Dehiscence of the anterior ethmoid artery: a preoperative sign with significant implications for surgical technique.

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Abstract:

Significance: Preoperative review of sinus computed tomography (CT) provides the detailed anatomic assessment essential for safe surgical intervention.

Findings: Early identification of anterior ethmoid artery (AEA) dehiscence can allow for targeted endoscopic surgery without the need for vessel manipulation.

Conclusion: Advances in understanding of endoscopic anatomy and sinus surgery instrumentation allow for safe and effective ethmoid and frontal sinus surgery in patients with complex anatomic variation.

Narrative:

A 23-year old male nonsmoker presented with complaints of longstanding nasal obstruction and frequent sneezing which failed to resolve with multiple trials of nasal steroid sprays including mometasone furoate that he has been using without relief for more than 6-weeks. He complained of associated mid-facial pain and pressure between the eyes however denied epistaxis, vision change, hearing loss or fever. He additionally reported significant difficulty sleeping and underwent a prior home sleep study, which was negative for apnea. He reported occasional consumption of alcohol but denied illicit drug use and works in an office setting. The SNOT-20 questionnaire revealed a score of 39.

On examination, the region of the right medial canthus was tender to palpation while the pupils were equal, round, and reactive to light and extraocular movements were without restriction. Nasal endoscopy revealed hypertrophy of the turbinates with significant nonpurulent thick nasal drainage bilaterally however no polyps were noted. Additional thick mucus was noted in the oropharynx. There were no palpable cervical lymph nodes and the remainder of the head and neck examination were within normal limits.

Computed tomography (CT)-sinus demonstrated multiple anatomic abnormalities. The nasal septum was in contact with the left inferior turbinate, the middle turbinate and medial wall of the maxilla. See Figures 1A-B.
Haller cells were present with significant mucosal thickening noted in the maxillary infundibulum along with suprabullar cells in the ethmoid sinus. See Figure 2. The frontal recess was notable for dehiscence of the left lamina papyracea, exposed anterior ethmoid artery and bilateral Kuhn Type I cells. See Figures 3A-B.

The patient was taken to the operating room where he underwent septoplasty, bilateral endoscopic sinus surgery with submucosal turbinate reduction under general anesthesia. Following left uncinectomy and uncapping of the agar nasi, dissection of the right ethmoid polyps was performed using the 4-millimeter microdebrider with inferior to superior and medial to lateral dissection of the bulla. However, upon dissection of the superior-portion of the ethmoid bulla the anterior ethmoid artery was visualized and demonstrated significant motion therefore the microdebrider pedal was instantaneously released. Examination revealed no further polyps superiorly and there was no evidence of injury to the dehiscent vessel and no further manipulation of the vessel was performed. See Video 1.

The frontal recess regions were obstructed by inflammatory polyps and successfully accessed using a flexible tip guidewire over which a 7mm balloon was advanced and dilated to twelve atmospheres on two occasions without complication and provided access for subsequent polypectomy using a combination of angled hand instruments. The patient tolerated the procedure well and a polyurethane sponge soaked in triamcinolone 40mg/ml was placed in the anterior ethmoid to medialize the middle turbinates bilaterally.
Discussion

The anterior ethmoid artery (AEA) is an important landmark in endoscopic dissection of the skull base that must be evaluated preoperatively via sinus computed tomography (CT) imaging. It originates from the ophthalmic artery, and supplies the anterior ethmoid, frontal sinus, and anterior one third of the nasal septum along with the lateral wall of the adjacent nasal cavity. Anatomic differences are known to exist between males and females and varying ethnicities.\(^1\) The AEA typically exits the orbit through the anterior ethmoidal foramen and crosses the nasal cavity inside the bony anterior ethmoidal canal in a postero-inferior direction before penetrating the skull base between the cribriform plate and the lateral lamella of the olfactory cleft.\(^2,3\)

In a cadaveric dissection of 25 nasal cavities, Araujo Filho et al. demonstrated that the anterior ethmoidal canal showed a degree of dehiscence in 2/3 of patients--42% partially dehiscent and 25% totally dehiscent.\(^4\) The AEA may be located within the ethmoid sinus mesentery in 20-40% of cases, typically occurring when a pneumatized supraorbital ethmoid cell is present. This anatomic variant increases the risk of injury during ethmoidectomy, and can result in significant hemorrhage, CSF leak or vessel retraction culminating in intra-orbital hematoma.\(^5\) Han et al. reported that 18% of retrobulbar hematomas at a single tertiary university hospital were related to endoscopic sinus surgery.\(^6\)

The location of the AEA can vary in its relationship to the ethmoid cells but most commonly it is found between the second and third lamellae in close proximity to the basal lamella in 85% of cases. The general position of the AEA was 21mm away from the axilla of the middle turbinate, 61mm from the anterior nasal spine and 64mm away from the upper-medial nostril border.\(^1,4\)

Advances in endoscopic sinus surgery allow for safe operative intervention in patients with complex anatomic variation. However, 0-degree endoscopy may limit proper identification of the AEA location in comparison to an angled endoscope.\(^7\) Following localization of the AEA, bipolar forceps may be utilized for cauteterization depending on its location, surrounding anatomy and disease extent. Both thorough preoperative assessment of sinonasal anatomy along with appropriate instrument selection during endoscopic sinus surgery remain paramount in performing safe and effective surgery.

References