

The effect of 2% citric acid in control of spontaneous epistaxis in Emergency Department

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Abstract: Introduction: Epistaxis is one of the most common causes of emergency department visits and almost 60% of the public have experienced it at least once in their lifetime. There are different methods for controlling the nasal bleeding. With due attention to the invasive and harmful features of most methods which makes them impossible to use in pre-hospital settings, the aim of this study is to prove that citric acid as a non-synthetic safe agent can be used in controlling the epistaxis. **Methods and materials:** In a randomized clinical trial, we studied 406 patients with chief complaint of epistaxis referring to the emergency department of Imam Reza Hospital of Tabriz from 2010 to 2011 in two groups of case and control. We used 5 drops of 2% citric acid in every nostril for patients in the case group and anterior nasal tampon in the control group. All data were recorded and finally, the appropriate statistical tests were used to compare and analyze them. **Results:** The mean age of patients was 53.94±14 years. 44.8% of patients were female and 55.2% of them were male. There was no significant difference between the controls of bleeding in two studied groups. **Conclusion:** Using both of anterior nasal tampon and 2% citric acid are effective in controlling spontaneous epistaxis and there is no significant difference between them; however, regarding the fact that citric acid or base substance of lemon juice is widely available, its usage is recommended.

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1. Introduction

Epistaxis is a common condition as well as a frequent otolaryngology emergency with up to 60% of people experiencing one episode in their lifetime. An estimated 7% to 14% of Americans experience a nosebleed each year. Some 10% of these groups seek medical attention, 10% of whom are ultimately referred to an otolaryngologist for further treatment (Bishop, 2003; Josephson, 1991; Shaw, 1993; Flint, 2010).

The main and most important function of “nose” is to warm up and moisturize the inspiratory airflow. For this purpose, nose has a rich vascular supply of both internal and external carotid arteries, making it vulnerable to episodes of bleeding, either spontaneously or as a result of localized trauma. Most of the time, the bleeding is mild and self-limited; although, it can be profuse and life threatening (Bernius and Perlin, 2006).

Cold and dry weather in autumn and winter is the cause of the high incidence of epistaxis in these seasons. Epistaxis is most common among males and in children, but it is more severe in adults. In previous studies, the age range for incidence of epistaxis has been reported to be below 10 years and above 50 years (Walker, 2007; Hussain, 2006; Nunez, 1999).

In our country, and especially in Tabriz city, HTN crisis is one of the most common causes of emergency visits and of its presentations, epistaxis can be mention. Although HTN is usually considered as a cause of epistaxis, studies have shown that the incidence of epistaxis in patients with HTN is equal to the base population (Theodosis, 2009; Knopfholz, 2009). There are studies that suggest HTN may be the cause of epistaxis (Isezuo, 2008; Hollingsworth, 1952; Charles and Corrigan, 1977).

There is a controversy over treatment of epistaxis in pre-hospital settings. Local application of an ice pack on the forehead or back of the neck, or sucking an ice cube has seen as a widespread practice, but it has been shown to have no statistically significant effects on nasal mucosal blood flow. There are conflicting opinions in the use of ice or nasal packing in the treatment of nose bleeds. Most suggest that using ice or nasal packing is not harmful when initial efforts to pinch the nose fail, while others advise against it (Teymoortash, 2003). The patients may be instructed to pinch the nostrils together for 5 to 30 nonstop minutes and to keep the head elevated but not hyper extended to avoid aspiration of the blood. Usually only 5 to 10 minutes is required to stop the bleeding. A piece of gauze soaked with a nasal decongestant spray, epinephrine at a ratio of 1:10,000, or phenylephrine and placed in

the affected nostril may also be helpful to induce localized vasoconstriction (Bernius and Perlin, 2006). If bleeding cannot be controlled with these simple measures, then transfer to an emergency department is required.

With due attention to the invasive and harmful features of most methods which make them impossible to use in pre-hospital settings, the aim of this study is to prove that citric acid as a non-synthetic safe agent can be used in controlling the epistaxis.

