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Research Article

Variation in weather patterns – a risk factor for hypertensive nasal bleeding

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Abstract. Introduction: Nasal bleeding - known as epistaxis - is one of the most common ENT emergencies. Epistaxis and hypertension are frequent conditions in the adult population, and their causal relationship is still under debate. Our study aims to evaluate the relationship between weather pattern variations – temperature and atmospheric pressure – , epistaxis and blood pressure. Material and Methods: The study included the review of the medical charts of patients with epistaxis that were medically or surgically treated in the ENT emergency room. Patients with epistaxis and hypertension were defined as patients with nasal bleeding and elevated blood pressure at presentation (> 140/80 mmHg), and the patients with diagnosis of essential hypertension and elevated blood pressure at presentation (>160/95 mmHg), who received antihypertensive medications. The data obtained from Cluj-Napoca meteorological station included the minimum and maximum temperature averages as well as the variations of atmospheric pressure on the days when patients with epistaxis presented to the emergency room. Results: During the study period, a total number of 299 adult patients were diagnosed with spontaneous epistaxis without an obvious cause of nasal bleeding. In 92 cases, the blood pressure was elevated within a range of values between 160/90 mmHg and 230/110 mmHg. We observed that the frequency of cases which presented to the emergency room for the association of nasal bleeding + blood pressure > 160/90 mmHg was higher on days when the weather warmed up and the atmospheric pressure increased, with a higher incidence during the cold periods of the year, but with the existence of this phenomenon even in the warmer months. Conclusions: The results of our study showed a positive correlation between the increase of atmospheric pressure and the frequency of nasal bleeding and high blood pressure values association. We also found a negative correlation between minimum/maximum temperature averages, spontaneous nasal bleeding and elevated blood pressure.

Key Words: epistaxis, blood pressure, temperature, atmospheric pressure.

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Introduction

Nasal bleeding - known as epistaxis - is one of the most common ENT emergencies, mostly assigned to coagulopathy, acute upper respiratory tract infections, intranasal pathology, allergic rhinitis, alcoholism, craniofacial trauma, and has also been correlated with environmental factors (Unsal et al 2019). Previous studies have highlighted a strong correlation between climate and the incidence of epistaxis, noting an increased frequency of epistaxis in winter months (Comelli et al 2015; Liu et al 2020). This is contrary to previously findings reported by Bray et al (2005) that do not support the idea of a relationship between epistaxis and temperature or seasonal variation.

Epistaxis is a cause of concern and requires appropriate treatment, especially in elderly patients or in ones with cardiovascular disease (Byun et al. 2020). Epistaxis and hypertension are frequent conditions in the adult population, and their causal relationship is fiercely debated between cardiology and ENT specialists. Sarhan and Algamal (2015) found no definite association between epistaxis and hypertension, but they concluded that epistaxis is much more difficult to control in hypertensive patients.

The seasonal influence on the arterial blood pressure has been demonstrated by various studies based on single or repeated measurements among adults, the elderly, and children, as well as in healthy and hypertensive subjects (Fares 2013). Both systolic and diastolic mean blood pressures show a seasonal peak during winter and a minimum in summer. Several possible reasons for the seasonality of hypertension could be external temperature, physical activity, seasonal variation in noradrenalin, catecholamine and vasopressin, vitamin D, and serum cholesterol. Our study aims to evaluate the relationship between weather pattern variations – temperature and atmospheric pressure –, epistaxis and blood pressure.

Material and methods

This retrospective cross-sectional study was conducted in the ENT Department of Emergency County Hospital between the 10th of February to the 31st of December 2020 with the agreement of the ethics committee of our institution. The study included the review of the medical charts of patients with epistaxis that were treated medically or surgically in the ENT emergency room.

All cases of spontaneous epistaxis that occurred during the study period were included. The exclusion criteria included the obvious causes of the nasal bleeding such as iatrogenic, craniofacial, or nasal trauma, sinonasal tumors, septum perforations, sinonasal surgery, coagulation disorders (including anticoagulant medication). Patients with epistaxis and hypertension were defined as those patients with nasal bleeding and elevated blood pressure at presentation (> 140/80 mmHg), and the patients with diagnosis of essential hypertension and elevated blood pressure at presentation (>160/95 mmHg), who received antihypertensive medications. Epistaxis management was assessed by reviewing the procedure codes of cauterization, anterior nasal packing, posterior nasal packing, arterial ligation, or endoscopic arterial cauterization.

