Anatomic variations and references of the sphenopalatine foramen in cadaveric specimens: a Mexican study

ABSTRACT

Background: The sphenopalatine foramen is located on the lateral nasal wall and has multiple variants and anatomic landmarks that are important in order to optimize results in the surgical management of posterior epistaxis. This study describes the endoscopic anatomy of the sphenopalatine foramen, related structures and anatomic variations in a Mexican population.

Methods: We performed a prospective, observational, and experimental study. Five cadaveric specimens were included. Dissections were performed to identify the anatomy of the sphenopalatine foramen and anatomic variants. Measurements were obtained from different anatomic references to the columella.

Results: Of a total of ten dissections, in 100% of cases ethmoid crests were identified anterior to the sphenopalatine foramen. Localization of the sphenopalatine foramen in the lateral nasal wall in 60% cases was in the transition from the middle meatus with superior meatus. The vidian nerve in 90% of the cases was located superior and posterior to the sphenopalatine foramen. For measurements, no significant differences between the two sides of each specimen were noticed.

Conclusions: The sphenopalatine foramen presents multiple anatomic variants and numerous landmarks, which are important to comprehend in order to perform successful and safe endoscopic sinus surgery.

Key words: Sphenopalatine foramen, sphenopalatine artery, vidian nerve, posterior epistaxis, ethmoid crest, lateral nasal wall.
BACKGROUND

The sphenopalatine foramen is located in the lateral nasal wall near the posterior insertion of the middle turbinate. The vertical diameter is 6.2 mm (4.5-7.5) and the horizontal is 5.1 mm (3.5-6.0). Its anatomic boundaries are anterior to the palatine orbital process; inferior to the perpendicular plate of the palatine; posterior to the sphenoidal process of the palatine, and the lateral is found in the pterygopalatine fossa.

The sphenopalatine artery emerges through the sphenopalatine foramen, which is the terminal branch of the internal maxillary artery and, in turn, separates into two branches and gives rise to the posterior nasal artery and nasoseptal artery. The anatomic references for locating the sphenopalatine foramen in the nasal wall are the ethmoidal crest of the palatine bone, which is located in 95% of patients, vidian nerve, anterior wall of the sphenoid sinus and posterior wall of the maxillary sinus.

Recognizing the anatomic variants and references of the sphenopalatine foramen allows performing an adequate vascular control of patients with nasosinus tumors of varied histology, safer approaches to the base of the skull, performance of neurectomies of the vidian nerve and clipping of the sphenopalatine artery for epistaxis control.

The surgical technique was performed with endoscopic vision with 0° and 30° rigid endoscopes, the middle turbinate was medialized, and the anatomic references were identified (posterior insertion of the middle turbinate, choana, anterior wall of the sphenoid and posterior fontanelle) (Figure 1). A vertical incision of ~1 cm was made behind the posterior fontanelle, and the submucosal flap was elevated until the ethmoidal crest was identified (Figure 2). Behind it the sphenopalatine foramen and the arterial trunk and its branches were found (Figure 3). The dissection was continued in a posterosuperior direction until the vidian nerve was localized (Figure 4). Subsequently, different measurements of the columella were carried out to the anatomic

METHODS

We carried out a prospective, observational, and experimental study. There were five adult cadaveric adult specimens of Mexican origin; the age and nationality of the specimens was corroborated with the data recorded by the forensic medical service in Mexico City. Specimens with a history of brain injury or facial traumatic injury, craniofacial malformations and sinus tumors were excluded. Dissections were carried out in the forensic medical service of Mexico City with permission (SP/DIS/083/2012) from February 1 to November 30, 2012.

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Figure 1. Image of cadaveric dissection in the left nasal fossa.

MT: middle turbinate, IT: inferior turbinate.
references (distances to the ethmoid crest, sphenopalatine foramen, vidian nerve and the nasal floor to the sphenopalatine foramen) using a digital calibrator (in centimeters). Descriptive statistics were used for non-parametric variables. For parametric variables, paired \( t \) test (Gaussian distribution) or Wilcoxon test (rank distribution) was used (SigmaPlot v.11.0 program).

**RESULTS**

A total of five cadaveric specimens were included and ten dissections were carried out. The median age was 61 years (54-68 years); 80% of the specimens were males. In 60% of the specimens the sphenopalatine foramen was located in the transition of the middle meatus with the superior meatus; in all specimens the ethmoid crest anterior to the sphenopalatine foramen was identified. In 70% a branch of the sphenopalatine artery was identified and in 20%, two of its branches and only in 10% three branches. In 90% of the cases the vidian nerve was localized in posterosuperior direction to the sphenopalatine foramen. In none of the specimens were the accessory foramen found (Figure 5).

The distance from the columella to the ethmoid crest on the right side was 7.12 ± 0.165 and on the left 6.98 ± 0.111. The right sphenopalatine foramen was 7.42 ± 0.190 and the left 7.36 ± 0.092. The right vidian nerve was 7.94 ± 0.128
Table 1. Distance (in cm) of the columella to the different anatomic references

<table>
<thead>
<tr>
<th></th>
<th>Right</th>
<th>Left</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethmoid crest</td>
<td>7.12 ± 0.165</td>
<td>6.98 ± 0.111</td>
<td>p = 0.226</td>
</tr>
<tr>
<td>Sphenopalatine foramen</td>
<td>7.42 ± 0.190</td>
<td>7.36 ± 0.092</td>
<td>p = 0.62</td>
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<tr>
<td>Vidian nerve</td>
<td>7.94 ± 0.128</td>
<td>7.8 ± 0.114</td>
<td>p = 0.063</td>
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<tr>
<td>Nasal floor of sphenopalatine foramen</td>
<td>1.88 ± 0.159</td>
<td>1.9 ± 0.070</td>
<td>p = 0.854</td>
</tr>
</tbody>
</table>
right. As far as the authors know, based on the review of the medical literature, this work is the first descriptive anatomic study in a Mexican population.

In conclusion, the endoscopic anatomy of the sphenopalatine foramen is complex and has multiple anatomic variants that should be kept in mind for adequate endonasal vascular control. The most important reference is the ethmoid crest because in 100% of the cases it was localized anterior to the sphenopalatine foramen, as well as its localization in the transition of the middle meatus with the superior meatus. The distances from the columella to the most utilized anatomic references for localizing the sphenopalatine foramen are described, which can be very useful for optimal results in nasal endoscopic surgery.

REFERENCES