Original Article

Etiology and clinical characteristics of primary epistaxis

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Background: Primary epistaxis (rupture of nasal artery vessels) is a common emergency, but the related factors are still controversial. This study collected the data on primary epistaxis patients and healthy people undergoing a physical examination at the same center to explore and classify primary epistaxis by its characteristics.

Methods: Primary epistaxis was divided into septal epistaxis and non-septal epistaxis, and logistic regression was performed to determine the risk factors.

Results: In total, 196 cases of septal epistaxis and 127 cases of non-septal epistaxis, and the control group was 182 healthy subjects. There were significant differences in sex, drinking history, hypertension history and hyperlipidemia between the bleeding group and the control group, but no correlation with smoking, diabetes, cardiovascular and cerebrovascular events, or anticoagulant drug use. In the age group of 26–40 years it was related to alcohol consumption and hypertension, for those aged 41–55 years it was related to hypertension, in the age group of 56–70 years it was related to hypertension, high triglyceride and high apolipoprotein B levels, and no related factors were found in the age group >70 years. The risk factors for non-septal cases were increased low-density lipoprotein (LDL) [P=0.035; odds ratio (OR), 2.450; 95% confidence interval (CI): 1.067–5.624], male sex (P=0.002; OR, 3.136; 95% CI: 1.501–6.554), and younger age (P=0.000; OR, 0.941; 95%CI: 0.920–0.962). All patients with nosebleed underwent nasal endoscopy and the bleeding site was successfully located and treated with electrocoagulation. No further bleeding or serious complications occurred after 6 months of follow-up.

Conclusions: Primary epistaxis is more common in males and is related to alcohol consumption, hypertension, and hyperlipidemia. In the young age groups, male sex, and increased LDL were high risk factors for non-septal hemorrhage in winter and spring. Nasal endoscopy and electrocoagulation are safe and effective.

Keywords: Electrocoagulation; hemostasis; nasal endoscopy; primary epistaxis

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Introduction

What causes a ruptured nasal artery to epistaxis? Is it similar to primary cerebral hemorrhage? Primary intracerebral hemorrhage is most likely to occur in the Lenticulostriate arteries, because it is a branch of the middle cerebral artery, which is vertically separated from the artery with high pressure. With greater pressure, it is easy to form microaneurysms or occlusions and rupture and hemorrhage. In addition, hypertension promotes Lenticulostriate arteries atherosclerosis, and the rupture of atherosclerotic plaque can also be complicated by thrombosis. Therefore, the cause of nasal artery rupture is not clear, and we hope to combine nasal endoscopy and laboratory examination indicators to find the cause of nosebleed. According to statistics, about 60% of people will experience a nosebleed in their lifetime (1), but only one-tenth of them will see a doctor for this reason, because in most cases it is mucosal hemorrhage. Nasal packing still represents the first-line approach to epistaxis in most emergency room, the gelatin-thrombin matrix as the better material and high cost-effectiveness of the management of posterior epistaxis than ribbon gauze or the Rapid Rhino (2) although, at present, it appears that there is clear evidence in the literature to suggest that it is less effective than endoscopic electrocoagulation-based management of posterior epistaxis. In conclusion, cauterization should be the first-line approach for its high cost-effectiveness rate and low risk of complications. The object of this study was primary epistaxis, which is caused by rupture of the nasal artery, which does not include mucosal hemorrhage. Although epistaxis is relatively common, there are no systematic reports on its etiology and classification, so we explored various aspects to elucidate the characteristics of primary epistaxis and its risk factors. We present the following article in accordance with the STROBE reporting checklist (available at https://atm.amegroups.com/article/view/10.21037/atm-22-6590/rc).

Highlight box

Key findings

- Epistaxis was more common in men and were associated with hypertension, alcohol consumption, and dyslipidemia. Epistaxis was classified in this paper.

What is known and what is new?

- The occurrence of epistaxis may be related to hypertension, arteriosclerosis and so on, and no relationship with anticoagulant drugs.
- Through retrospective cohort studies, we found that epistaxis was divided into septal hemorrhage and non-septal hemorrhage at the location of root ruptured artery. It was found that non-septal hemorrhage was related to hypertension, autumn and winter seasons, and dyslipidemia.

What is the implication, and what should change now?

- It implicated that effective identification and intervention should be carried out for different populations with epistaxis, including the selection of emergency hemostasia methods and long-term management, especially the management of blood pressure, lipid and lifestyle, and the monitoring of atherosclerosis indicators.

