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# Effect of nasal surgery on laryngeal mucosa

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## ABSTRACT

**Background:** The aim of the study was to compare stroboscopic features of laryngeal mucosa before and after the nasal surgery.
**Methods:** Prospective randomized case control study in which 60 patients divided into two groups each include 30 patients, group I with bilateral nasal obstruction due to deviated nasal septum with hypertrophic inferior turbinate, group II bilateral nasal obstruction due nasal polyposis undergoing septoplasty with turbinectomy group I and FESS in group II with video- stroboscopic examination before and 3 months after the surgery for each patient and 30 normal volunteers as a control group.
**Results:** Swollen true vocal cord, laryngeal erythema and laryngeal edema were significantly decreased after the nasal surgery, As Swollen true vocal cord changed from 8 to one patient in group I and from 16 to 4 patients in group II, laryngeal erythema changed from 28 to 6 patients in group I and from 29 to 7 patients in group II and laryngeal edema changed from 28 to 5 patients in group I and from 29 to 8 patients in group II.
**Conclusions:** The nasal surgery would have a significant impact on laryngeal edema, erythema and vocal cord edema.

**Keywords:** Nasal obstruction, Septoplasty, FESS, Stroboscopy

## INTRODUCTION

Nasal obstruction is the main complaint of patients attending otorhinolaryngology outpatient clinics.[1] Nasal polyposis and deviated nasal septum with hypertrophic inferior turbinate are the most common causes of nasal obstruction affecting general population.[2] Nasal cavity and sinuses share in determination of the sound quality as they affect resonance of voice.[3] So patients with chronic nasal obstruction suffering from change of their voice.[4] Video-stroboscopic examination of the larynx enables us to determine the changes in glottis region, laryngeal mucosa and other laryngeal structures.[5] The clinical studies on laryngeal changes due to chronic nasal obstruction are so rare and its results are not sufficient.[6] The aim of this prospective randomize study is to study the effect of chronic nasal obstruction due to nasal polyposis and deviated nasal septum with hypertrophic inferior turbinate on laryngeal structures.

## METHODS

The study was approved by the research ethics committee of Benha faculty of medicine, written consents were obtained from all patients and participants. The study included 60 patients divided into two groups, the first of which included 30 patients with bilateral nasal obstruction due to deviated nasal septum with hypertrophic inferior turbinate and the second group included 30 patients suffered from bilateral nasal obstruction due nasal polyposis, The control group of this study were 30 normal volunteers people with no otorhinolaryngological symptoms, This study would be at Benha University hospital, faculty of medicine, ENT department between April 2016 to April 2017. Both nasal

polyposis and deviated nasal septum with hypertrophic inferior turbinate were diagnosed by anterior rhinoscopy, nasal endoscopy and all patients had computed tomography before the operation, All patients and volunteers were examined by speech specialist who were blind about this study to exclude the organic laryngeal diseases and functional disorders, video- stroboscopic recording was performed for each patient pre-operatively and 3 months post-operatively by the same speech specialist and by the same video- stroboscopic system, patients with major pathological finding in the larynx, smokers, patients with hormonal implance and patients with autoimmune diseases were excluded from this study, The patients with nasal polyposis were operated up on with functional endoscopic sinus surgery by using Messerklinger technique and patients with deviated nasal septum with hypertrophic inferior turbinate were operated by septoplasty with turbinectomy. The evaluation criteria used in video- stroboscopic examination were criteria set out by Hirano and Bless.[5]

***Statistical analysis:***

The clinical data would be expressed as mean and standard deviation for quantitative data, frequency and distribution for qualitative data. Quantitative data would be compared using paired t test and Wilcox on test (Z-test). All data would be tabulated and analyzed using the computer program SPSS (statistical package for social science) version 20. P<0.05 would be considered statistically significant (*) while >0.05 statistically insignificant p<0.01would be considered highly significant (**) in all analyses.

