ANATOMICAL RELATIONSHIPS OF FORAMEN OVALE: A RADIOANATOMICAL STUDY

Ahmed Youssef MD, C. Arturo Solares MD Ahmed Tantawy MD, Ahmed Aly Ibrahim MD,
Bradley A. Otto MD, Daniel M. Prevedello MD, Leo Ditzel Filho MD, Ricardo L. Carrau MD.
Departments of Otolaryngology-Head and Neck Surgery: Alexandria University, Egypt & Ohio State University Wexner Medical Center, Columbus, OH, USA.

Background

- Endonasal endoscopic transpterygoid approaches are valuable and commonly used techniques to access the infratemporal fossa and parapharyngeal space.
- Important endonasal endonal landmarks for the post styling parapharyngeal space, hence the internal carotid artery, include: the mandibular nerve at the level of foramen ovale and the lateral pterygoid plate.
- We aimed to define the anatomic relationships of the foramen ovale and the mandibular nerve, establishing their distance to other important anatomical landmarks such as the pterygoid process and columella.

Methods

- Distances between foramen ovale, foramen rotundum and fixed anatomical landmarks like the columella and pterygoid process were measured using CTA scans and cadaveric dissections of the pterygopalatine and infratemporal fossae.
- The distance from the columella to the foramen ovale was measured on the CTAs.
- The most anterior and inferior point of the columella and the most anterior and inferior point of the foramen ovale were selected, and distances were calculated using the Osirix software.
- The most anterior and inferior part of the columella was again used as a reference point to measure the distance to the foramen rotundum.
- The most anterior part of the foramen rotundum on its extracranial surface was used as the second point.
- The distance was then calculated using the previously described technique, then the distance from the pterygoid prominence to the foramen ovale was measured as follows: We identified a point on the pterygoid prominence by finding the most anterior portion of the pterygoid process in an axial scan and then aligning it with the most lateral aspect of the lateral pterygoid viewed on a coronal scan. The second point was placed on the most anterior and inferior aspect of foramen ovale.

Radiological Measurements

Endoscopic Measurements

Results

- Analysis of the endoscopic measurements yielded that the mean distances from foramen ovale and foramen rotundum to the columella were 9.15 cm and 7.09 cm, respectively.
- Radiological measurements done in 28 CTAs showing average, standard deviation, and confidence intervals.
- Left and right measurements were then combined into the same data set and the same calculations were implemented.
- Our null hypothesis for the t-test was that there is no difference in the measurements between left and right sides as shown in the table.
- The P value was greater than 0.05 indicating that the null hypothesis would be accepted. This supports the notion that there was not a statistically significant difference between the right and left measurements.
- Measurements for male and female patients were analyzed in a similar manner obtaining a P value of greater than 0.05; thus, indicating no statistical significance between the measurements in male and female patients.
- The average distance from foramen rotundum to columella was found to range from 6.59cm to 6.95cm in CTAs measurements, whereas the endoscopic measurements mean distance was 7.09cm.
- As regard the foramen ovale measurements to columella, there is a statistically significant difference between the endoscopic measurements mean distance (9.15cm) and the average of radiological measurements (7.25-7.52cm).

Discussion

- Endonasal endoscopic transpterygoid approaches are effective for the treatment of select lesions affecting the infratemporal fossa.
- Important landmarks during the endonasal endoscopic approach to the ITF (infratemporal fossa) and post styling space include the pterygoid plates, V3 and the Eustachian tube.
- Objective measurements of these anatomical landmarks enhance the understanding of the endoscopic anatomy of the ITF allowing a safe and complete resection of lesions arising or extending to that area. In addition, they also serve as a template for the design of new instrumentations.

Foramen ovale and its measurements to pterygoid process

F0: Foramen ovale, F1: Internal maxillary artery, FR: Foramen rotundum, V3: Mandibular nerve, V2: Maxillary nerve, PP: Pterygoid process

Measurements of foramen ovale and rotundum to columella
F0: Foramen ovale, IMA: Internal maxillary artery, FR: Foramen rotundum, V3: Mandibular nerve, V2: Maxillary nerve

Measurements of foramen ovale to pterygoid plate

Average radiological measurements of foramen ovale and rotundum in males and females.

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Sex</th>
<th>Average Distance (mm)</th>
<th>95% Confidence Interval (mm)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columella to Foramen Ovale</td>
<td>Male (Right)</td>
<td>7.60</td>
<td>7.29-7.94</td>
<td>0.331</td>
</tr>
<tr>
<td></td>
<td>Male (Left)</td>
<td>7.47</td>
<td>7.35-7.60</td>
<td>0.524</td>
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<tr>
<td></td>
<td>Female (Right)</td>
<td>7.23</td>
<td>7.00-7.46</td>
<td>0.227</td>
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<tr>
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<td>Female (Left)</td>
<td>7.28</td>
<td>7.10-7.46</td>
<td>0.183</td>
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<tr>
<td>Pterygoid Prominence to Foramen Ovale</td>
<td>Male (Right)</td>
<td>1.72</td>
<td>1.64-1.80</td>
<td>0.079</td>
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<td>Female (Right)</td>
<td>1.79</td>
<td>1.70-1.81</td>
<td>0.103</td>
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<td>Female (Left)</td>
<td>1.69</td>
<td>1.60-1.74</td>
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<tr>
<td>Columella to Foramen Rotundum</td>
<td>Male (Left)</td>
<td>6.58</td>
<td>6.33-6.83</td>
<td>0.048</td>
</tr>
<tr>
<td></td>
<td>Female (Right)</td>
<td>6.58</td>
<td>6.47-6.83</td>
<td>0.048</td>
</tr>
<tr>
<td></td>
<td>Female (Left)</td>
<td>6.62</td>
<td>6.40-6.85</td>
<td>0.029</td>
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</table>