ABSTRACT

Introduction: The asymmetric hidden sphenoid sinuses get separated by a bony septum which rarely lies in the median plane. Deviated Nasal Septum (DNS) formed by bony and cartilaginous parts can be identified by clinical examination. Paucity of literature about the concomitant side deviation of both the septum, has been found.

Aim: To find the predictive relation between the side deviation of nasal and sphenoid septum.

Materials and Methods: A cross-sectional study was undertaken with coronal CT image sets of paranasal air sinuses at Chennai Medical College Hospital and Research Centre, Trichy, Tamil Nadu. Images of subjects above 18 years of age without chronic sinusitis blocking Infundibulo-osteal complex, space occupying lesion, previous sinonasal surgeries, and inflammatory polyps were included from December 2016 to January 2017. In 130 source image sets, side deviation of the nasal septum and sphenoid septum were observed and categorised. The data were analysed using IBM SPSS Statistics for Windows, version 26 and a p-value of <0.05 was considered as statistically significant. The agreement of corresponding side deviation of nasal and sphenoid septum was tested using chi-square and Kappa test.

Results: The DNS was noted in 94.6% (123 of 130) of images. The right, left and median deviations were observed in 50.8% (66 of 130), 43.8% (57 of 130) and 5.4% (7 of 130), respectively. The sphenoid septum deviations of right, left and median was noted in 43.1% (56 of 130), 36.9% (48 of 130), and 19.2% (25 of 130), respectively. The right deviated sphenoid septum was seen in 39 out of 66 right DNS images and left deviated in 29 out of 57 left DNS images. Chi-square showed statistical significance (p-value=0.0031) and kappa [0.231 (SE of kappa=0.064, 95% confidence interval: from 0.104 to 0.357)] was assessed as a fair agreement between the observed values.

Conclusion: The fair agreement between sides of DNS with position of sphenoid septum concludes that DNS could be a probable predictor of position of sphenoid septum.

INTRODUCTION

The sphenoid sinuses are asymmetric air cavities located within the body of sphenoid bone and are separated by a bony septum [1]. The sphenoid sinuses present with varying degrees of pneumatization and are also related to vital structures near the sellar region [2]. The sphenoid septum lies rarely on the median plane but very often deviated laterally to one side or the other [3-5]. Minimal traumatisation of nasal structures enabling quick recovery postoperatively with less complications in addition to providing panoramic view of operating field have made endoscopic endonasal trans-sphenoidal approach as the preferred surgical route to pituitary tumours now a days [6,7].

The sphenoid sinus is a hidden sinus and examination of it could be only possible by image analysis. There is a paucity of literature proposing any anatomical structure as predictor for sphenoid septal deviation by physical examination itself. An insignificant association between sides of nasal septal deviation and position of sphenoid septum in Mediterranean ethnicity was reported [8].

Nasal septum having bony and cartilaginous nasal components also occurs rarely in midline, causing DNS with a reported incidence of 62% that can be identified by clinical examination itself [8-13]. By mid-sixth week of development, the developing sphenoid bone cartilage contributes to the nasal septum formation [14]. This developmental sequence forms the basis for consideration that the side of deviation in sphenoid septum might result in concomitant side deviation of nasal septum [14].

Therefore, this study was done to test the hypothesis that the clinically observed side of deviation of nasal septum could act as a predictor for side of sphenoid septum deviation.

MATERIALS AND METHODS

A cross-sectional computerised tomographic study was undertaken with coronal CT image sets of paranasal air sinuses from archives of Department of Radiology, Chennai Medical College Hospital and Research Centre, Trichy, Tamil Nadu collected over a period of two months from December 2016 to January 2017. Without subject to any further sampling, universally we have included all the clinical records applicable during reference period. The study was initiated with approval from the Institutional Ethics Committee (IEC no. CMCH&RC/IEC NO- 34, dated 20/09/2016) and after obtaining informed consent from the study participants. The CT scan images were taken using GE Healthcare Lightspeed Ultra CT Scan Machine 8 slice with 3 mm thickness. The age of the subjects ranged from 18 to 60 years.

Images of subjects above 18 years of age were included in the study. The subjects with chronic sinusitis blocking Infundibulo-osteal complex, space occupying lesions, previous sinonasal surgeries, and inflammatory polyps were excluded from the study.

The 130 coronal CT source image sets obtained without subjecting to any further sampling, universally we have included all the image sets available during the reference period and after applying exclusion and inclusion criteria. They were analysed by RadiAnt DICOM Viewer (Medixant co., version-2020.1.1). The reference line for determining DNS was marked by two points. The first point was made at the superior attachment of nasal septum at the base of crista galli and the second point was made at the inferior attachment of septum at maxillary crest/anterior nasal spine. The bony part of the nasal septum was assessed for deviation in coronal images. The side of nasal septum convexity/deviation was determined posteriorly.
to the reference line and was classified into right, left or median (no deviation) [15].

The deviation direction of sphenoid septum was observed from anterior to posterior plane. In images with more than one septum, a complete median or paramedian oriented septum extending from anterior to posterior was confirmed as the main septum. The deviation direction of sphenoid septum was determined as right, left and median with reference to posterior wall of the sphenoid sinus [8]. The number of images that showed corresponding side deviation of both nasal and sphenoid septum was also noted.