The data obtained from Cluj-Napoca meteorological station (location: 46.783 degrees latitude, 23.567 degrees longitude, and height, 413m above sea level) included the minimum and maximum temperature averages and the variations of atmospheric pressure on the days when patients with epistaxis presented to the emergency room. The climate is considered typical of southeastern Europe; the summer is hot, with peak temperatures that range from 29 to 350C, whereas the winter is cold, with minimum temperatures that range from 0 to -180C.

Statistical analysis was carried out using the MedCalc® Statistical Software version 20.014 (MedCalc Software Ltd, Ostend, Belgium; https://www.medcalc.org; 2021). Data was tested for normality of distribution and was expressed as median and 25-75 percentiles. Comparisons between groups was tested using the Mann-Whitney test. Correlations between variables were tested using the Spearman's rho. The independent association between variables and number of epistaxis cases was established by multiple linear regression, after logarithmic transformation. A p-value <.05 was considered statistically significant.

Results

During the study period, a total number of 299 adult patients were diagnosed with spontaneous epistaxis without an obvious cause of nasal bleeding. In 92 cases, the blood pressure was elevated within a range from 160/90 mmHg to 230/110 mmHg. The presence of arterial hypertension was associated with a higher number of epistaxis cases (2 (1; 3) vs. 1 (1; 2); p<0.001). The demographic characteristics of the study population are shown in Table 1.

Most patients presented with no active bleeding during the first consultation (47.15%). In 248 cases, localized nasal bleeding was found and the most frequent one (71.23%) was the anterior epistaxis. Only 12% of all patients required a new examination for recurrence, and only 26 patients required hospitalization (Table 2).

During the study period, the month with the highest frequency of epistaxis cases was March with 52 cases (17.4%), as shown in Figure 1. Seventy-two cases of epistaxis associated with elevated blood pressure occurred during the coldest months of the year. There were weak negative correlations between the number of epistaxis cases and the minimal and maximal temperature (Table 3).

The presence of arterial hypertension was independently associated with a higher amount of epistaxis. Minimal temperatures were independently associated with lower frequency of epistaxis (Table 4).

Table 1. Demographic characteristics

Characteristics	Spontaneous epistaxis (n = 299)	Associated hypertension (n = 92)
Male	178 (59.53%)	54 (58.69%)
Female	121 (40.47%)	38 (41.31%)
Age	50.23 ± 16.62	45.5 ± 15.23

Table 2. Characteristics of the nasal bleeding

Variable	N (%)
Severity of bleeding:	
Absent	141 (47.15)
Moderate	137 (45.81)
Severe	21 (7.04)
Localization	
Localized	248 (82.94)
Diffuse	51 (17.06)
Topography	
Anterior	213 (71.23)
Posterior	32 (10.71)
Undetermined	54 (18.06)

Table 3. Correlations for the frequency of epistaxis

Variables	r	p
Min temperature	-0.264	**<0.001**
Max temperature	-0.231	**0.002**
Air pressure	-0.038	0.613

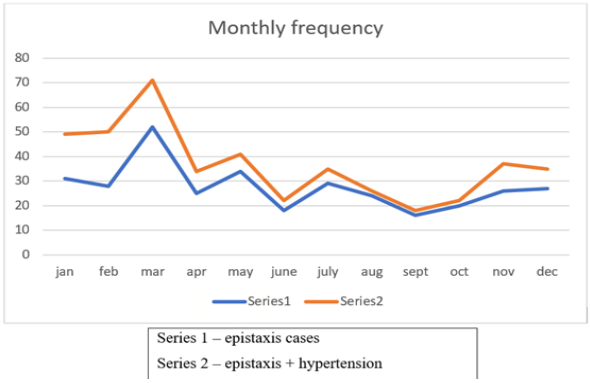

Fig. 1. The monthly frequency of epistaxis cases

Discussions

Epistaxis and elevated blood pressure are frequent problems that occur in patients presenting in the emergency department. The association between hypertension and epistaxis is controversially discussed in literature. Knopfholz et al (2009) published a well-designed study evaluating the incidence of epistaxis in

Table. 4. Multivariate analysis for number of epistaxis

Variables	Unstandardized Coefficients	t	P	95.0% CI for B	
	B			Min	Max
(Constant)	0.228	4.47	<0.001	0.127	0.329
Arterial hypertension	0.133	3.32	0.001	0.054	0.213
Min temperature	-0.128	-2.492	0.014	-0.229	-0.026

hypertensive patients according to stages of hypertension and compared the blood pressure readings in these episodes to routine readings. No difference in the incidence of epistaxis was found; the average systolic blood pressure for all 36 patients was 154 ± 19 mmHg on routine readings and 157 ± 22 mmHg on epistaxis episodes. No difference was neither observed regarding diastolic blood pressure: 104 ± 18 mmHg vs 105 ± 18 mmHg. They conclude that the epistaxis incidence in hypertensive patients is not associated with the severity of hypertension. However, there is some evidence from a postmortem study that hypertension can lead to nasal vascular damage. Patients with epistaxis and history of hypertension have their nasal cavity arteries more severely injured (degenerative fibrous changes in the tunica media) than those with epistaxis but no hypertension (Middleton 2004).