Methods

We collected the 403 cases of epistaxis diagnosed and treated by Tianjin Huanhu Hospital from January 2020 to January 2021, including 323 patients with primary nasal hemorrhage with complete clinical data and follow-up 6 months, and the control group was 182 healthy subjects from the same center during the same period.

All patients treated by Department of Otolaryngology of Tianjin Huanhu Hospital were screened out, with complete laboratory examination data, complete general clinical data and complete follow-up.

Septal hemorrhage can be treated with nasal packing in the emergency department, but non-septal hemorrhage, which needs endoscopic operation due to its deep location, according to different treatment methods, nasal hemorrhage was divided into nasal septum (196 cases) and non-nasal septum (127 cases). Nasal septum hemorrhage included the Little's area, the posterior septum and the olfactory fissure area, and non-nasal septum hemorrhage included the lateral wall of the nasal cavity, the nasal roof and nasal floor. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013. The study was approved by ethics board of Tianjin Huanhu Hospital (No. 2023-001) and individual consent for this retrospective analysis was waived.

The risk factors included history of hypertension, diabetes, cardiovascular and cerebrovascular diseases, anticoagulant use, smoking and drinking, blood pressure, height and weight [body mass index (BMI)], and routine blood, coagulation, and biochemistry tests, and different seasons

Hypertension is characterized by an increase in systemic arterial blood pressure (systolic and/or diastolic) (systolic ≥140 mmHg, diastolic ≥90 mmHg), The normal range of serum cholesterol is 0–5.18 mmol/L, the normal range of triglycerides is 0.7–1.7 mmol/L, the normal range of

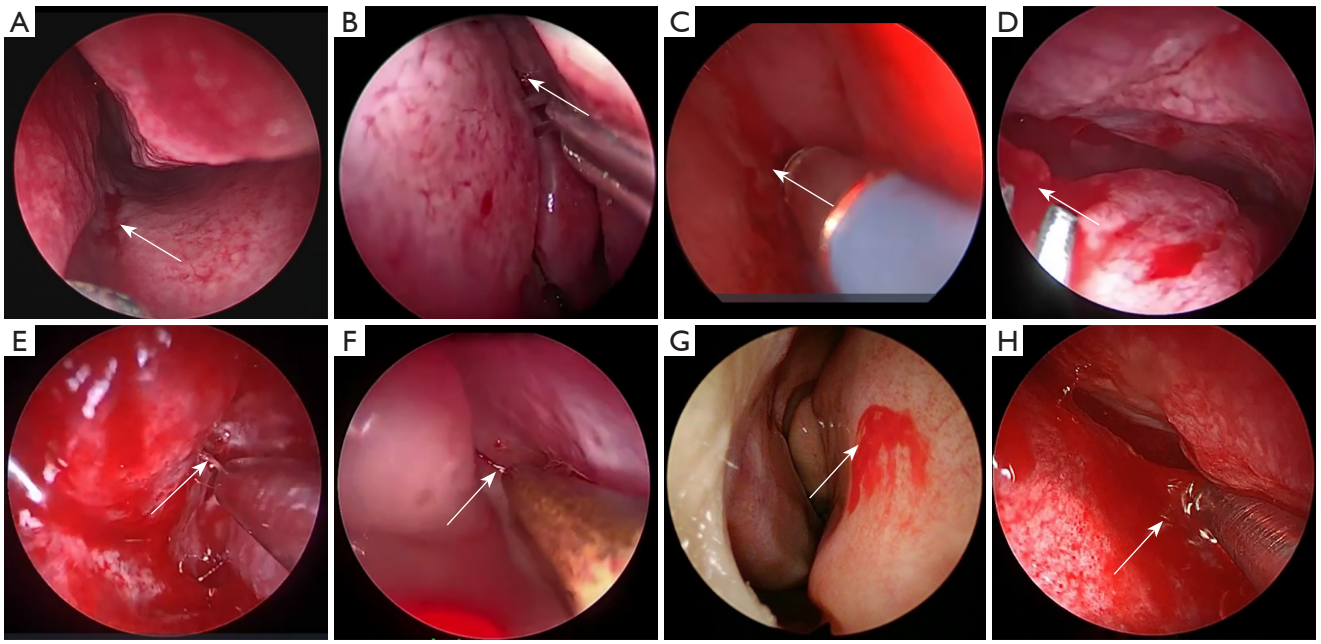

Figure 1 Location of non-septal nosebleed (arrows). (A) Left nasal floor; (B) right nasal roof; (C) posterior of right inferior meatus; (D) anterior of left inferior meatus; (E) right middle meatus; (F) upper edge of right inferior nasal concha. Septal hemorrhage: (G) right Little's area; (H) left olfactory cleft.

