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Atmospheric Pressure Changes Are Associated with Type A Acute Aortic Dissections and Spontaneous Abdominal Aortic Aneurysm Rupture in Tuzla Canton

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ABSTRACT

Aim: The aim of this study was to investigate a relationship between seasonal variation and incidence of type A acute aortic dissection (AAD) and spontaneous abdominal aneurysm rupture (rAAA) in Canton Tuzla, Bosnia and Herzegovina. **Patients and methods:** A total of 81 cases, 41 AAD and 40 of ruptured AAA were identified from one center over a 6-year, from 2008 till 2013. In 2012 were admitted (45.6% or 36 patients). **Results:** Seasonal analysis showed that 19(23.4%) patients were admitted in spring, 15(18.5) in summer, 26(32%) in autumn and 21(25.9) in winter. The most frequent period was autumn/winter with 47 or 58% patients. A causal link between atmospheric pressure (AP) and incidence of rAAA and AAD on seasonal and monthly basis was found.

Key words: atmospheric pressure, type A acute aortic dissections, abdominal aortic aneurysm rupture.

1. INTRODUCTION

We studied atmospheric pressure influence on incidence of Atmospheric Pressure Changes (rAAA) and Acute Aortic Dissections (AAD) in Canton Tuzla, Bosnia and Herzegovina, and their seasonally and monthly distribution in six year period. Many studies suggested that periods of low atmospheric pressure increased risk of abdominal aortic aneurysm rupture (1). Low temperature and cold weather correlated with increased incidence of AAD and rAAA in Northern Ireland (2). Some studies have examined and described the effect of fluctuation in AP on daily, seasonal, monthly incidence of rAAA and AAD and their high mortality rates (3). The high incidence of postoperative mortality showed its importance, especially because low risk patients screening reduced rAAA specific mortality by 78% compared to 52% in the high risk group (4). Patients screening in period of atmospheric pressure and temperature changes and their follow up in period of expected increased incidence, should decrease high mortality incidence of those patients.

2. PATIENTS AND METHODS

We investigated a total of 40 cases of spontaneous rAAA and 41 cases AAD in Tuzla Canton, Bosnia and Herzegovina, in 6-year period retrospectively study from January 2008 to December 2013. The diagnosis was performed with CT scan. All patients underwent standard anesthesiological protocol with central vena cava catheter and arterial line for intensive monitoring. Tube replacement were performed in all patients underwent surgery. From all patients with AAD Bental procedure were performed in seven patients. Nine patients were under Deep Hypothermic Circulatory Arrest. Local meteorological data for this period, barometer pressure and temperature was recorded from Federal Hydro Meteorological Institute from Bosnia and Herzegovina. Mean value and SD of atmospheric pressure at the day of incidences were compared with 30 years average atmospheric pressure for the appropriate months. We analyzed seasonal and monthly distribution of those patients.

3. STATISTICAL ANALYSIS

The continues variables were expressed as mean ± standard deviation (SD). Non-parametric methods were used for all comparisons of meteorological parameters. Data were compared by the Wilcoxon signed -rank test so that value of $p<0.05$ was considered significant in all tests.

4. RESULTS

A total of 81 cases, 58 (71.6 %) male and 23 female (28.4%) were identified during study period. Twenty eight or 68.2% male and 13 (31.7) female had AAD. Ruptured AAA was diagnosed in 30 (75%) male and 10 (25%) female patients. 17 (20.9) patients were admitted with hemorrhagic shock signs. 27 (33.3%) patients died, 8 (19.5%) with AAD and 19 (47.5%) with rAAA. At time of surgery died 14 (17.3%) and 7 (8.6%) patients short time after surgery. Four patients with AAA and 2 patients with AAD died before surgery.

	2008	2009	2010	2011	2012	2013
Abdominal aortic aneurysm-rupture	4	2	5	11	14	4
Thoracic Aortic Aneurysm rupture	-	2	3	8	23	5

Table 1. Distribution of AAD and rAAA in six years period (2008-2013).

