Surgical implications of an unusual anomaly of the infraorbital nerve

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Abstract
The infraorbital nerve is a direct extension of the maxillary division of the Vth cranial nerve. It typically courses anteriorly through a canal within the bone of the orbital floor. We describe an unusual anatomic variation of this canal that to our knowledge has not been previously described in the literature. This anomaly may have significant implications during surgery on the paranasal sinuses and maxillofacial skeleton. Careful preoperative assessment of the course of the infraorbital nerve is necessary to prevent iatrogenic hypoesthesia, paresthesia, or neuralgia.

Introduction
The infraorbital nerve is responsible for the sensory innervation to the skin of the malar area between the lower eyelid and upper lip. Traumatic or iatrogenic injury to this nerve may result in hypoesthesia, paresthesia, or pain in this area. Therefore, nerve function must be evaluated and documented following any midface trauma or prior to any surgery on the midface or paranasal sinuses, particularly when a Caldwell-Luc approach is planned. It is also important to appreciate the course of the nerve on preoperative radiography. Fine-cut computed tomography (CT) with triplanar reconstruction has enhanced our ability to delineate the course of the infraorbital nerve through its bony canal.

In this article, we describe a case in which an unusual anatomic variation of the infraorbital nerve was observed. The presence of this variation would have made a sublabial approach impossible without nerve sacrifice.

Case report
A 42-year-old man with a 20-year history of chronic sinusitis came to us with symptoms of postnasal drainage, headache, and facial pressure that was greater on the right than on the left. He had undergone endoscopic sinus surgery 2 and 4 years prior to presentation; both surgeries resulted in temporary relief. There was no infraorbital hypoesthesia. The patient’s medical history was unremarkable.

After additional attempts at maximal medical therapy were unsuccessful, the patient elected to undergo revision endoscopic sinus surgery, and preoperative CT was ordered. The CT identified an unusual anatomic variation: The right infraorbital nerve canal passed through the lumen of the maxillary sinus within the lamella of an infraorbital ethmoid (Haller’s) cell (figure).

The patient underwent revision endoscopic sinus surgery under stereotactic image guidance, and the infraorbital ethmoid cell was marsupialized. Care was taken to preserve the bone of the infraorbital nerve canal, and the procedure was completed without complications.

Discussion
The maxillary division of the Vth cranial nerve exits the superior maxillary foramen and enters the orbit via the inferior orbital fissure. It continues anteriorly as the infraorbital nerve and lies within a canal or groove in the orbital floor.

It is important to identify this nerve during surgery on the midface and paranasal sinuses because injury to it may have significant implications on the patient’s quality of life postoperatively. Furthermore, iatrogenic injury to this nerve may prompt medicolegal action against the surgeon. Therefore, it is important to document facial sensation preoperatively and to carefully identify the nerve’s course during preoperative radiologic evaluation.

The infraorbital nerve is particularly at risk during a Caldwell-Luc antrostomy. The availability of endoscopic technology means that this approach is seldom indicated for the routine management of chronic inflammatory disease, but the procedure is occasionally required for the resection of neoplasms, for the ligation of the internal maxillary artery, and during repair of the orbital floor. The infraorbital nerve can be injured during a Caldwell-Luc procedure when the facial flap is elevated at the point where the nerve exits the infraorbital foramen. Cadaver studies have demonstrated that this foramen is located ap-
proximately 6.1 to 7.2 mm from the inferior orbital rim.\textsuperscript{3-5} In our patient, this distance was approximately 14 mm, which would have posed an increased risk of injury had a Caldwell-Luc procedure been required.

In our patient, the infraorbital nerve canal traversed the lumen of the maxillary sinus within the lamella of the infraorbital ethmoid cell rather than coursing within the bone of the orbital floor. Therefore, if a Caldwell-Luc procedure had been performed, the nerve might have been at significant risk during entry into the sinus. Endoscopic sinus surgery with removal of the uncinate process and enlargement of the natural ostium might not have increased the risk to the infraorbital nerve, but meticulous attention was necessary to preserve the nerve during management of the infraorbital ethmoid cell. Portions of this cell that incorporated the infraorbital canal were successfully preserved with the aid of image-guided surgical navigation.

Whittet proposed that dehiscence of the infraorbital nerve canal may result in facial pain in the setting of a narrow natural ostium.\textsuperscript{6} Regional anesthetic blockade of the infraorbital nerve is occasionally required in cases of neuropathic facial pain, as well as during some surgical procedures on the upper jaw.\textsuperscript{5} In these scenarios, it would be important to recognize anatomic variations in the nerve’s course. It is possible that in our patient, bony osteitis and mucosal inflammation in the associated infraorbital ethmoid air cell might have contributed to his symptomatology. Because he did well during the early preoperative period, the option to perform neural blockade was deferred.

In summary, this case highlights the need for careful preoperative evaluation of nerve function and anatomy as depicted by radiographic imaging. Anatomic variations of the infraorbital nerve may increase the risk of iatrogenic injury during surgery of the midface, paranasal sinuses, and maxillofacial skeleton. Such a complication may have a significant impact on the patient’s quality of life.

References