Serum Oxidative Stress Levels in Patients with Nasal Septal Deviation

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Original Investigation

Abstract

Objective: Comparison of the total oxidant status (TOS), total antioxidant status (TAS) and paraoxonase (PON1) serum levels in patients with nasal septum deviation (NSD) and healthy subjects.

Methods: The TAS, TOS, and PON1 serum levels of 47 patients with NSD (mean age 35.3) and 50 healthy subjects (mean age 37.8) were compared in this study.

Results: We found significantly higher TAS levels in the control group (p<0.001). The mean TAS value was 1.196 mmoL/L in the control group, whereas it was 1.046 mmoL/L in the NSD group. On the other hand, TOS was significantly higher in the NSD group (p<0.001). We found that the mean TOS value was 6.600 mmoL/L in the control group, and 20.194 mmoL/L in the NSD group. The NSD and control groups had similar PON1 levels (p=0.446). The mean PON1 value was 279.64 U/L in the control group, and 324.21 U/L in the NSD group.

Conclusion: We detected higher TOS and lower TAS levels in patients with NSD compared to healthy subjects. These results indicate that patients with NSD are exposed to oxidative stress.

Keywords: Nasal obstruction, nasal septum deviation, total oxidant status, total antioxidant status, paraoxonase

Introduction

Nasal septum deviation (NSD) is a deformity of the nasal septum from midline, and the resulting nasal obstruction may lead to hypoxia (1, 2). The NSD may alter cellular metabolism due to hypoxia. Some cellular compartments may disappear, and the release of free oxygen radicals from lysosomes may increase (3). Studies have reported that the production of free oxygen radicals increases after hypoxia/re-oxygenation periods (4).

In an organism, there is an equilibrium between antioxidant and oxidant molecules. Antioxidants keep free oxygen radicals within the physiological limits and alleviate their harmful effects (5).

If this equilibrium shifts against antioxidants, oxidative stress occurs, resulting in damage due to free radicals (6). Free oxygen radicals play a role in the pathogenesis of various diseases, including cancer, systemic lupus erythematosus, diabetes, atherosclerosis, rheumatoid arthritis, and Behçet's disease (7).

Recently, studies have focused on oxidant/antioxidant molecules. Although it is possible to measure plasma concentrations of oxidant molecules separately, this is not feasible as those molecules may affect each other. For this reason, Total Oxidant Status (TOS) measurement that reflects the general oxidant status was developed (8-10). TOS measurement is more informative than measurements of antioxidants individually. Thus, instead of individual antioxidants, measurements of the Total Antioxidant Status (TAS) are more commonly used (8). The Paraoxonase (PON1) is an ester hydrolase associated with high-density lipoprotein (HDL) that can hydrolyze paraoxon, which is a strong inhibitor of cholinesterases (11, 12).

In our study, we compared the TAS, TOS, and PON1 serum levels in patients with NSD and healthy controls. Our study is the first study that investigates the new oxidative stress measurement methods, TAS and TOS, along with paraoxonase levels in patients with NSD.

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Methods

This study was conducted at Otorhinolaryngology Department of Hitit University School of Medicine, between January 1, 2016, and June 31, 2016. Gaziosmanpaşa University Ethics Committee approved the study protocol (decree no: 15-KAEK-191). Forty-seven patients with NSD and 50 healthy subjects between the ages of 18 and 50 years were recruited. The NSD was diagnosed based on the presence of nasal obstruction complaint, and anterior rhinoscopy and nasal endoscopy showing NSD. The exclusion criteria for the NSD group were the presence of atherosclerotic heart disease, malignancy, hypertension, severe systemic diseases, allergies, nasal polyps, diabetes mellitus, and nasal pathologies other than the isolated NSD. Exclusion criteria for the control group were nasal polyposis, allergy, bronchial asthma, tumors, and history of previous sinonasal surgery, or any chronic disease that had destroyed the anatomic structures.

All patients and controls provided their written informed consents. Blood samples were collected between 8 and 10 a.m. Ten milliliters of venous blood was collected from all participants into vacuum biochemistry tubes. The blood samples were centrifuged for 10 minutes at 4000 rpm after waiting for 30-45 minutes, the sera were separated, and stored at -80°C in Eppendorf tubes until analysis.

Measurement of TAS, TOS, and paraoxonase: We employed Erel's methods for analysis (8, 10).

TOS levels were measured with fully automated Rel Assay kit (Rel Assay Diagnostics kit; Mega Tıp, Gaziantep, Turkey) using colorimetric and an autoanalyzer (Vital Scientific, Selectra/Flexor E, Hollanda). The results were presented as μmol H2O2 equivalent/L (8).

Fully automated RL0031 Rel Assay® kit (Rel Assay Diagnostics kit; Mega Tıp, Gaziantep, Turkey) and Abbott Architect® c16000 auto analyzer were used for TAS measurements. The results were presentedas micromolartrolox/L (8, 9).

We measured the Paraoxonase levels with fully automated RelAssay® kit (Rel Assay Diagnostics kit, Mega Tıp, Gaziantep, Turkey), in Abbott Architect® c16000 autoanalyzer. The results were presented as U/mol. PON1 enzyme breaks paraoxon into p-nitrophenol (diethyl-p-nitrophenyl phosphate) when activated in the Tris buffer by calcium ions. p-nitrophenol has a molar absorptivity of 18.290 M-1 cm-1, and one unit of paraoxonase activity is equivalent to 1 mole/min at 37°C (8).

