

Effects of Deviated Nasal Septum on Sinus Mucosa: A Cadaveric Study

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Abstract

Introduction: A role of deviated nasal septum in nasal obstruction may result into recurrent or chronic sinus infection (sinusitis), as it may block openings of paranasal air sinuses.

Materials and Methods: In this study, we have taken one control group (cadavers with midline septum) and one study group (cadavers with deviated nasal septum). From both groups, mucosa of maxillary sinus was taken.

Results: It was found that in the control group, there were no changes in mucosa or submucosa, but in this study, group findings were suggestive of acute and chronic inflammation.

Conclusion: This proves a strong correlation between deviated nasal septum and chronic sinusitis.

Key words: Chronic sinusitis, Deviated nasal septum, Maxillary ostium, Maxillary sinus mucosa

INTRODUCTION

The nasal septum plays a major role in both formation and function of the nose. Deviation of the nasal septum is extremely common. Theile¹ was first to calculate the frequency (22%) of nasal septum deviation. McKenzie² studied over 2000 European skulls and found that only 23% had a straight septum. Septal deviation has an unfavorable influence on sinus ventilation and drainage. Ganjian *et al.*³ observed that ostial patency is essential to the function of the maxillary sinus. Normally, all paranasal air sinuses open into the lateral wall of the nasal cavity by various small ostia. A deviated nasal septum can obstruct these ostia and may trap fluid in a sinus causing recurrent or chronic sinusitis. Elahi and Frenkiel⁴ found an increased incidence and severity of bilateral chronic sinus disease with increasing septal deviation.

This study was done in cadavers to study the septal deviation and its role as a cause for chronic sinus disease.

MATERIALS AND METHODS

This study was conducted in the Department of Anatomy at Himalayan institute of Medical Sciences, Jolly Grant, Dehradun, Uttarakhand and Shri Guru Ram Rai Institute of Medical and Health Sciences, Dehradun, Uttarakhand. We have divided this study into two groups.

Group - A (Control): It comprised 15 cadavers with a midline nasal septum.

Group - B (Study): It comprised 15 cadavers with a deviated nasal septum.

Total we have taken 30 cadavers. Cadavers with gross external nasal deformity, abnormal mass, or polyps in the nasal cavities were excluded from the study. The head and face regions were cut sagittally just to the right of the midline. The cadavers were examined for midline or deviated nasal septum and associated paranasal sinus involvement.

We observed the following parameters:

I. Nose:

The nasal septum was examined to find out whether in midline or deviated. If deviated:

1. Side - right or left
2. Shape - C-shaped or S-shaped
3. Deformity in cartilaginous part or bony part or both.

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II. Paranasal sinuses:

In this study, only maxillary sinus was taken into account because of all paranasal sinuses - maxillary sinuses are most constant in shape and size, and also most commonly involved in chronic sinusitis.⁵

We observed the following parameters:

1. Patency and size of maxillary ostium - it was done with the help of probes of different sizes and were measured with the help of sliding caliper
2. The volume of maxillary sinus - it was measured with the help of mustard seeds, funnel, and volumetric jar. Mustard seeds being more or less circular leave no interseed space when fully packed and also cost-effective. These were filled in volumetric jar up to a measured level. The sinuses were filled through the ostia by means of a funnel with mustard seeds⁶
3. Histological study of mucosa is taken from maxillary sinus - it was fixed in 10% formalin and further processed for paraffin sections and were stained by Hematoxylin and Eosin method.

The results were compared between two groups.

RESULTS

I. Nasal septum:

1. Side Incidence - In Group B, it was observed that right sided deviation found in 47% cases while left-sided deviation was in 53%
2. In 80% cases, C-shaped deviation on both sides was found while S-shaped deviation was much less in comparison to C-shaped (Figure 1)
3. Incidence of deviation of the cartilaginous part was much more (80%) than bony part (20%).

II. Maxillary sinus:

1. Patency and size of maxillary ostium - The reading observed in Group B was statistically significant ($P < 0.01$, Figure 2)
2. Volume of maxillary sinus - The reading observed in Group B was statistically significant ($P < 0.001$, Figure 3)
3. Histological Examination - On microscopic examination of mucosa is taken from cadavers of both groups, it was observed as follows:

Group A - Most of the cadavers (73.4%) had normal mucosa (pseudostratified ciliated columnar epithelial lining without erosion) (Figure 4).

Group B - Findings suggestive of acute (20% cadavers) as well as chronic inflammation (80%) were found.

- Acute inflammation: There was epithelial erosion, congested, and dilated blood vessels with infiltration of polymorphs (Figure 5)

- Chronic inflammation: Glands were seen hyperplastic along with eroded epithelium. Edema was seen in submucosa beneath the epithelium (Figure 6). Infiltration of lymphocytes and polymorphs is also seen (Figure 7).