## RESULTS

A total of 60 patients, divided into two main groups were included in this study, the first group included 30 patients suffered from nasal obstruction due to deviated nasal septum with hypertrophic inferior turbinate 13 male patients and 17 female patients with mean age 35.97±0.5, while the second group included 30 patients suffered from nasal obstruction due to nasal polyposis 16 male patients and 14 female patients with mean age 37.98±0.78, the control group included 30 persons with no rhinological symptoms 12 male patients and 18 female patients with mean age 34.0±0.14.

As compared to the preoperative data and the postoperative data of video stroboscopic examination of the patients, there was no statistically significant difference according to phase symmetry of vocal cords movements, vocal cords mobility, false vocal cord compression and complete vocal cord closure as shown in Table 1. By reviewing of the statistical data, there were significant changes in the true vocal cords in group I after the surgery as there were 20 patients had Smooth true vocal cords became 27 postoperative, but there were 2 patients had bowed true vocal cords still 2 postoperative, while there were 8 patients had swollen true vocal cords became only one postoperative Also there were significant changes in the true vocal cords in group II after the surgery as there were 11 patients had smooth true vocal cords became 23 postoperative, but there were 3 patients had bowed true vocal cords still 3 postoperative, while there were 16 patients had swollen true vocal cords became 4 postoperative.