high-density lipoprotein (HDL) is 1.16–1.42 mmol/L, the normal range of low-density lipoprotein (LDL) is 0–4.47 mmol/L, and the normal range of apolipoprotein A1 is 1.2–1.8 mmol/L. Apolipoprotein B normal range 0.6 to 1.14 mmol/L. Normal BMI range: 18.5 to 23.9 kg/m^2.

As for the seasons, March, April, and May are spring, June, July, and August are summer, September, October, and November are autumn, and December, January, and February are winter.

Statistical analysis

SPSS 27.0 software was used for analysis. The independent sample *t*-test was used for measurement data, chi-square test was used for count data, and binary logistic regression analysis was performed. P<0.05 was considered statistically significant.

Results

All patients underwent nasal endoscopy and electrocoagulation hemostasis under local anesthesia. The hemorrhagic sites were examined in the following order: Little's area of the nasal septum, olfactory fissure, nasal roof, nasal floor, inferior meatus, and middle meatus, as well as according to the direction of blood flow. All hemorrhagic sites were successfully treated (*Figure 1A-1H*). No rebleeding or serious complications were found in the follow-up 6 months after the operation.

The epistaxis and control groups were divided into four age groups, and the differences of related indexes in each stage were compared. Nasal hemorrhage in the 26–40-year-old group was associated with drinking and hypertension, with P values of 0.011 and 0.000, respectively. For the 41–55-year-old, it was associated with hypertension, with a P value of 0.000, while in the 56–70-year-old epistaxis was associated with high triglyceride apolipoprotein B levels and hypertension, with P values of 0.000, 0.020, 0.003, respectively; no difference was found in the group aged over 70 years (*Table 1*).

According to the location of rupture (septal or non-septal), the independent sample *t*-test showed differences in BMI and age, with P values of 0.035 and 0.000, respectively. Chi-square test showed differences in season and sex, with P values of 0.009 and 0.000, respectively (*Table 2*). In binary logistic regression analysis, elevated LDL, male sex and younger age were risk factors for non-nasal septal hemorrhage (*Table 3*, *Figure 2*).

Table 1 Comparison between primary epistaxis and control group (different age groups)

Risk factors	26–40 years		41–55 years		56–70 years		>70 years	
	N	P value	N	P value	N	P value	N	P value
Smoking		0.114		0.967		0.660		0.994
Yes	55		50		51		20	
No	73		87		115		54	
Drinking		0.011		0.304		0.692		0.999
Yes	37		48		35		12	
No	91		89		131		62	
Diabetes		0.759		0.836		0.328		0.993
Yes	6		12		36		16	
No	122		125		130		58	
Hypertension		0.000		0.000		0.003		0.993
Yes	46		76		106		56	
No	82		61		60		18	
Cardiovascular and cerebrovascular events		1.000		0.998		0.512		0.296
Yes	1		11		46		29	
No	127		126		120		45	
Anticoagulant		0.860		0.999		0.595		0.994
Yes	65		10		22		25	
No	63		127		144		49	
Hypertriglyceridemia		0.056		0.434		0.000		0.993
Yes	56		55		68		18	
No	72		82		98		56	
Hypercholesterolemia		0.991		0.290		0.077		0.994
Yes	53		61		69		20	
No	75		76		97		54	
High LDL		0.801		0.829		0.307		0.998
Yes	50		54		65		19	
No	78		83		101		55	
Low HDL		0.506		0.224		0.925		0.998
Yes	94		90		98		48	
No	34		47		68		26	
Low ApoA1		0.307		0.583		0.637		0.998
Yes	46		45		41		21	
No	82		92		125		53	

Table 1 (*continued*)

Table 1 (*continued*)

Risk factors	26–40 years		41–55 years		56–70 years		>70 years	
	N	P value	N	P value	N	P value	N	P value
High ApoB		0.807		0.656		0.020		0.993
Yes	26		30		26		5	
No	102		107		140		69	
Sex		0.572		0.065		0.800		0.319
Male	110		97		91		47	
Female	18		40		75		27	
BMI (kg/m^2)	–	0.874	–	0.883	–	0.608	–	0.148

LDL, low-density lipoprotein; HDL, high-density lipoprotein; Apo, apolipoprotein; BMI, body mass index.