Statistical analysis

We used the Statistical Package for the Social Sciences package program (version 22.0, IBM Corp.; Armonk, NY, USA) for statistical analysis. Shapiro-Wilk test was used to test distribution of normality. The descriptive statistics were presented as follows: Continuous variables were presented as the mean±standard deviation, the median (min-max) according to distribution hypotheses, and the categorical variables were presented as number and percentage. Independent sample t test was used to compare the mean values of two independent, normally distributed continuous variables. Non-normally distributed independent continuous variables were compared with Mann-Whitney U test. The significance level was set at $p<0.05$.

Results

There were 25 males and 22 females (n=47, mean age 35.3) in the NSD group, and 23 men and 27 women (n=50, mean age 37.8) in the control group. The age of the patients in the NSD and control groups ranged between 18 and 50 years. Two groups were similar with regard to age and gender.

When the control and NSD groups were compared, the TOS was significantly higher in the NSD group (Table 1). However, the TAS was significantly higher in the control group ($p<0.001$) (Table 2). Two groups had similar PON1 levels ($p=0.446$) (Table 3).

Discussion

We found that TOS was significantly higher in patients with NSD when compared to the control group. The TAS values, however, were statistically significantly higher in the control group. Analysis of the PON1 values did not show any significant difference between the groups. As far as we know, TAS and TOS have not been studied in patients with NSD and compared with the controls, our study being the first one that investigated TAS, TOS, and PON1 in patients with NSD.

Kazkayası et al. (13) studied nasal packing and suturing after septoplasty in terms of oxidative stress. They measured malondialdehyde (MDA), suphydril (SH), and nitric oxide (NO) levels, and they did not find a significant difference between packing and suturing groups. They concluded that suturing the septum after septoplasty did not affect the oxidant-antioxidant system negatively.

Alkan et al. (14) studied serum oxidative stress parameters before and after nasal packing in patients who underwent septoplasty. When compared with the preoperative serum levels, the serum MDA levels decreased, but NO and catalase levels increased. A decrease in the MDA levels that indicates oxidative stress, and an increase in the antioxidant catalase, shows that patients with NSD are exposed to oxidative stress. Similarly, in our study, we have detected that TOS, and thus oxidative stress, was higher in patients with NSD when compared to the control group.

Table 1. Comparison of total oxidant status in NSD and control groups

	Groups	n	Mean±SD	Median (min-max)	p
TOS	Control	50	6.600±17.24	1.59 (0.02-107)	p<0.001*
	NSD	47	20.194±16.79	33.1 (0.08-38.8)	
	Total	97	13.187±18.26	2.38 (0.02-107)	

*Mean difference is significant

NSD: nasal septal deviation; SD: standard deviation; TOS: total oxidant status

Table 2. Comparison of total antioxidant status in NSD and control groups

	Groups	n	Mean±SD	p
TAS	Control	50	1.196±0.15	p<0.001*
	NSD	47	1.046±0.15	

*Mean difference is significant

NSD: nasal septal deviation; SD: standard deviation; TOS: total oxidant status

Table 3. Comparison of paraoxonase levels between NSD and control groups

	Groups	n	Mean±SD	Median (min-max)	p
PON	Control	50	279.64±152.48	204.5 (92-618)	p=0.446
	NSD	47	324.21±213.69	259.0 (38-947)	
	Total	97	301.24±185.06	243.0 (38-947)	

NSD: nasal septal deviation; SD: standard deviation; PON1: paraoxonase

Ekinci et al. (15) in their study found that there was a significant difference between the TAS and TOS levels before and after septoplasty. They reported that the mean TAS value after septoplasty increased and the mean TOS value decreased. As a result, they reported that patients with NSD were exposed to less oxidative stress after septoplasty.

There is a balance between antioxidant and oxidant molecules in an organism. Oxidative stress occurs if this balance shifts against antioxidants (6). In recent years, instead of measurements of individual antioxidants, TAS, which measures the total antioxidant value, is commonly used (8). As the oxidant molecules may affect each other, TOS measurement was developed to reflect the total antioxidant status instead of individual measurements (8-10). Some studies investigated the effects of the oxidative system and antioxidant enzyme levels on various diseases including migraine, head and neck tumors, chronic tonsillitis, nasal polyps, adenoid hypertrophy, Behçet's disease, and chronic obstructive lung disease (16-21).

A study by Bozkus et al. (16) has shown increased oxidative stress parameters in serum and tissues of patients with nasal polyposis when compared to patients with turbinate hypertrophy and nasal septal deviation.

In our study, we compared the NSD and control groups and found that the TOS was significantly higher in the NSD group, whereas the TAS was significantly higher in the control group. There was no significant difference detected between the NSD and the control groups regarding PON1. We concluded that the increase in TAS in the control group was caused by an increase in antioxidants other than PON1 enzyme.

Our study has some limitations. First, NSD was not graded, and relations between the patient symptom scores and oxidative parameters were not studied. Moreover, we suppose that it may be helpful to measure those levels pre- and post-operatively in patients undergoing septoplasty.

Conclusion

In patients with NSD, the TOS levels were increased, and the TAS levels were decreased, compared to the control group. This shows that patients with NSD are exposed to oxidative stress. Larger, more comprehensive studies are needed to investigate this subject. We suggest that comparison of pre- and postoperative TAS, TOS, and PON1 levels in patients who underwent septoplasty may be helpful in this respect.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Gaziosmanpaşa University (decision no: 15-KAEK-191).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

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