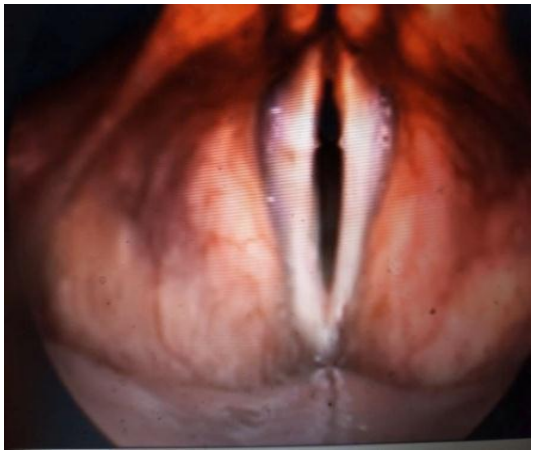

**Figure 1: Laryngeal erythema before the surgery.**

**Figure 2: Laryngeal erythema after the surgery.**

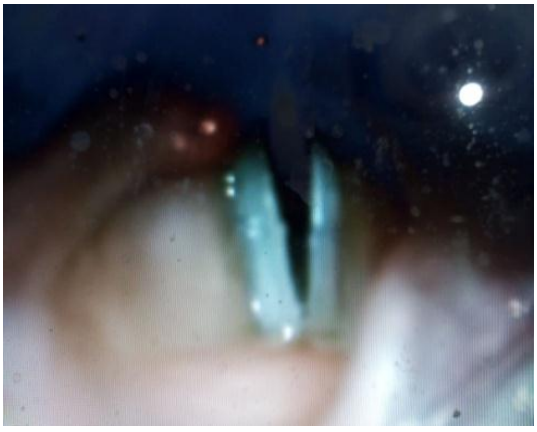

**Figure 3: Laryngeal edema before the surgery.**

**Table 1: Distribution of study groups according to the results**

| Video stroboscopic features | Group I septoplasty with turbinectomy (30 patients) | | Group II FESS of nasal polyposis (30 patients) | | Group III control (30 persons) | Statistical test | P value |
|---|---|---|---|---|---|---|---|
| Male | 13 (43.3) | | 16 (53.3) | | 12 (40.0) | X2=1.17 | 0.56 |
| Female | 17 (56.7) | | 14 (46.7) | | 18 (60.0) | | |
| Age | 35.97±0.5 | | 37.98±0.78 | | 34.0±0.14 | F=403.8 | <0.001** |
| **Phase symmetry** | Before | After | After | Before | | FET1=0.69<br>FET2=0.69<br>FET3=0.0<br>FET4=0.0 | P1=1.0<br>P2=1.0<br>P3=1.0<br>P4=1.0 |
| Regular | 29 (96.7) | 29 (96.7) | 28 (93.3) | 28 (93.3) | 29 (96.7) | | |
| Irregular | 1 (3.3) | 1 (3.3) | 2 (6.7) | 2 (6.7) | 1 (3.3) | | |
| **True vocal cord borders** | Before | After | Before | After | | FET1=23.16<br>FET2= 3.99<br>FET3=6.58<br>FET4=11.59 | P1=<0.001**<br>P2= 0.45<br>P3=0.03*<br>P4=0.002** |
| Smooth | 20 (66.7) | 27 (90.0) | 11 (36.7) | 23 (76.7) | 28(93.3) | | |
| Bowed | 2 (6.7) | 2 (6.7) | 3 (10.0) | 3 (10.0) | 1 (3.3) | | |
| Swollen | 8 (26.7) | 1 (3.3) | 16 (53.3) | 4 (13.3) | 1 (3.3) | | |
| **True vocal cord mobility** | Before | after | Before | after | 28(93.3) | FET1=0.61<br>FET2=0.61<br>FET3=0.0<br>FET4=0.0 | P1=1.0<br>P2=1.0<br>P3=1.0<br>P4=1.0 |
| Normal | 29 (96.7) | 29 (96.7) | 28 (93.3) | 28 (93.3) | | | |
| Mild stiffness | 1 (3.3) | 1 (3.3) | 2 (6.7) | 2 (6.7) | 2 (6.7) | | |
| **False vocal cord compression** | Before | After | Before | After | | FET1=1.04<br>FET2=1.04<br>FET3=0.0<br>FET4=0.0 | P1=1.0<br>P2=1.0<br>P3=1.0<br>P4=1.0 |
| No | 27 (90.0) | 27 (90.0) | 28 (93.3) | 28 (93.3) | 27 (90.0) | | |
| Mild | 2 (6.7) | 2 (6.7) | 1 (3.3) | 1 (3.3) | 2 (6.7) | | |
| Moderate to Severe | 1 (3.3) | 1 (3.3) | 1 (3.3) | 1 (3.3) | 1 (3.3) | | |
| **Vocal cord closure** (complete) | Before | After | Before | After | 30 | - | - |
| | 30 | 30 | 30 | 30 | | | |
| **Laryngeal erythema** | Before | After | Before | After | 28 (93.3) | $X^2$1=72.28<br>FET2=4.35<br>$X^2$3=34.15<br>$X^2$4=33.62 | P1=<0.001**<br>P2=0.34<br>P3=<0.001**<br>P4=<0.001** |
| No | 2 (6.7) | 24 (80.0) | 1 (3.3) | 23 (76.7) | | | |
| Mild | 14 (46.7) | 1 (3.3) | 9(30.0) | 2 (6.7) | 1 (3.3) | | |
| Moderate to Severe | 14 (46.7) | 5 (16.7) | 20(66.7) | 5 (16.7) | 1 (3.3) | | |
| **Mucosal edema** | Before | After | Before | After | 26 (86.7) | $X^2$1= 61.96<br>FET2=3.3<br>$X^2$3=36.16<br>$X^2$4=31.62 | P1=<0.001**<br>P2=5.3<br>P3=<0.001**<br>P4=<0.001** |
| No | 2 (6.7) | 25 (83.3) | 1 (3.3) | 22 (73.3) | | | |
| Mild to moderate | 18 (60.0) | 2 (6.7) | 16 (53.3) | 3 (10.0 | 3 (10.0) | | |
| Moderate to severe | 10 (33.3) | 3 (10.0) | 13 (43.3) | 5 (16.7) | 1 (3.3) | | |

1=comparison between three groups before, 2=comparison between three groups after, 3=comparison between 1st group before and after, 4=comparison between 2nd group before and after, *=significant at p<0.05 **= significant at <0.001**

According to laryngeal erythema, the changes were statistically significant as in group I there were 2 patients had no laryngeal erythema became 24 postoperative, but there were 14 patients with mild laryngeal erythema became only one postoperative, while there were 14 patients had moderate to severe laryngeal erythema became 5 postoperative.

