Correlation of Nasal Septum Deviation With the Risk of Cardiac Arrhythmia and the Effect of septoplasty

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Abstract

Background and objectives: Nasal obstruction is a highly prevalent problem worldwide that can negatively affect quality of life and can result in many cardiac complications. One of the common causes of nasal obstruction is a deviated nasal septum. The aim of this study was to examine the risk of ventricular and atrial arrhythmias in patients who were diagnosed with deviated nasal septum and to find out the effect of septoplasty on the risk of cardiac arrhythmia through studying P wave dispersion and corrected QT dispersion values. **Methods:** The study involved 45 patients with nasal septal deviation whom underwent septoplasty. Electrocardiographic records were used to calculate both P wave dispersion and corrected QT wave dispersion both preoperatively and 6 months postoperatively and comparing them with control group. **Results:** Pre-operatively, the mean + SD of the P wave dispersion among cases was 55.33 + 12.17 milliseconds which was significantly higher than the mean of the controls (42.0 + 10.36 milliseconds). The mean of the QT corrected dispersion was also significantly higher among cases than the controls (51.09 vs. 44.53 milliseconds respectively). In addition, P wave dispersion and QT corrected dispersion values were significantly greater in preoperative patients with deviated nasal septum when compared with the same patients postoperatively. **Conclusions:** atients with severe nasal septal deviation are at risk of development of cardiac arrhythmia, and septoplaty relieves upper airway obstruction and will eventually reduce the risk of development of cardiac arrhythmia.

Keywords: Nasal septum, Septoplasty, Cardiac arrhythmia.

Introduction

The nasal septum is the organ that separates the nasal cavity into two chambers and also functions by supporting the nasal dorsum and maintaining the shape of the tip and columella. Anatomic deviation of nasal septum causes cosmetic problem and significant upper airway obstruction[1]. The nose can contribute to the major part of airway resistance, so any minor change in the nasal septum and nasal patency can have a significant outcome on the airflow resistance[2]. Upper airway obstruction (UAO) has been previously investigated as a cause for cardiac complication which revealed that there is an association between the upper airway obstruction and the cardiac rhythm disorder[3].

Amongst the factors that cause cardiovascular complication in a patient with an upper airway obstruction, are activation of sympathetic nervous system, enhanced oxidative stress and increased intra-thoracic presssure[4], P wave dispersion (Pd) and QT wave dispersion(QTcd) parameters can suggest abnormalities in the cardiac physiology and autonomic nervous system. P-wave dispersion is a simple and non invasive ECG indicator for atrial remodeling and a predictor for atrial fibrillation, Pd is defined as the difference between widest and narrowest p wave duration recorded in 12-lead surface electrocardiogram, an increase in Pd indicate prolongation of intra-atrial and interatrial conduction time and lack of coordinated contraction system within atrial muscle[5]. The QT dispersion (QTd) is the difference between longest QT and shortest QT on the 12-lead surface electrocardiogram which indicate the time between the initiation of depolarization and the end of repolarization, the corrected QT dispersion (QTcd) with heart rate is an indirect indicator of non-homogeneity in ventricular refrac-

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toriness[6]. Increased QTcd can put individuals at higher risk for arrhythmia and death in a variety of cardiac and noncardiac disorder. For this reason, the use of QTcd to evaluate any patient who is at increased risk for developing ventricular arrhythmias has become one of the accepted ways for those with noncardiac problem[7, 8]. Studies have shown that mechanical UAO due to nasal septal deviation can cause inactivation of nasal reflex, hypercapnia, hypoxia, disturbance of autonomic nervous system, over activation of sympathetic nervous system, disturbance of coronary blood flow, generation of oxygen free radicals and oxidative stress that could destroy cardiac myocytes which in turn facilitate arrhythmogenesity[3].

The aim of this study was to examine the risk of ventricular and atrial arrhythmias in patients who were diagnosed with deviated nasal septum and also to find out the effect of septoplasty on cardiac arrhythmia risk among these group of patients through studying P wave dispersion and corrected QTd values during the pre- and postoperative periods and comparing them to the control group.

Patients and Methods

It's a prospective study involved 45 patients (18 women and 27 men) whom underwent closed technique septoplasty due to marked(severe) S- or C-shaped nasal septal deviation that caused significant nasal obstruction from December 2016 to January 2018 in Erbil, at Rizgary Teaching Hospital. The other (control) group was also composed of 45 healthy age- and sex-matched subjects (21 women, 24 men) without any problem at the upper airway.

A detailed ENT examination—including Mallampati classification, Friedman tongue position, anterior rhinoscopy to assess anterior septum and valve area, flexible nasopharyngoscopic examinations to examine mid and posterior part of septum and to exclude other possible nasal pathology, patients satisfaction regarding the effectiveness of septoplasty and assessing the severity of septal deviation were questioned with the Nasal Obstruction and Septoplasty Effectiveness (NOSE) -Scale pre and postoperatively has been done.

