes of Stanford A and Stanford B AAD was performed in order to evaluate potential influence of factors of interest on various types of dissections.

Statistical analysis

All data were analyzed using IBM SPSS Statistics for Windows, Version 21 (IBM Corp. Released 2012, Armonk, NY: IBM Corp) and are presented as continuous or categorical variables. Continuous data were evaluated for normality using one sample Kolmogorov-Smirnov-test and confirmed by histograms. Continuous variables were expressed as the mean ± standard deviation in cases of normally distributed variables or median (interquartile range) in cases of non-normally distributed variables. Categorical variables are presented as total numbers and percentages. Continuous data potentially associated with clinical events of interest were analyzed using unpaired Student t-test for normally distributed variables and Mann Whitney U-test for non-normally distributed variables. Pearson’s χ² or Fisher exact tests were used for categorical data dependent on the minimum expected count in each cross tab. Binary logistic regression model was applied for analysis of potential predictors of clinical events of interest. P values <0.05 were considered statistically significant.

Results

A total of 348 patients diagnosed with an AAD were admitted during the time period from January 2006 to July 2015 to our institution. Of them, 255 had Stanford A AAD whereas 87 were diagnosed with Stanford B AAD. Table 1 shows the seasonal and monthly distribution of AAD events.

In the univariate analysis, there were no statistically significant differences between meteorological parameters on days of AAD events...
compared to control days. Air temperature (10.20±6.67 vs. 10.80±6.89 °C, p=0.124) and air pressure (1004.28±8.27 vs. 1003.95±8.86 mmHg, p=0.512) were equally distributed between days of AAD events and control days. Also, there were no statistically significant differences in terms of the distribution of months (p=0.171) and seasons (p=0.753) between days on which AAD occurred and control days. The presence of full moon did also not influence the incidence of AAD while full moon was present on 2.3% (n=8) vs. 3.5% (n=111) of event vs. control days (p=0.232). Logistic regression model showed that air pressure (OR 1.004, 95% CI 0.991-1.017, p=0.542), air temperature (OR 0.978, 95% CI 0.949-1.008, p=0.145), season (p=0.918) and month of the event (p=0.175) as well as full moon (OR 1.579, 95% CI 0.763-3.270, p=0.219) were not able to predict AAD events.

Figure 1 and 2 demonstrate the seasonal and monthly event of ADD and means atmospheric pressure during the study period.

Also, no predictive power of meteorological data and season was found analyzing their impact on different types of AAD events.

An analysis of the subgroup of Stanford A dissection did also not reveal any dependence on meteorological factors and seasonal changes. In the univariate analysis, there were no statistically significant differences between meteorological parameters on days of Stanford A AAD events compared to control days. Air temperature (10.26±6.70 vs. 10.77±6.88 °C, p=0.248) and air pressure (1004.47±8.02 vs. 1003.95±8.86 mmHg, p=0.354) were similarly distributed between days of Stanford A AAD events and control days. Also, there were no statistically significant differences in terms of the distribution of months (p=0.135) and seasons (p=0.398) between days on which Stanford A AAD occurred and control days. The presence of full moon did not influence the incidence of AAD while full moon was present on 1.9% (n=5) vs. 3.5% (n=114) of event vs. control days (p=0.169). Logistic regression model showed that air pressure (OR 1.007, 95% CI 0.993-1.022, p=0.329), air temperature (OR 0.985, 95% CI 0.953-1.018, p=0.398), season (p=0.956) and month of the event (p=0.160) as well as full moon (OR 1.895, 95% CI 0.766-4.690, p=0.167) were not able to predict Stanford A AAD events.

An analysis of the subgroup of Stanford B AAD showed that this event could also not be predicted by or was associated with meteorological factors, season or month of event occurrence. In the univariate analysis, there were no statistically significant differences between meteorological parameters on days of Stanford B AAD events compared to control days. Air temperature (10.00±6.60 vs. 10.75±6.87 °C, p=0.312) and air pressure (1003.70±9.00 vs. 1003.91±8.80 mmHg, p=0.761) were equally distributed between days of Stanford B AAD events and control days. Also, there were no statistically significant differences in terms of the distribution of months (p=0.121) and seasons (p=0.489) between days on which AAD occurred and control days. The presence of full moon did not influence the incidence of AAD while fool moon was present on 3.4% (n=3) vs. 3.4% (n=116) of event vs. control days (p=1.000). Logistic regression model showed that air pressure (OR 0.995, 95% CI 0.971-1.018, p=0.654), air temperature (OR 0.960, 95% CI 0.907-1.018, p=0.170), season (p=0.577) and month of the event (p=0.190) as well as full moon (OR 1.016, 95% CI 0.315-3.275, p=0.979) were not able to predict Stanford B AAD events.