2. Material and Methods

In a randomized clinical trial, we studied 406 patients with chief complaint of epistaxis referring to the emergency department of Imam Reza Hospital of Tabriz from 2010 to 2011 divided randomly in two groups of case and control. Sample size was determined using the formula below:

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta} \right)^2 \times [P_1(1 - P_1) + P_2(1 - P_2)]}{(P_1 - P_2)^2}$$

For each patient, a form including demographic data, the cause of epistaxis and the initial vital signs and lab results was filled out.

We used 5 drops of 2% citric acid in every nostril for patients in the case group after cleaning the nostrils with gauze and BP and PR of the patients were checked 5 and 10 minutes after applying the solution. If the nasal bleeding did not stop in 5 minutes, another 5 drops was applied. If bleeding was not stopped after 10 minutes, standard treatment of epistaxis (anterior nasal tampon) was used. Patients were monitored for 24 hours in case rebleeding would occur.

In control group, the standard treatment of anterior nasal tampon was used and as of the case group, the BP and PR of the patients were recorded 5 and 10 minutes after the procedure.

All data were recorded using descriptive analysis (frequency, mean ...), and analyzed using SPSS statistic software to compare the two groups. In every statistical analysis, significance was determined at p value of less than 0.05.

Although 2% citric acid, the base substance of lemon juice, was attenuated, and is thoroughly self-used, a written consent was obtained from each patient and the principles of declaration of Helsinki were met.

3. Results

In this study, 406 patients visiting emergency department of a central hospital with complaint of epistaxis were studied (203 patients in the case group and 203 in the control group). The age

range in the case group was 12-79 years with mean of 53.94 ± 14.00 years of age. Significant difference was not found between mean age of patients in two groups ($P=0.155$) (Chart 1). 42.6% of patients were female and 57.4% were male. In the case group 2 patients had coagulation disorders as well as 4 patients in control group, who were excluded from the study. Mean of age, platelet, PT, PTT and INR of patients based on Diabetes Mellitus, Liver Disease, Hypertension and Cardiovascular Disease are shown in table 1 and 2.

35.8% of patients were hypertensive, and 14% had liver disease without affecting their coagulation tests. Diabetes mellitus had been diagnosed in 33.3% of the patients.

In the group receiving 2% citric acid for the treatment of epistaxis (case group), bleeding stopped in 61.7% of the cases five minutes after using citric acid. In the next 10 minutes, bleeding stopped in all except 6 patients. In the group receiving the standard treatment (anterior nasal tampon), in 63.8% of the patient the bleeding stopped in 5 minutes, and after 10 minutes only in 4 patients rebleeding occurred. Comparison between the two groups in terms of bleeding stoppage in 5 and 10 minutes after treatment, did not show any statistically significant difference ($P=0.25$, $P=0.175$).

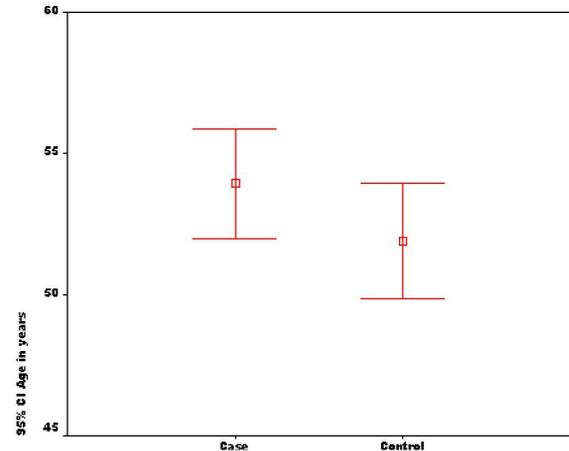


Chart 1. Distribution age of patients between two groups

Minimum platelet count was 150000 and maximum number obtained was 421000 (with the mean of 290630 ± 8450). Lowest PTT was 30 seconds and 98 seconds was the maximum rate with the mean values of 94.8 ± 78.40 seconds. INR range was variable between 1 and 2.5, with mean of 1.3 ± 0.30 . There was no significant difference in platelet count and INR in the two groups ($p=0.367$, $P=0.490$, $P=0.598$).