**STATISTICAL ANALYSIS**

The data collected were statistically analysed using IBM SPSS Statistics for Windows, version 26 (IBM Corp., Armonk, N.Y., USA). The p-value of <0.05 was considered statistically significant for all tests. Statistical agreement of two variables, corresponding side deviation of nasal and sphenoid septum was done using Chi-square and Kappa test.

**RESULTS**

The computerised tomographic analysis of 130 coronal image sets of paranasal air sinuses with a mean±SD age of 40.3±1.63 years were analysed for deviation direction of nasal septum and sphenoid septum. In the study, male to female distribution was 64 and 66, respectively. The DNS was noted in 94.6% of images (123 of 130) and the deviation direction of nasal septum was determined to be on right, left and median [Table/Fig-1,2].

<table>
<thead>
<tr>
<th>Deviation direction</th>
<th>Number of images</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>66</td>
<td>50.8%</td>
</tr>
<tr>
<td>Left</td>
<td>57</td>
<td>43.8%</td>
</tr>
<tr>
<td>Median</td>
<td>7</td>
<td>5.4%</td>
</tr>
<tr>
<td>Total</td>
<td>130</td>
<td>100%</td>
</tr>
</tbody>
</table>

[Table/Fig-1]: Incidence of deviation direction of nasal septum.

The sphenoid septum was observed in 99.2% of images (129 of 130) and was absent in 0.8% of images (1 of 130). The incidence of deviation direction of sphenoid septum was observed to be on the right, left or median (no deviation) as tabulated [Table/Fig-3,4].

<table>
<thead>
<tr>
<th>Deviation direction</th>
<th>Number of images</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>56</td>
<td>43.1%</td>
</tr>
<tr>
<td>Left</td>
<td>48</td>
<td>36.9%</td>
</tr>
<tr>
<td>Median</td>
<td>25</td>
<td>19.2%</td>
</tr>
<tr>
<td>Absent</td>
<td>1</td>
<td>0.8%</td>
</tr>
<tr>
<td>Total</td>
<td>130</td>
<td>100%</td>
</tr>
</tbody>
</table>

[Table/Fig-3]: Incidence of deviation direction of sphenoid septum.

The sphenoid septum was deviated to right side in 39 out of 66 images that belonged to right sided DNS. The sphenoid septum was deviated to left side in 29 out of 57 images with left sided DNS. This association between the side of DNS and sphenoid septal deviation proved to be statistically significant with p-value=0.0031 after applying chi-square test [Table/Fig-5].

The Kappa test was applied to know the intergroup agreements between the deviation direction of nasal and sphenoid septa. The value of k=0.231 (SE of k=0.064, 95% confidence interval: From 0.104 to 0.357) was assessed as a fair agreement between the observed values of direction deviations of nasal and sphenoid septa (kappa between 0.21 and 0.40: fair agreement).

The proposed null hypothesis was that there is no statistically significant association between the side of DNS and sphenoid septal deviation has been rejected as the association was shown to be statistically significant by applying chi-square test (p-value=0.0031).

**DISCUSSION**

A common phenomenon that occurs in the nasal septum is its deviation to either side. Previous literature shows references of such deviation of DNS with either right or left side predominance [Table/Fig-6] [8-19].

Right-sided dominance was observed in the present study and was reported by some previous studies as well [9, 17, 18-19]. Such deviations were proposed to be as a result of trauma either during intrauterine life or postnatal life [20]. A developmental theory was also put forth as the probable cause for such deviation in the nasal septum with sphenoidal process playing the pivotal role [21,22]. The sphenoidal process of cartilaginous septum in cases of DNS was observed to be significantly longer and prominent with distinct histology [21]. A study on role of sphenoidal process in DNS showed that increasing angle of deviation noted in cases with long sphenoid process [22]. These observations could be...
The endoscopic endonasal trans-sphenoidal approach has wide application and recommended in treatment of pituitary tumours, craniofacial disorders, germinomas of sellar and parasellar region in adult as well as paediatrics, due to its minimal invasiveness, less trauma and for maintaining anatomical integrity [26,27]. During this procedure, the excision of sphenoid septum is a necessity for adequate exposure of sella and the surgeon must have orientation to deviated direction of sphenoid septum pre operatively [6,7,26,27].

The anatomical variations of deviated sphenoid septum and its relationship to nearby vital structures like internal carotid artery, optic nerve, pituitary gland delineates the determination of its position for safety during surgery [1,2].

In concordance with present study’s finding of same side deviation of DNS and sphenoid septum to either right side (59.09% i.e., 39 out of 66) or left side (50.87% i.e., 29 out of 57), another study also observed and reported concomitant deviation of both septa to right or left sides in 21.8% and 18.8% cases, respectively [8]. The possible predictive relation of side of deviation of DNS in determining the sphenoid septal position in this study stands in fair agreement statistically by kappa analysis of 0.231 and significant by Chi-square with p=0.0031.

### Limitation(s)

In spite of this statistical agreement, the limited sample size and the cross-sectional study design limited the generalisability of the relation between sides of DNS to the side of sphenoid septum position.

### Conclusion(s)

The present study findings shows a fair statistical agreement between sides of deviation of nasal septum with position of sphenoid septum, thus we conclude that the direction of DNS could be a probable predictor of side deviation of sphenoid septum. These relational findings would aid the surgeon to preoperatively plan upon the side of main access during endoscopic endonasal trans-sphenoidal approaches. Further prospective studies are recommended with more sample size of endoscopic endonasal trans-sphenoidal approach regarding this relation between the septa are needed to confirm the relationship.

### References

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