



Concomitant lateral gaze limitation and mydriasis during sinus surgery

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Key-words. Sinusitis; postoperative complications; parasympathetic ganglia; abducens nerve; paralysis **Abstract**

Abstract. *Concomitant Lateral Gaze Limitation and Mydriasis During Sinus Surgery.* **Problem:** Orbital complications (eg, proptosis and loss of vision) may develop rapidly during functional endoscopic sinus surgery (FESS) under local anesthesia.

Case: A 51-year-old man undergoing FESS for recurrent chronic sinusitis complained of blurred vision and diplopia during surgery. The operation was stopped immediately. Physical examination revealed that movement of the right eye was limited in terms of the abduction and dilatation of the right pupil. Magnetic resonance imaging and an ophthalmologic consultation were ordered. Finally, a clinical diagnosis was made of short ciliary and abducens nerve palsy caused by injection of the sphenopalatine block.

Conclusion: We report the first case of concomitant lateral gaze limitation and mydriasis due to the inadvertent injection of anesthesia into the short ciliary and abducens nerve. The patient's prognosis was good; however, every complication can be burdensome to the surgeon. More attention should be paid to avoid such complications when performing local infiltration.

Introduction

The paranasal sinuses are intimately related to the orbit. This relationship has always rendered sinonasal surgery a potential source of major and minor orbital complications. Although orbital complications are uncommon, they are critically important since proptosis and loss of vision can develop rapidly, directly or indirectly,¹ and can be a great burden to surgeons. In addition, there are potential complications that have not, as yet, been reported. When a surgeon encounters an unknown complication, he/she may be flustered and unsure of the appropriate course, which can affect the surgical result.

In this article, we report a newly identified complication that arose during functional endoscopic sinus surgery (FESS); concomitant lateral gaze limitation and mydriasis.

Case

A 51-year-old man was scheduled to undergo FESS for recurrent chronic sinusitis. The procedure was performed under local anesthesia. A cotton pledget soaked in a mixture of 4% lidocaine (60 ml) and epinephrine (1 mg/ml, 20 ml) was inserted into the middle meatus. Sphenopalatine and anterior ethmoid blocks were performed with lidocaine/epinephrine injections (1:100,000, 1 ml), each via a 23 G needle. The eye was uncovered for the patient's convenience.

Ten minutes after local infiltration, the operation was initiated. The ethmoidectomized cavity was filled with soft tissue due to recurrent sinusitis. In addition, anatomic landmarks were disrupted by previous surgery. During the removal of some of the soft tissue from the anterior ethmoid sinus using a microdebrider, the patient complained of blurred vision and diplopia. An ophthalmologic consultation was sought immediately. Physical

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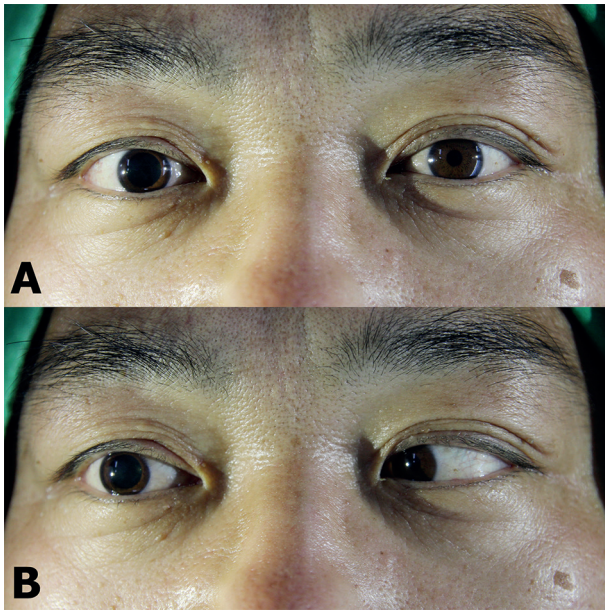


Figure 1

An intraoperative photo of the patient. Note that the right eye is limited in terms of abduction. (A) The right pupil is dilated (8 mm in diameter) and fixed, exhibiting no direct or consensual response to light. The left pupil is not dilated (3 mm in diameter) and exhibited a brisk direct and consensual light response. (B) Abduction is severely limited in the right eye.

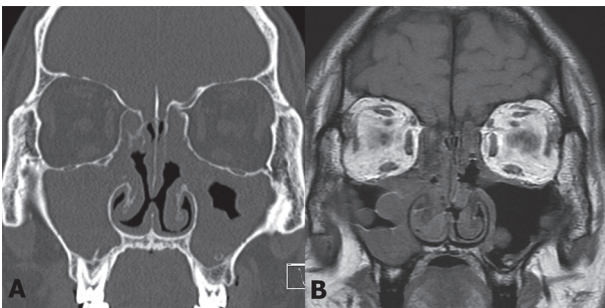


Figure 2

Preoperative computed tomography images of the patient. (A) Soft tissue fully occupies both the maxillary and ethmoid sinuses. Both lamina papyracea are intact. (B) A postoperative magnetic resonance image of the patient reveals evidence of nasal packing and the absence of lesions, such as intraorbital hematoma.

examination revealed that the right pupil was 8 mm in diameter and fixed; it did not exhibit a direct or consensual response to light (Figure 1A). A relative afferent pupillary defect was absent. The left pupil measured 3 mm in diameter and exhibited a brisk direct and consensual light response. The movement of the right eye was limited in terms of abduction (Figure 1B). No other neurological abnormalities were evident. The preoperative computed tomography scan was rechecked (Figure

2A). In addition, the operating site was checked using a navigation system. The medial orbital walls and skull base were intact. The surgery was discontinued. Magnetic resonance imaging revealed no abnormalities (Figure 2B). The patient was kept under observation in the hospital. After 6 hours, the right pupil returned to its normal diameter and the lateral gaze limitation was resolved. A clinical diagnosis was made of short ciliary and abducens nerve palsy caused during injection of the sphenopalatine block. Four months later, the patient remained asymptomatic.