Multiple studies have related hypertension to nosebleeds (Herkner et al 2006, Kikidis et al 2014, Acar et al 2017, Byun et al 2020). A Korean retrospective study (Byun et al 2020) used national health insurance data to compare two cohorts of patients: one with drug-treated hypertension and one without hypertension. Each cohort comprised ≈36,000 patients who were matched by age, sex, socioeconomic status, and chronic diseases. During a median follow-up of 5.5 years, the incidence rates for epistaxis were significantly higher in the hypertension group than in the control group (33 vs 23 per 10,000 people). About 13% of patients with epistaxis in the hypertension group sought care in an emergency department compared with 5% in the control group. More patients with epistaxis in the hypertension group than in the control group required posterior nasal packing (1.9% vs 0.4%). Herkner et al (2006) concluded that further management of patients with epistaxis and high blood pressure should include confirmation or exclusion of sustained arterial hypertension by 24-hour ambulatory blood pressure recording. Acar and his collab (2017) demonstrated an increased masked hypertension prevalence in patients with epistaxis. They suggested that all patients with epistaxis should undergo ambulatory or home blood pressure measurements to detect masked hypertension, which could be a possible cause of epistaxis. In a systematic review, Kikidis et al. (Kikidis et al. 2014) pointed out that the presence of high arterial blood pressure during the actual episode of nasal bleeding cannot establish a causative relationship with epistaxis because of confounding stress and possible white coat phenomenon but may lead to the initial diagnosis of an already installed arterial hypertension. As we described in the results section, in our case series, 92 patients of 299 (30.76%) presenting nasal bleeding had a high blood pressure ranging from 160/90 mmHg to 230/110 mmHg.

Although the causal relationship between hypertension and epistaxis is still under debate, the influence of the environment on hypertension is unanimously accepted. Vencloviene et al (2015) aimed to assess the relationship between short-term variations in the meteorological and space weather conditions and the risk of daily emergency ambulance calls for elevated arterial blood pressure. According to their data, individuals over 65 years of age were more sensitive to heliophysical disturbances. This may be since there were more females among older patients. Older people were also more sensitive to low atmospheric pressure, somewhat more sensitive to changes in air temperature, and less sensitive to changes in wind speed. A more substantial influence of the air temperature and atmospheric pressure was observed on the rate of cardiovascular events and the number of daily emergency calls in this population. Seven years later, Vencloviene et al (2020) published new data about associations between quasi-biennial oscillation phase, solar wind, geomagnetic activity, and the incidence of acute myocardial infarction on a large database of 13,629 events. They found higher blood pressure values in hypertensive patients on cyclonic days than in anticyclonic days with a strong impact during the cold months of the years. Based on repeated blood pressure measurements in Suzhou, Xu et al (2019) found that temperature imparts a very short-term effect on the blood pressure. Their results indicate the need of timely protective measures within a few hours to prevent the risk of an increase in blood pressure as cold waves or cold weather moves in.

In our cross-sectional study we observed that the frequency of cases that presented to the emergency room for the association of nasal bleeding + blood pressure > 160/90 mmHg was higher on days when the weather warmed up and the atmospheric pressure increased, with a higher incidence during the cold periods of the year but with the existence of this phenomenon even in the warmer months. Neither very high (>30^{0}C) or very low temperatures (< -10^{0}C) caused more presentations of nasal bleeding associated with high blood pressure values but the warming of the weather and the increas of atmospheric pressure. Blood pressure values above 200/110 mm Hg were recorded in cyclonic days and predominantly in cold seasons. Our results are also consistent with numerous studies that support the influence of temperature on the incidence of epistaxis during the cooler months, with a negative statistically significant correlation between the daily number of epistaxis and the mean daily temperature (Sowerby et al 2014, Magussi-Gomes et al 2016, McMullin et al 2019).

Because our study is a retrospective one based on chart review, it has limitations: it is a single-center study, which limits its external validity, but the data shown here is valuable and helps understanding the profile of spontaneous epistaxis and the correlation between spontaneous epistaxis and the assessed weather patterns.

Conclusions

The results of our study showed that high blood pressure values were independently associated with higher amount of nasal bleeding. We also found a negative correlation between minimum temperature averages, spontaneous nasal bleeding, and elevated blood pressure.

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