Table 2 Comparison of septal and non-septal bleeding groups

Risk factors	Septal bleeding group	Non-septal bleeding group	P value
Age (years)	61.33±13.74	49.11±13.80	0.000
BMI (kg/m^2)	26.14±4.00	27.08±3.71	0.035
Sex (male + female)	122+74	110+17	0.000
Season (winter spring + summer fall)	109+87	89+38	0.009

Data are expressed as mean ± standard deviation or n. BMI, body mass index.

Discussion

The main blood supply to the nasal cavity is the maxillary artery branch of the external carotid system, the sphenopalatine artery, the facial artery branch (nasal septum branch and turbinate branch) and ophthalmic artery branch of the internal carotid system anterior ethmoid and posterior ethmoid arteries (3). Therefore, primary epistaxis can be upper or lower nasal bleeding (4) and according to the site of the bleeding, it is divided into anterior and posterior; most cases are anterior bleeding in Little's area. Epistaxis in the posterior part of the nasal cavity only accounts for 5–10% of the total cases (5). By observing the direction of the blood vessels at the bleeding site, we found that in the front of the nasal cavity (i.e., the nasal septum) they are relatively flat, whereas the blood vessels at the meatus are located just at the turning point. We suspect that under the condition of high blood flow velocity, the blood vessels at the turning point would bear a relatively large centrifugal force and the impact of blood pressure on the blood vessel wall would be relatively large. Therefore, we classified primary epistaxis into flat nasal hemorrhage, namely nasal septum hemorrhage, and non-nasal septum hemorrhage. Kosugi *et al*. (6) defined the S point as the "axillary" protrusion located in the upper part of the nasal septum near the middle turbinate, and is a branch of the anterior ethmoid artery. Electrocoagulation and hemostasis can reduce the probability of rebleeding (7). The non-nasal septum was defined as the bleeding point around the bend of the nasal passage, including the lateral wall of the nasal cavity, the nasal floor and the nasal roof.

Based on these anatomical locations, we compared the two types of nosebleed and found statistical differences between the two groups in many aspects. We believe that because the non-nasal septal surface is curved, the centrifugal force of blood flow is larger. Vascular rupture here may be the result of fibrosis of the arterial middle layer caused by hypertension (8), or atherosclerosis (9), or a vascular malformation (10).

The main points of controversy in the management of epistaxis are whether it is related to hypertension, control of the bleeding, relationship to the use of anticoagulant drugs, anatomical abnormalities, temperature, and humidity, etc. In a meta-analysis (11), the relationship between

Table 3 Binary logistic analysis of related factors of the two types of epistaxis

Risk factors	P value	OR	95% CI	
			Lower	Upper
Smoking	0.742	0.896	0.466	1.724
Drinking	0.831	1.075	0.551	2.099
Diabetes	0.844	1.081	0.496	2.359
Cardiovascular and cerebrovascular events	0.517	0.749	0.314	1.791
Anticoagulant	0.071	2.413	0.926	6.290
Triglyceridemia	0.839	1.060	0.604	1.861
Cholesterolemia	0.519	0.766	0.340	1.723
LDL	0.035	2.450	1.067	5.624
HDL	0.389	1.336	0.691	2.582
ApoA1	0.221	0.672	0.355	1.271
ApoB	0.655	0.818	0.338	1.979
Sex	0.002	3.136	1.501	6.554
Hypertension	0.281	1.409	0.755	2.631
Age	0.000	0.941	0.920	0.962
BMI	0.814	0.991	0.917	1.070

OR, odds ratio; CI, confidence interval; LDL, low-density lipoprotein; HDL, high-density lipoprotein; Apo, apolipoprotein; BMI, body mass index.