Mean systolic blood pressure and the mean diastolic blood pressure in our patients was 142.83 ± 25.04 and 81.26 ± 10.54 mmHg respectively. There was no significant differences between case and control groups in terms of systolic and diastolic blood pressure during the first visit ($P=0.990$, $P=0.740$).

Five minutes after applying 2% citric acid, in 3 patients rise of blood pressure was noticed and in 6 patients after 10 minutes. In most patients the blood pressure was either intact or decreased in therapeutic range because of the antihypertensive drugs given to the cases with high blood pressure. There was no significant difference between the change of blood

pressure in the two groups 5 and 10 minutes after the treatment ($P=0.132$, $P=0.136$).

The mean heart rate of 83.16 ± 7.91 bpm was detected in our patients. 5 min after intervention in case group, 143 patients (70.4%) had no change in heart rate and the change in other patients was negligible. Heart rate changes at 5 minutes after intervention in case and control groups were not significantly different from one another ($P=0.102$). After 10 minutes of intervention, 98% of patients had no change in heart rate. Changes in heart rate 10 minutes after the intervention in case and control groups were not significantly different from each other ($P=0.136$).

Table 1. Evaluation of age, platelet, PT, PTT and INR of patients based on Hypertension and Cardiovascular Disease

	Hypertension			Cardiovascular Disease		
	Yes	No	P	Yes	No	P
Age in years	58.46 ± 12.18	48.76 ± 14.56	<0.001	58.77 ± 12.62	51.25 ± 14.46	<0.001
platelet counts	263.78 ± 74.36	310.31 ± 81.07	<0.001	257.18 ± 74.18	299.82 ± 81.12	<0.001
PT	15.07 ± 2.70	14.97 ± 4.27	0.770	16.97 ± 5.52	14.46 ± 2.72	<0.001
PTT	39.97 ± 7.06	41.36 ± 10.03	0.119	45.09 ± 14.32	39.53 ± 6.08	0.001
INR	$1.18 \pm .19$	$1.22 \pm .37$	0.133	$1.42 \pm .54$	$1.14 \pm .15$	<0.001

Table 2. Evaluation of age, platelet, PT, PTT and INR of patients based on Diabetes Mellitus and Liver Disease

	Diabetes Mellitus			Liver Disease		
	Yes	No	P	Yes	No	P
Age in years	56.98 ± 11.48	50.20 ± 15.52	<0.001	58.22 ± 13.04	51.66 ± 14.44	<0.001
platelet counts	295.83 ± 90.67	286.69 ± 74.92	0.289	284.18 ± 87.04	291.84 ± 80.19	0.456
PT	15.27 ± 3.94	14.85 ± 3.50	0.279	15.75 ± 4.25	14.84 ± 3.51	0.082
PTT	42.01 ± 11.93	39.94 ± 6.00	0.043	46.21 ± 12.09	39.47 ± 7.41	<0.001
INR	$1.26 \pm .37$	$1.17 \pm .25$	0.004	$1.38 \pm .47$	$1.16 \pm .24$	<0.001

4. Discussions

To control spontaneous epistaxis, many schemes of therapy have been recommended, such as K and C vitamins, anterior and posterior nasal packing, penicillin, cautery, ice packs, thrombin and fibrin foam, and ligation of the external carotid artery (Menger, 1995). Anterior nasal tampon or packing is a common method for the treatment of epistaxis and is widely used in the Departments of Emergency Medicine. Despite being an effective method of controlling epistaxis, its application demands a skilled person.

To introduce a method that can be efficient and at the same time practicable by non-medical staff, we conducted this study to investigate the effect of 2% citric acid in controlling epistaxis in the emergency medicine department.

