Surgical relevance of sphenoid sinus and its ostium: An anatomical study

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ABSTRACT

Background: Sphenoid sinuses and their ostia are highly variable structures. Normal opening of sphenoid sinus lies in the sphenoethmoidal recess medial to superior turbinate. The sphenoid sinus is surrounded by several important structures like optic nerve, carotid arteries and the trigeminal nerves. Objective: The present study was performed to determine the anatomical correlations of the sphenoid sinus ostium with surrounding structures. Materials and Methods: The study was carried out in the Department of Anatomy, Kasturba Medical College, Manipal on 40 sagittal head and neck sections of adult formalin fixed cadavers. The shape of the sphenoid sinus ostia was noted. The distance of the ostium from the major landmarks were measured using vernier calipers. The landmarks used were the choana, nasion, anterior end of superior concha and basisphenoid. The extent of pneumatization towards the sella was also noted. Results: In our study, majority of cases showed sellar variety on both right and left side. The shape of the sphenoid sinus ostia was slit type in majority of cases followed by oval and round shape. Conclusion: The sphenoid ostium provides a natural portal for entering the sphenoid sinus and beyond up to the base of the skull. It is not always easy to locate the ostium during endoscopic approach. The present study was therefore designed to establish readily identifiable anatomical landmarks for locating the sphenoid ostium.

Key words: Choana, sphenoethmoidal recess, sphenoid ostium, sphenoid sinus

INTRODUCTION

The body of the sphenoid bone is pneumatized to form the sphenoid air sinus. The sphenoid sinus communicates with the nasal cavity through the so-called sphenoid ostia, located at each side of the midline. Sphenoid sinuses and their ostia are highly variable structures. Normal opening of sphenoid sinus lies in the sphenoethmoidal recess medial to superior turbinate.\[1\]

The sphenoid sinus is surrounded by several important structures. These include the optic nerves, which border the supero-lateral wall, the carotid arteries which line the mid-lateral wall, the trigeminal nerves in the infero-lateral wall and the Vidian nerves in the floor of the sinus. More than 50% of the bone covering these structures may be less than 0.5 mm thick and in many cases there may be a bony dehiscence in the sinus.\[2\]

The pituitary fossa is separated from the sphenoid sinus only by a thin layer of bone (the floor of the sella turcica).\[3,4\] According to the extent of sinus pneumatization, the bone separating the carotid arteries, optic nerves, maxillary nerves, and Vidian nerves can be thin or even absent, making these structures susceptible to iatrogenic injuries.\[5\]

The transnasal-sphenoidal approach has become a standard procedure for resection of pituitary tumors due to the recent application of endoscopy, which is being increasingly used by surgeons as an effective
The present study was performed to determine the anatomical correlations of the sphenoid sinus ostium (SO) with surrounding structures in the cadavers to find out surgical landmarks for safe sellar floor dissection in anterior skull base surgery with endoscopy or microscopic surgery. The exact location of sphenoid ostium is very much essential in endoscopic sinus surgeries as well as trans-sphenoidal hypophyseal approach. Although the literature reveals quite a number of studies on anatomy of sphenoid sinus, limited literature is available for the SO and its relations. Therefore this study was undertaken to identify the location of SO in relation to the surgically relevant anatomical landmarks.

MATERIALS AND METHODS

The study was carried out in the Department of Anatomy, Kasturba Medical College, Manipal on 40 sagittal head and neck sections (20 right and 20 left) of adult formalin fixed cadavers. The SO was located and its shape were noted. The landmarks taken were choana (C), nasion (N), anterior end of superior concha (SC) and basisphenoid (BS). The distances were measured from the SO using vernier calipers. The extent of pneumatization towards the sella was noted and the sphenoid sinus was classified as presellar and sellar variety.

RESULTS

The present study was done on 40 sagittal sections of head and neck specimens. The mean and standard deviation of the studied parameters were represented in Table 1.