DISCUSSION

In this study, the incidence of left-sided nasal septal deviation was found to be more (53.3%) than that of right side which was seen in 46.7% cadavers. The c-shaped

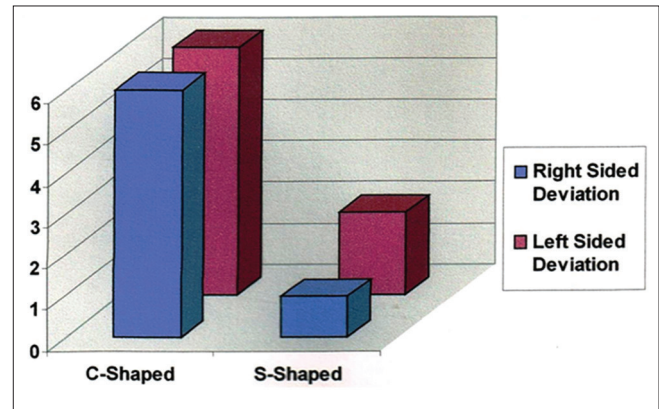


Figure 1: Incidence of right and left sided deviation according to shape of nasal septal deviation in Group B

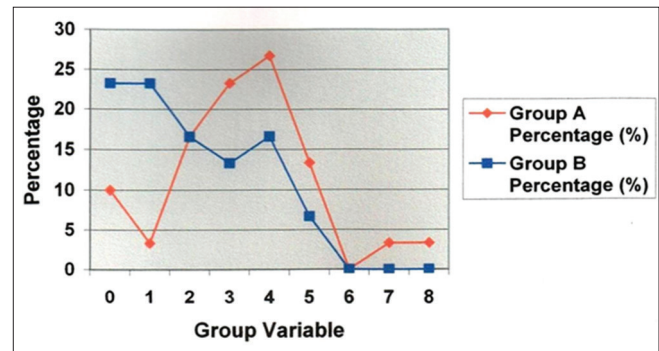


Figure 2: Comparison of incidence of number of cadavers in different group variables of size of ostium in both groups

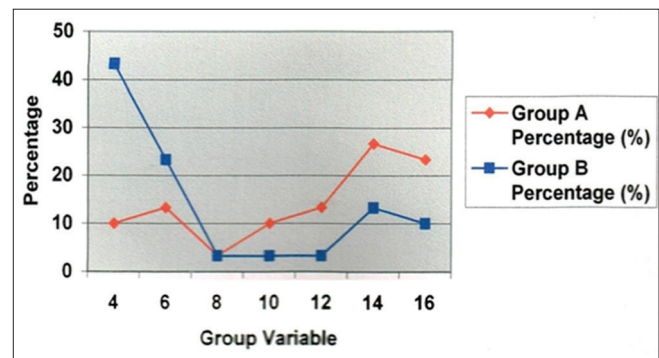


Figure 3: Comparison of incidence of number of cadavers in different group variables of volume of maxillary sinuses in both groups

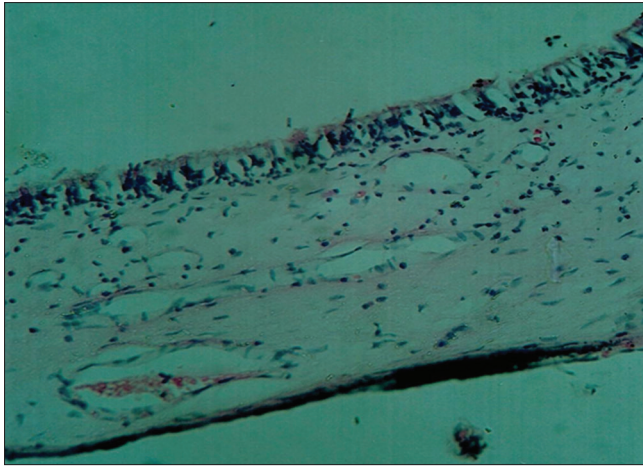


Figure 4: Normal histology of maxillary sinus mucosa of midline septum cadaver showing pseudostratified ciliated columnar epithelium, (H and E, ×200)

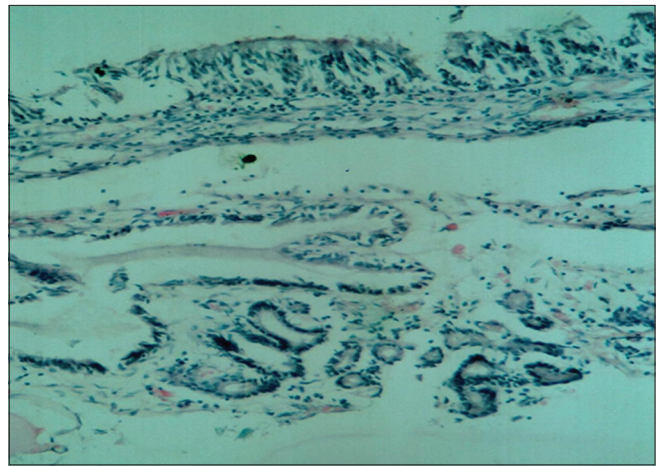


Figure 6: Sinus mucosa of deviated septum cadaver showing chronic inflammation. Epithelial erosion is seen along with edema in submucosa. Gland is too much enlarged and hyperplastic in nature, (H and E, ×200)