In a study conducted by Theodorsis et al, it was noted that the incidence of epistaxis in males is

higher than in females. Also in this study, the mean age for the incidence of epistaxis has been reported 54.76 ± 13.23 years (Theodosis, 2009). Other studies have also revealed greater incidence of epistaxis in male gender, with more severity in adults (Walker, 2007; Hussain, 2006; Nunez, 1999). By comparing our results with these studies, partial consistency is observed.

In various studies, there is controversy over the role of blood pressure in epistaxis; however, as seen in the present study, the mean systolic blood pressure was high in patients visiting ED with complaint of epistaxis. Wang et al. in their study stated the necessity of blood pressure control in prevention of intractable epistaxis (Wang, 2006).

In a study by Isezuo et al., they retrospectively investigated the analysis of 62 adults to find a relationship between blood pressure and epistaxis. And finally, they noted a significant

relationship between increased blood pressure and increased incidence of epistaxis (Isezuo, 2008).

In a study by Herkner et al. at the University of Vienna, studying the relationship between blood pressure and epistaxis, it has been concluded that the increase in arterial blood pressure is an independent cause of bleeding in epistaxis patients (Herkner, 2002). These studies suggest a relationship between elevated blood pressure and increased incidence of epistaxis, which are comparable with findings of our study and confirm our results.

The presence of extremely high systolic blood pressure is said to be a contraindication of using vasoconstrictive drugs, due to the possible danger of cerebral accident (Hollingsworth, 1952).

The results obtained in this study showed that the use of 2% citric acid had no effect on the patient's vital signs and due to its high dilution, it does not affect the lining of nasal epithelium unlike other methods such as chemical cauterization with silver nitrate with negative effects on the mucosa (Bernius and Perlin, 2006; Krempl and Noorily, 1995).

Comparison between the case and control study in the present study did not show any statistically significant difference in treatment success rates. No published studies were found studying the use of citric acid in the treatment of epistaxis; however, there are numerous studies on nasal tampon. In a study by Adornato et al, they noted that the use of nasal tampons could appropriately control the nose-bleeding (Adornato, 2000). In another study carried out by Goddard et al., they noted the anterior nasal tampon as a cost-effective treatment of epistaxis (Goddard and Reiter, 2005). According to a study by Singer et al, anterior nasal packing has been mentioned as a painful procedure both while packing and while taking the pack out after bleeding has stopped (Singer, 2005).

Use of intranasal Oxymetazoline in controlling epistaxis was studied by Kremple and Noorily; sixty-five percent of the patients were successfully managed with Oxymetazoline as their sole therapy. An additional 18% were managed successfully with silver nitrate cautery in combination with Oxymetazoline. These data suggest that pharmacologic management may be adequate in the majority of patients with epistaxis, thus avoiding the need for nasal packing with its associated complications (Krempl and Noorily, 1995).

Menger et al. studied the use of estrogen to control epistaxis. Although effective, it is not accessible, and since possible side effects have not been studied, it cannot be used in ED and in the pre-hospital settings (Menger, 1995).

In our study, both methods of anterior nasal packing and usage of 2% citric acid were effective in controlling the bleeding and there was no significant difference in terms of bleeding control between both interventions. But regarding that the 2% Citric acid or diluted base substance of lemon juice is available in domestic bases and considered to be a safe substance, therefore, it is suitable to control epistaxis.

Conclusion:

This study investigated the effect of 2% citric acid in controlling spontaneous epistaxis in the Department of Emergency Medicine. Finally, we concluded that the impact of this approach in controlling epistaxis is similar to using anterior nasal packing and both of these methods may be effective in controlling epistaxis. However, using the diluted citric acid to control epistaxis is practical in domestic bases. As the results showed, application of 2% citric acid had no effect on patients' vital signs; thus, it can be used by individuals at home. Using this method, owing to its ease and speed of implementation, would be useful in controlling epistaxis in pre-hospital settings.

Observations are being made on the possible side effects of this means of therapy, but not enough data have been accumulated warranting the conclusions. Further investigations should be carried out to resolve this matter.

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