The study group included patients with marked nasal septal deviation that caused significant bilateral nasal obstruction for more than one year whom did not respond to several trials of medical treatment (at least three courses) and normal preoperative electrocardiography.

We excluded patients with mild NSD, patient having deviated nasal septum associated with turbinate hypertrophy, upper airway obstruction related conditions (i.e., adenotonsillar hypertrophy, mass in the airway, vocal cord palsy or OSA), history of cardiac disease (i.e., myocardial infarction, arrhythmia, previous cardiac surgery, congestive heart failure, disordered heart valve, BBB, or CMP), medical conditions which affect cardiac conduction systems (i.e., HTN, hyperlipidemia, thyroid disease or diabetes mellitus,), and chronic medical illnesses that required long term drug use.

Only those patients in the study group with septal deviation underwent the surgery for correcting the deviated septum, while the other participants in the study whom labeled as control did not undergo septoplasty. Operations were carried out under general anesthesia, after infiltration of both sides of nasal septum with Xylocaine: Adrenaline (1:100000) for vasoconstriction, the hemitransfixion incision was carried out at the caudal end of nasal septum usually on concave side of nasal septum, both mucoperichondrial and mucoperiostial flap elevated with the help of cottle and freer elevator, the bony and cartilaginous septum were exposed from both sides, deviated part of nasal septum was removed with the help of cutting and Tilley Henckel forceps and deviated maxillary crest removed with Tilley nasal gouge, sufficient cartilage and bone were maintained for structural support. Trans-septal through and through suturing done and internal nasal splints were applied. ECG record was used to measure Pd and QTcd values in nasal septal deviated patients preoperatively and 6-12 months postoperatively and also in control group. Standard 12-lead ECG 50-mmV recordings were carried out at ENT department ward following a 5-minute rest. All recordings were taken during spontaneous breathing. All measurements for all patient and control group were taken by the same device. Pd was calculated from the first upward going sign from the baseline and back to the point of baseline. The value of P-wave dispersion (milliseconds) can be calculated by difference between the longest and shortest P-waves in any of the 12 leads. The QT interval was calculated starting from the beginning of the QRS complex until the end of T-wave. Corrected QT wave dispersion was calculated by subtracting the minimum value from maximum value and correcting with heart rate9.

Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 22). Chi square test of association was used to compare proportions. Student's t test of two independent samples was used to compare two means. Paired t test was used to compare the means of the study parameters before and after the operation. A p-value of ≤ 0.05 was considered statistically significant.

The ethical approval of the present study was obtained from the Kurdistan Board for Medical Specialties (KBMS) in Erbil in 2016. The verbal and written consent form was obtained from all patients in advance. The patients were given a guarantee for the confidentiality of their personal information.

Results

Ninety persons were included in the study. Half of them (45 patients with nasal septal deviation) underwent an operation for septoplasty, and the rest were healthy persons and served as a control group. The mean age + SD of the whole sample were 30.6 + 8.5 years. No significant (p-value = 0.386) difference was detected between the mean age of cases (31.4 years) and that of the control group (29.8 years) as presented in Table 1.

The highest proportions (40%) of patients were in the age group 25 to 34 years. No significant difference was detected in the age distribution of cases and controls (p-value = 0.513). The table shows that 60% of the cases were males compared with 53.3% of the control group (p-value = 0.523).

Table (1): Age and gender distribution.

Age & gender	Control		Case		Total		p-value
	No.	(%)	No.	(%)	No.	(%)	
Age							
< 25	14	(31.1)	11	(24.4)	25	(27.8)	0.513
25-34	19	(42.2)	17	(37.8)	36	(40.0)	
≥ 35	12	(26.7)	17	(37.8)	29	(32.2)	
Mean (±SD)	29.8	(±8.2)	31.4	(±9.0)	30.6	(±8.5)	0.386*
Gender							
Male	24	(53.3)	27	(60.0)	51	(56.7)	0.523
Female	21	(46.7)	18	(40.0)	39	(43.3)	
Total	45	(100.0)	45	(100.0)	90	(100.0)	

*Comparing mean age of cases and controls by t test.

Pre-operatively, the mean + SD of the Pd among cases was 55.33 + 12.17 milliseconds which was significantly (p-value < 0.001) higher than the mean of the controls (42.0 + 10.36 milliseconds). The mean of the QTcd was also significantly (p-value = 0.001) higher among cases than the controls (51.09 vs. 44.53 respectively) as presented in Table 2.