The most patients were admitted in 2011 (19 or 23.4%) and 2012 (36 or 45.6%).

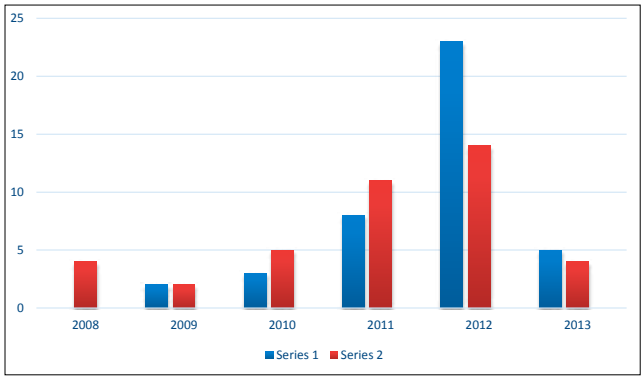

Figure 1. Series 1. Patients with AAD Series 2. Patients with rAAA

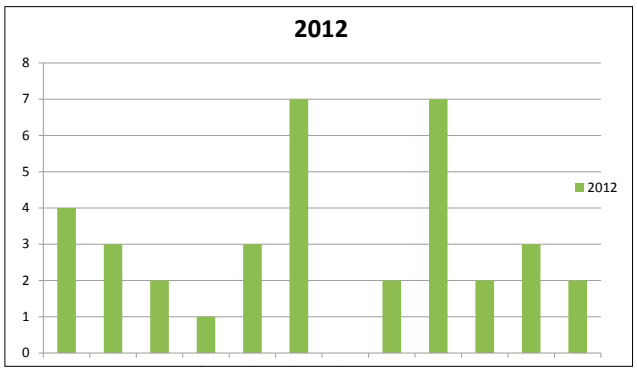

Figure 2. Seasonal distribution of rAAA and AAD in 2012.

Analysis of seasonally admissions showed that the most frequently periods were summer/autumn 2012. (Jun 8, September 7) and spring–autumn in 2011., (March 4, September 3 and November 4).

The most patients admissions were in January (11), Jun (11) and November (12).

In spring there were 19 (23.4%) in summer, 15 (18.5%), autumn 26 (32%) and in winter 21 (25.9%) patients admissions in hospital. Most frequent period was autumn/winter with 47 (58%9).

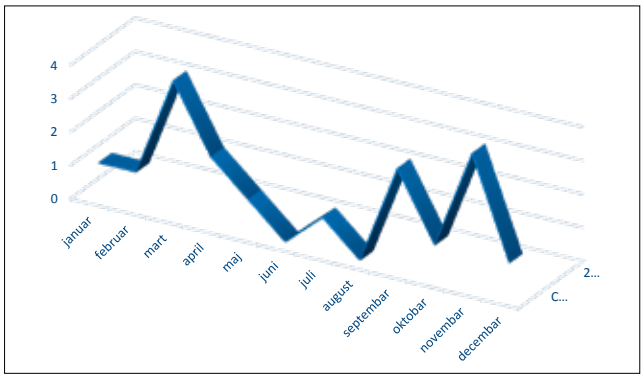

Figure 3. Seasonal distribution of rAAA and AAD in 2011.