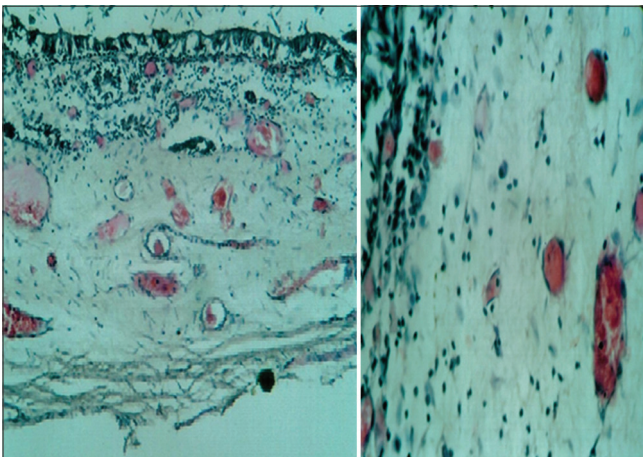


Figure 5: Sinus mucosa of deviated septum cadaver showing acute inflammation dilated and congested blood vessels are seen with infiltration of polymorphs (H and E ×200), (H and E, ×400)

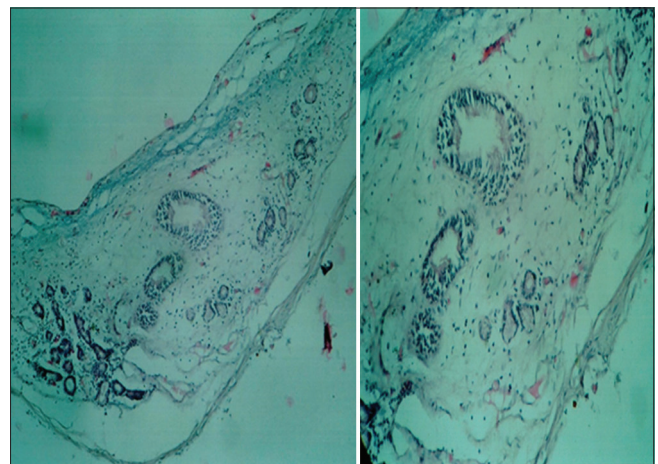


Figure 7: Sinus mucosa of deviated septum cadaver showing chronic inflammation. Epithelium not well marked. Edema and cellular predominance in submucosa. Glands are exceedingly numerous and hyperplastic, (H and E, ×100), (H and E, ×200)

deviation was more common than S-shaped deviation. Sinha and Maheshwari⁷ also reported this in anatomical study on skulls (879) from different provinces; they found 25% incidence of deviation of bony septum. They also found left sided deviation more common than the right side.

In Group A, the average size of ostium was 3.65 mm while in Group B it was 2.15 mm. Statistically this difference was found to be highly significant ($P < 0.01$). In previous studies, Francis and Mathew⁸ found that ostium size averages 2.4 mm but can vary from 1-17 mm, whereas Saijo *et al.*⁹ found it to be 6.8 mm (range 3.7-14.5). Less diameter of the maxillary ostium of Group B signifies that edema of mucosa surrounding it can markedly reduce the size of the ostium.

In this study, the average volume of maxillary sinus was 10.16 cc (range 3-16 cc) in Group A while in Group B it was 6.13 cc (range 2-16 cc). Thus, it was less in Group B than Group A ($P < 0.001$). This finding correlated well with the size of ostium. In previous computed tomography research studies, Sanchez *et al.*¹⁰ found that volume of maxillary sinus was 13.07 cm³ while according to Francis and Mathew⁸ it was 15 ml.

In this study, we observed that most of the cadavers had normal mucosa in Group A while cadavers in Group B had marked changes in the mucosa of maxillary sinus like acute as well as chronic inflammation. In both these groups, there was correlation of histological findings with other measurements like size of ostia and volume of the sinuses.

All these findings suggestive of inflammatory changes of sinus mucosa were more marked in cadavers of Group B.

In this study, it was found that all cases of chronic maxillary sinusitis were associated with anatomical variations and most common was deviated nasal septum.

CONCLUSION

In this study, histopathology of maxillary sinus mucosa was done which proves a strong correlation of deviated nasal septum with chronic sinusitis. It is, therefore, necessary that the management of chronic maxillary sinusitis should include simultaneous treatment of deviated nasal septum.

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