Table 1: Seasonal and monthly distribution of AAD.

<table>
<thead>
<tr>
<th>Season</th>
<th>AAD</th>
<th>AAD A</th>
<th>AAD B</th>
</tr>
</thead>
<tbody>
<tr>
<td>December</td>
<td>28 (8.0%)</td>
<td>20 (7.7%)</td>
<td>8 (9.2%)</td>
</tr>
<tr>
<td>January</td>
<td>30 (8.6%)</td>
<td>28 (10.7%)</td>
<td>2 (2.3%)</td>
</tr>
<tr>
<td>February</td>
<td>32 (9.2%)</td>
<td>21 (8.0%)</td>
<td>11 (12.6%)</td>
</tr>
<tr>
<td>March</td>
<td>26 (7.5%)</td>
<td>15 (5.7%)</td>
<td>11 (12.6%)</td>
</tr>
<tr>
<td>April</td>
<td>34 (9.8%)</td>
<td>26 (10.0%)</td>
<td>8 (9.2%)</td>
</tr>
<tr>
<td>May</td>
<td>34 (9.8%)</td>
<td>25 (9.6%)</td>
<td>9 (10.3%)</td>
</tr>
<tr>
<td>June</td>
<td>33 (9.5%)</td>
<td>27 (10.3%)</td>
<td>8 (9.2%)</td>
</tr>
<tr>
<td>July</td>
<td>31 (8.9%)</td>
<td>16 (6.1%)</td>
<td>5 (5.7%)</td>
</tr>
<tr>
<td>August</td>
<td>26 (7.5%)</td>
<td>20 (7.7%)</td>
<td>8 (9.2%)</td>
</tr>
<tr>
<td>September</td>
<td>31 (8.9%)</td>
<td>19 (7.3%)</td>
<td>12 (13.8%)</td>
</tr>
<tr>
<td>October</td>
<td>17 (4.9%)</td>
<td>14 (5.4%)</td>
<td>3 (3.4%)</td>
</tr>
<tr>
<td>November</td>
<td>36 (10.3%)</td>
<td>30 (11.5%)</td>
<td>8 (9.2%)</td>
</tr>
</tbody>
</table>

Figure 1: Mean seasonal atmospheric pressure and acute aortic dissection.

Figure 2: Mean monthly atmospheric pressure and acute aortic dissection.
Discussion

The influence of weather on acute aortic dissection has been occasionally postulated in the past; is this assertion a reality or just a myth? The relationship between atmospheric pressure and rupture of abdominal aortic aneurysm is investigated and some authors have confirmed this thesis [6-10]. We can find only a few literatures about the influence of weather on acute aortic dissection. However, the few literatures show conflicting results with regard to the AAD and meteorological parameter.

Krdzalic et al., Rabus et al. [2,3], postulated the link between atmospheric pressure and AAD with statistically significance, but the final results of them are not congruent. Krdzalic reported that atmospheric changes (increasing or decreasing) have an influence on Incidence of AAD, but Rabus found a high positive correlation between AAD and increasing of atmospheric pressure. On the other hand Verberkmoes [4] did not find any correlation between atmospheric pressure and AAD, but he reported a correlation between cold weather and incidence of AAD. Also Benouaich [5], demonstrated a correlation between type A dissection and low atmospheric temperature and Law [6], reported that high atmospheric pressure and absence of thunderstorm warning were associated with increasing of ADD in univariant analysis, but the multiple regressions analysis showed that the lower the temperature, the higher the incidence of AAD. We can see, there are different results with respect to this topic.

In the present study, we did not find any statistically significant correlation between atmospheric pressure, ambient temperature, presence of full moon and the frequency of acute aortic dissection. This result is also congruent with the study of Repanos et al. [7].

The different study methods and different geographic zone make a comparison of reported results very difficult.

However, data on the correlation between atmospheric pressure and rate of AAD remain controversial. Currently the mechanism of how atmospheric pressure would influence the rate of dissection remains unclear.

Also, all mentioned studies including the present study, are retrospective and therefore the exact time of the event and the exact weather information at the moment remained unknown.

There are several limitations in our study that need to be considered. Firstly, this study is retrospective and this makes it difficult to determine the exact time of event. Thus, the temperature and air pressure can also not be accurately determined. Secondly, we included only the patients, who were admitted to our institution. A prospective multicenter study is necessary to capture more patients and the exact moment of the event as well as the exact weather changes.

In conclusion, we could not reveal any dependence of atmospheric pressure, air temperature or the presence of full moon on the incidence of different types of acute aortic dissection.

References