<table>
<thead>
<tr>
<th>Parameters measured</th>
<th>Right side mean±SD in cm (n=20)</th>
<th>Left side mean±SD in cm (n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C- SO</td>
<td>1.37±0.33</td>
<td>1.5±0.46</td>
</tr>
<tr>
<td>N- SO</td>
<td>4.58±0.48</td>
<td>4.49±0.25</td>
</tr>
<tr>
<td>SC- SO</td>
<td>1.52±0.30</td>
<td>1.42±0.39</td>
</tr>
<tr>
<td>BS- SO</td>
<td>3.64±0.63</td>
<td>3.62±0.60</td>
</tr>
</tbody>
</table>

C- Choana, N- Nasion, SC- Anterior end of superior concha, BS- Basi-sphenoid, SO= spheno id sinus ostium

After classification of the sphenoid air sinus based on the extent of pneumatization, we found that majority of the cases showed sellar variety on both right (85%) and left sides (82%). The presellar variety was 15% on the right side and 18% on the left side.

The shape of the sphenoid sinus ostia was slit type in majority of the cases (13 right and 12 left) followed by oval (6 right and 6 left) and round (1 right and 2 left) shape.
DISCUSSION

The sphenoid sinuses are the most inaccessible paranasal sinuses. They are also bordered by more vital structures than any other sinus.

In a study by Gupta et al[1] the mean distance from the supero-lateral angle of the posterior choana to the SO was found to be 21.21 ± 6.02 mm. The mean distance between the inferior end of the SO and the postero-inferior edge of the superior turbinate was 8.03 ± 3.52 mm. In our study the mean distance from the supero-lateral angle of the posterior choana to the SO was found to be 13.7 ±0.33mm on right side and 15± 0.46 mm on the left side. The mean distance between the inferior end of the SO and the postero-inferior edge of the superior turbinate was 15.2 ± 0.3 mm on right side and on left side 14.2±0.39 mm respectively. Various authors have focused on the anatomy of the sphenoid sinus, including their level of pneumatization and the shape and quantity of their inner septa, or the diameters of their cavities. However articles focusing on the anatomy of the sphenoid sinus ostia are scarce. The location of the ostia of the sphenoid air sinus has implications for the transsphenoidal approach. Kim et al[7] suggested that the best anatomical reference that enables identification of the sphenoid ostia is the postero inferior end of the superior turbinate, where each cavity is located medially and superiorly. In addition, they also found that both ostia were located half-way between the superior and inferior margin of the anterior wall of the sphenoid sinus.

Figure 3: Postsellar type of sphenoid sinus (ST-Sella turcica, SS-Sphenoid sinus)

Type of sphenoid sinus pneumatization depends on the position of the sinus in relation to the sella turcica. In the present study the classification proposed by Hammer and Radberg[9] was adopted which classified the sphenoid sinus into three types: conchal, presellar, and sellar. In a study by Tan et al[10] sellar type was found in 55% of sinuses (53/96) followed by conchal (28%) and presellar type (17%). Twelve specimens (25%) had bilateral sellar cavities while none was totally conchal or presellar. In our study we found that sellar pneumatization was common. Sellar pneumatization is an ideal anatomical configuration for trans-sphenoidal hypophysectomy because the bulge of the sella turcica floor is easily visualized in the operative field.[11]

Shape of the sphenoid ostia when visualized in a study by Lang J revealed 70% of the ostia to be round in shape, whereas 28% were ovoid, with the greater diameter usually oriented in the vertical plane.[12] In our study we found the sphenoid sinus ostia was slit type in majority of the cases followed by oval and round shape. The round shape ostia were seen more on the left side compared to the right side.

The complex and diverse relations of the sphenoid sinus have a dual significance. Firstly, diseases of the sphenoid sinus tend to give rise to a complexity of symptoms and potentially serious complications. Secondly, inadequate understanding of these relationships undoubtedly increases the possibility of serious and occasionally fatal iatrogenic mishaps.

CONCLUSION

The sphenoid ostium provides a natural portal for entering the sphenoid sinus and beyond up to the skull base. It is not always easy to locate the ostium during the endoscopic approach. The present study would therefore be useful to establish readily identifiable anatomical landmarks for locating the sphenoid ostium.
REFERENCES


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