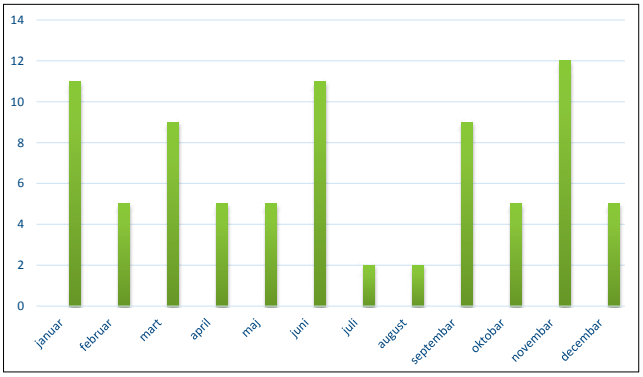

Figure 4. Six year monthly distribution of rAAA and AAD

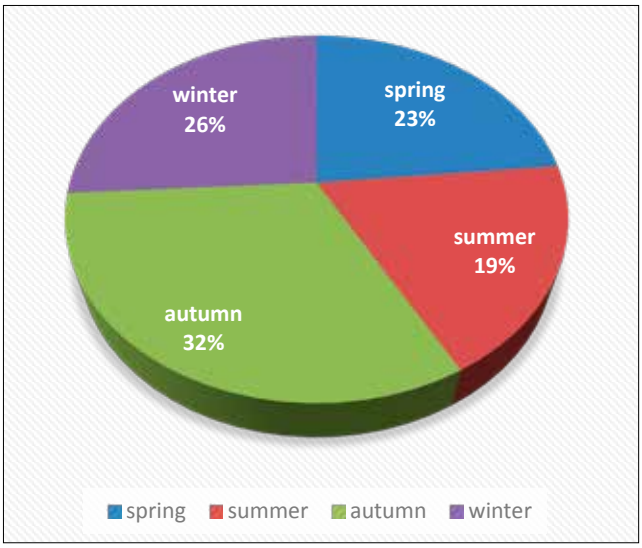

Image 5. – Seasonal patients distribution

Comparative analyses of barometric pressure mean values and SD between admitting day with 30 years average values for the appropriate months showed that atmospheric changes (increasing or decreasing) have influence on increasing incidence of rAAA an AAD with statistically significance for 2009, 2011 i 2012 year.

5. DISCUSSION

Several studies have reported the correlation between regional weather patterns and various vascular diseases (5). It is showed that arterial blood pressure is higher in winter than in summer, and in 1982 Brenan et al. concluded that the winter blood pressure increase could be observed in large samples of patients with high blood pressure, as well in treated as in untreated subgroups (6).

Harkin et al. reported that low atmospheric pressure is associated with high abdominal aneurysm rupture incidence (2). Rabus et al. founded in study about AAD statistically significance during winter months versus other seasons and positive correlation between incidence of AAD and mean atmospheric pressure as in our study where we found statistically significance between atmospheric pressures between days of incidents and 30 years average values for same data. On the other side Repanos et all. revived in their study that was unable to demonstrate any statistical significant relationship between atmospheric pressure, temperature and AAD. They also concluded that there have also been studies examining the incidence of other vascular disruptions with changing season and weather conditions, in one study a modest correlation was found between high atmospheric pressure, daily change in pressure and the risk of rupture of subarachnoid aneurysms and in another study demonstrated seasonal variation in spontaneous cervical artery dissection (7). Previous work has shown that the only physiological parameter positively associated with atmospheric pressure is arterial blood gas concentration. However the exact mechanism by which reduced arterial oxygen tension may cause rupture of an aneurysm of dissection remains unknown. The onset of labor is the only other medical change thought to be associated with falling atmospheric pressure (8).

It is interesting that the most of patients with AAD and rAAA are admitted in Clinical Center Tuzla, in 2012. (45.6%). According to the Federal Hydro-Meteorological Institute, the weather conditions in 2012 were extremely hot. That year had the highest temperature ever officially recording in 30 years period. Extremely changes were recorded in 2011 but not such extreme as in 2012 indeed. Increased incidences were verified in those two years in comparison with other years in period of 2008-2013(9). The mortality rate after rupture and dissection is high: about 80% of those who reach the hospital and 50% of those undergoing emergency surgery will die (10, 11). So the patients screening in periods with atmospheric changes in temperature and pressure and follow up in season when rAAA and AAD can be expected should decrease their incidence (12).

6. CONCLUSION

Suddenly atmospheric changes we suffered as result of global weather changes have influence on increasing rAAA and AAD with high mortality rate. High risk patients screening in period when incidents are expected should decreased mortality rate of these patients. We cannot change weather conditions, but we can follow up atmospheric change and try to decrease rAAA and AAD incidence in routine control of cardiovascular patients. It would be the aim of another long term investigation.

CONFLICT OF INTEREST: NONE DECLARED

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