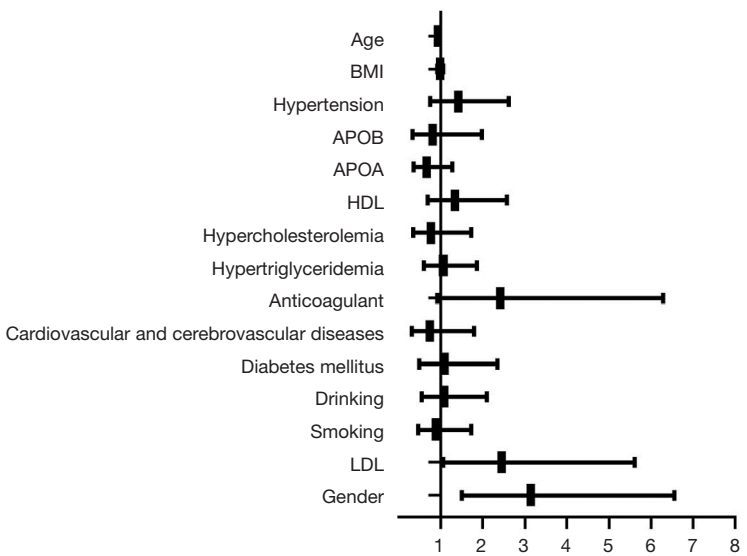

Figure 2 In the binary logistic regression analysis, high LDL, male sex, and younger age were risk factors for non-septal bleeding. BMI, body mass index; Apo, apolipoprotein; HDL, high-density lipoprotein; LDL, low-density lipoprotein.

nosebleed (including mucosal rupture) and hypertension was found to be controversial. Hypertension was considered as a risk factor for nosebleed, but it was not determined whether it was the cause, because bias caused by sex and age was not excluded (11). Nosebleed is believed to be the result of vascular injury caused by multiple factors (12). In addition to hypertension, this includes elevated blood lipids, especially LDL, grade III retinal arteriosclerosis, blood sugar levels, heart failure, obstructive sleep apnea/hypopnea syndrome, etc. (13). We compared primary nosebleed with a control group after age stratification to eliminate the influence of age on blood vessels, and found different risk factors for nosebleed at different ages. One study suggested nosebleed is associated with the use of anticoagulants, topical steroids, etc. (14), but those researchers included bleeding from the nasal mucosa rather than ruptured nasal blood vessels. Another study found that the incidence of nosebleed increased with increased use of oral anticoagulants, but the number of patients requiring hospitalization did not increase (15). We found that nosebleed was not related to the use of anticoagulants, smoking, diabetes, cardiovascular and cerebrovascular disease, which is consistent with study that has found nasal septum deviation and nasal septum perforation as causes of nasal bleed (16). We agree with that finding, although such patients were not included in this study. In our cases we believe that the vascular rupture was at front of the nasal septum, and the influence of air humidity and mechanical damage was more obvious. We also found that non-nasal septum hemorrhage usually occurs in winter and spring, when the temperature difference between indoor and outdoor areas is large in northern China, resulting in obvious contraction and relaxation of nasal blood vessels, resulting in dryness of nasal mucosa and increased risk of ruptured nasal blood vessels. Low temperature and dryness are risk factors for nasal bleeding (1,17).

The treatment of primary nosebleed includes tamponade, local application of drugs (18), microwave therapy (19), sphenopalatine artery ligation (20), and vascular interventional embolization (21). In our study, the vascular rupture site was located by nasal endoscopy and electrocoagulation and hemostasis were simultaneously applied. In all patients the outcome was very good, and there was no recurrence of bleeding within 6 months. We recommend nasal endoscopy as the first choice for treating primary nasal hemorrhage, but selection of a treatment plan can be done after identifying the bleeding site. The principle of treatment selection is that bleeding in the flat part of the nasal septum can be compressed with packing material, which should be removed 3 days after cessation of bleeding. Because the non-nasal septum is not flat it cannot be compressed tightly, requiring endoscopic electrocoagulation of the hemorrhagic points.

Conclusions

We found that the characteristics of primary nosebleed in different age populations are different, but the common factors are hypertension, hyperlipidemia, alcohol consumption and old age. We believe we are the first report to report classification of the two types of bleeding as nasal septal and non-nasal septal based on the location of blood vessels. Bleeding in these different locations has different causes. We found that young age, high BMI, male sex, increased LDL and winter and spring were risk factors for non-nasal septal bleeding in this cohort. However, our study also has some limitations, such as insufficient number of subjects and a single-center study.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://atm.amegroups.com/article/view/10.21037/atm-22-6590/rc

Data Sharing Statement: Available at https://atm.amegroups.com/article/view/10.21037/atm-22-6590/dss

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://atm.amegroups.com/article/view/10.21037/atm-22-6590/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was

conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by ethics board of Tianjin Huanhu Hospital (No. 2023-001) and individual consent for this retrospective analysis was waived.

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