Table (2): Pre-operative means of p wave dispersion and QT cd of the two study groups.

p wave dispersion and QT cd	Case		Control		p-value
	Mean	(±SD)	Mean	(±SD)	
p wave dispersion (milliseconds)	55.33	(±12.17)	42.00	(±10.36)	< 0.001
QTcd (milliseconds)	51.09	(±12.74)	44.53	(±2.19)	0.001

Table 3 shows significant improvement of the NOSE scale after the operation. It was 14.69 before the operation, and decreased to 3.76 after the operation (p-value < 0.001). The mean of the p wave dispersion was 55.33 milliseconds before the operation, and decreased to 52. 22 milliseconds after the operation (p-value = 0.029). The same for the mean of QTcd. It decreased from 51.09 milliseconds before the operation to 44.64 milliseconds after the operation (p-value < 0.001).

https://doi.org/10.56056/amj.2019.89

Table (3): Comparison between the pre and post-operative means of NOSE scale, p wave dispersion, and QT cd of cases.

NOSE scale, p wave dispersion, and QT cd	Pre-operative		Post-operative		p-value
	Mean	(±SD)	Mean	(±SD)	
NOSE scale	14.69	(±2.78)	3.76	(±2.11)	< 0.001
p wave dispersion milliseconds	55.33	(±12.17)	52.22	(±8.76)	0.029
QTcd milliseconds	51.09	(±12.74)	44.64	(±13.05)	< 0.001

Discussion

Although the effect of other causes of upper airway obstruction such as adenotonsillar hypertrophy in children and OSA in adult on cardiopulmonary system has been adequately investigated and mechanisms identified. However, the effect of deviated nasal septum on heart has not been well studied; therefore, it may be difficult to determine the mechanism linking between deviated nasal septum and development of cardiac arrhythmia. There is only one study on the effect of deviated nasal septum and septoplasty on cardiac arrhythmia by Uluyol et al which states that there is significant association between nasal obstruction secondary to deviated nasal septum and cardiac arrhythmia risk, as its confirmed that the patency of nasal airway necessary to activate nasal mechanosensitive receptor which has direct positive effect on spontaneous ventilation, higher minute ventilation and higher resting breathing frequency, thus obstruction of nasal pathway and mouth breathing will decrease the activation of these mechanosensitive receptors which consequently leads to inhibition of nasal ventilation reflex, increased bronchoconstriction, decreased respiratory rate, minute ventilation and muscle tone which can cause respiratory accident in patients who are susceptible such as those with subclinical OSA or leads to worsening apnea episode[3] .

In our study we used Pd and QTcd as a useful and non invasive marker for assessing the patients with severely deviated nasal septum who are at risk for developing atrial and ventricular arrhythmia, we found that those patients with deviated nasal septum had higher NOSE scale, Pd and QTcd preoperatively when compared with the same group of patients after septoplasty for relieving obstruction at the upper airway and also higher than healthy control group. These results suggest that there is relation between deviated nasal septum and development of cardiac arrhythmia, as there are studies which show that chronic upper airway obstruction can suppress vagal tone and increase sympathetic out flow to the cardiac muscles which may contribute to the development of cardiac arrhythmia directly by causing remodeling of both atrium and ventricle and indirectly by affecting blood pressure, heart rate and coronary blood flow[3].

Ogredin et al observed correcting deviated nasal septum has positive impact on the cardiopulmonary function in patients with deviated nasal septum and they also stated that septoplasty could have preventive role in development of future pathology in cardiopulmonary function[11].

Darin et al performed a prospective study to find out any impact of nasal septal deviation on cardiac arrhythmia by using 24 hour rhythm holter analysis before and after correcting deviated nasal septum and they revealed that correcting nasal septal deviation lowers ventricular and supra ventricular extrasystole and improvement of hypoxia has been showed to lower extrasystole[12].

The above studies may show and determine the effect of nasal obstruction secondary to nasal septal deviation on the cardiac function; QTcd vary greatly between 30-60 millisecond and in normal individuals with average value may sometimes lies around 70 milliseconds while P wave dispersion lies between (7+/- 2.7 to 58.56+/- to 15.24)[13]. But still there is no proved limit value to determine arrhythmia by Pd and QTcd; the above could be regarded as a limitation for the study.

There are several limitations of our study including small number of participants in the study, short duration of follow up and inability to perform sleep study to rule out patients with OSA.

Conclusions

In our study, we used P wave dispersion and corrected QT wave dispersion to assess atrial and ventricular arrhythmia risk, it showed that it was higher than control group, and its value 6 months after septoplasty has decreased and become closer to that of control group, this indicates that there is association between development of cardiac arrhythmia and marked nasal septal deviation. We advocate doing septoplasty for patient with marked nasal septal deviation as early as possible to prevent development of cardiac arrhythmia.

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