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Endoscopic endonasal surgical anatomy of the optic canal: key anatomical relationships between the optic nerve and ophthalmic artery

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Abstract

Purpose: A detailed understanding of the neurovascular relationships between the optic nerve (ON) and the ophthalmic artery (OA) in the optic canal (OC) is paramount for safe surgery. We focused on the neurovascular anatomy of this area from both an endoscopic endonasal and transcranial trajectories to compare the surgical exposures and perspectives offered by these different views and provide recommendations to increase the intraoperative safety.

Methods: Twenty sides of ten formalin-fixed, latex-injected head specimens were utilized. The surgical anatomy and anatomical relationships of the OA in relationship to the ON along their intracranial and intracanalicular segments was studied from endoscopic endonasal and transcranial perspectives.

Results: Three types of OA-ON relationships at the origin of the OA were identified: inferomedial (type 1, 35%), inferior (type 2, 55%), and inferolateral (type 3, 10%). The endoscopic endonasal trajectory offers an inferomedial perspective of the ON-OA neurovascular complex, in which the OA, especially when located inferomedially, is first encountered. When comparing with the transcranial view, all OA were covered by the nerve, type 1 was located below the medial third, type 2 below the middle third, and type 3 below the lateral third of the OC. The mean extension of the intracanalicular portion of both OA and ON was 8.9 mm, while the intracranial portion of the OA and ON were 9.3 mm and 12.4 mm, respectively. The OA, endoscopically, is located within the inferior half of the OC, and occupies

39%, 43%, and 42% of the OC height at its origin, mid, and end points, respectively. The mean distance between the superior margin of the OC at its origin and superior margin of the OA is 1.4 mm.

Conclusions: Detailed anatomical understanding of the OC, and the ON and OA at their intracranial and intracanalicular segments is paramount to safe surgery. When opening the OC dura endoscopically, our results suggest that a medial incision along the superior third of the OC with a proximal to distal direction is recommended to avoid injury of the OA.

Keywords: Anatomy; Endoscopy; Measurements; Ophthalmic artery; Optic canal; Optic nerve.