Also, in group II there were one patients had no laryngeal erythema became 23 postoperative, but there were 9 patients with mild laryngeal erythema became 2 postoperative, while there were 20 patients had moderate to severe laryngeal erythema became 5 postoperative.

Finally, the changes of laryngeal mucosal edema were statistically significant, as in group I there were 2 patients had no laryngeal mucosal edema became 25 postoperative, but there were 18 patients with mild to moderate laryngeal mucosal edema became 2 postoperative, while there were 10 patients had moderate to severe laryngeal mucosal edema became 5 postoperative.

Also, in group II there were one patients had no laryngeal mucosal edema became 22 postoperative, but there were 16 patients with mild to moderate laryngeal mucosal edema became 3 postoperative, while there

were 13 patients had moderate to severe laryngeal mucosal edema became 5 postoperative.

**Figure 4: Laryngeal edema after the surgery.**

## DISCUSSION

The co-ordination between the vocal cords and the respiratory system including the nasal cavity is important for voice production.[7] Nasal resistance to airflow represents a major role in the quality of voice.[8] About two-third of nasal resistance is through the anterior nasal valve which is mainly a resistance valve and formed by the upper lateral nasal cartilage, the nasal septum and the anterior end of the inferior turbinate.[9] Chronic nasal obstruction may affect may affect the quality of voice and recently with the advances in otorhinolaryngological studies, optimal voice hygiene have gained importance.[9] Nasal polyposis and deviated nasal septum with hypertrophic inferior turbinate are represent two of the most common pathogens that cause chronic nasal obstruction.[2] So in this present study assess the effect of chronic nasal obstruction due to these two pathogens on the quality of voice of those patients. By analysis of the results of this present study, according to laryngeal erythema, the changes were statistically significant as in group I , there were 2 patients had no laryngeal erythema became 24 postoperative, but there were 14 patients with mild laryngeal erythema became only one postoperative, while there were 14 patients had moderate to severe laryngeal erythema became 5 postoperative.

Also, in group II there were one patients had no laryngeal erythema became 23 postoperative, but there were 9 patients with mild laryngeal erythema became 2 postoperative, while there were 20 patients had moderate to severe laryngeal erythema became 5 postoperative.

The changes of laryngeal mucosal edema were statistically significant, as in group I there were 2 patients had no laryngeal mucosal edema became 25 postoperative, but there were 18 patients with mild to moderate laryngeal mucosal edema became 2 postoperative, while there were 10 patients had moderate to severe laryngeal mucosal edema became 5 postoperative.

Also, in group II there were one patients had no laryngeal mucosal edema became 22 postoperative, but there were 16 patients with mild to moderate laryngeal mucosal edema became 3 postoperative, while there were 13 patients had moderate to severe laryngeal mucosal edema became 5 postoperative

The results of the present study are in agree with Karimi et al study in which the laryngeal erythema and the laryngeal mucosal edema were the commonest changes with nasal polyposis that improved significantly after FESS as laryngeal erythema was documented in 18 patients after a 3-month follow-up. Four patients (13.3%) showed mild-to-moderate TVC edema and 26 patients (86.7%) had normal TVC mucosa.[10] By analysis of the results of the present study, the border of the true vocal cords are swollen in 8 patients with deviated nasal septum with hypertrophic inferior turbinate and in 16 patients with nasal polyposis that improved significantly after the nasal surgery to be one patient and 4 patients respectively. The mechanism by which chronic nasal obstruction affect laryngeal mucosa and true vocal cords are clearly not defined but according to Yegin et al, it may be due to changes in the harmonic movement of the true vocal cords because of change in the resistance to air flow due to chronic nasal obstruction.[11]

## CONCLUSION

The nasal surgery would have a significant impact on laryngeal edema, erythema and vocal cord edema.

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*Ethical approval: The study was approved by the Institutional Ethics Committee*

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