Discussion

Functional endoscopic sinus surgery is one of the most common surgical techniques for treating diseases of the paranasal sinuses.²⁻⁴ Since the orbit is in close proximity to the sinuses, there is always a risk for orbital injuries during sinus surgeries. Direct orbital injuries that occur during sinus surgery include injury confined to the lamina papyracea with periorbital ecchymosis, major injury to the lacrimal duct, and damage to the orbital muscles or optic nerve with permanent functional defects, which can be classified as minor, major, and serious injuries, respectively.⁵ However, ocular complications caused by local anesthesia differ from those caused by direct injury. Local anesthetic agents usually cause temporary functional defects, which wear off along with the effects of the anesthetic agent.

Common ocular complications following local anesthetic injection include diplopia, strabismus, ptosis, loss of accommodation, ophthalmoplegia, and blindness.⁶ These are often caused by the posterior superior alveolar nerve block or inferior alveolar nerve block performed by a dentist⁷ and have been mainly reported in the dental literature. Reports regarding orbital complications are less common in the ENT field. Simultaneous occurrences of concomitant lateral gaze limitation and mydriasis have not previously been reported in the literature. Therefore, we presented this case and tried to elucidate the cause of this complication. Several etiologies have been considered as causes for temporary ocular complications.⁸⁻¹⁰ First, inadvertent injection into the orbit can cause orbital complications.¹¹ Second, lidocaine injected into the maxillary area can cause a retrograde flow from the internal maxillary artery to the middle meningeal artery and to the ophthalmic artery.^{9,12}

Table 1

The possibility of each complication per various hypotheses*.

Hypothesis	CN VI palsy	Mydriasis
Arterial injection	+	-
Venous injection	+	-
Direct diffusion	+	+
Intraorbital injection	-	+

*CN VI denotes abducens nerve, + denotes highly possible, - denotes unlikely to occur

Third, inadvertent injection into the pterygoid venous plexus can cause all of the lidocaine to enter the cavernous sinus.¹³ Fourth, direct diffusion of lidocaine from the pterygopalatine fossa (PP fossa) to the orbit can occur.¹⁰ Similar etiologies could be considered in this case.

In the first instance, we suspected that intraorbital injection of lidocaine through the medial orbital wall was the cause of our patient's orbital complications. Intraorbital lidocaine can block the parasympathetic ciliary ganglion and cause mydriasis. The parasympathetic ganglion is located just behind the eye in the posterior orbit (Figure 3). However, the patient also experienced a lateral gaze limitation without medial gaze limitation. Lateral gaze limitation without medial gaze limitation by intraorbital lidocaine injection is biologically implausible. The lateral rectus is located far from the medial orbital wall (Table 1). Considering this fact, the probability of intraorbital injection of lidocaine through the medial orbital wall as the etiology in this case was low.

Kim et al. proposed an arterial hypothesis for gaze limitation during FESS.¹⁴ However, an arterial hypothesis cannot explain these orbital complications sufficiently for two reasons. First, inadvertent injection into the sphenopalatine artery was unlikely because we performed an aspiration before injection to prevent direct injection into a vessel. Second, an arterial injection hypothesis cannot explain the mydriasis observed in this case. Injected lidocaine can reach the lateral rectus muscle via the internal maxillary artery to the middle meningeal artery; however, isolated involvement of the ciliary ganglion is unlikely (Figure 3, Table 1). The venous diffusion hypothesis focuses on the diffusion of lidocaine from the pterygoid venous plexus to the cavernous sinus. The abducens nerve is located in the middle of the cavernous sinus,

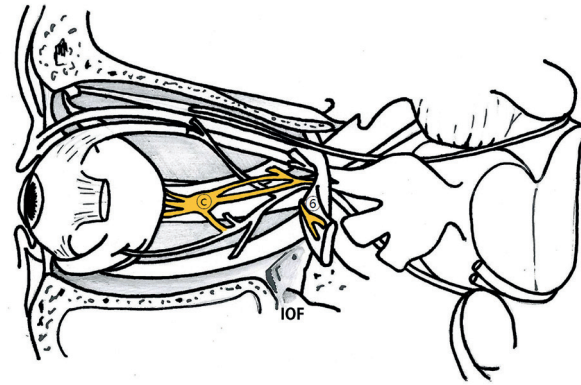


Figure 3

The ciliary ganglion and abducens nerve in orbit. Injected lidocaine is hypothesized to have diffused from the inferior orbital fissure (IOF) to the ciliary ganglion (©) and the abducens nerve (®).

which could cause the lateral gaze limitation. However, it is difficult to explain mydriasis via this route (Table 1).

We propose a direct diffusion hypothesis, which can explain both the lateral gaze limitation and mydriasis. Although the surgeon in this case made an aspiration prior to the injection, lidocaine can enter the sphenopalatine foramen, PP fossa, and inferior orbital fissure. At the level of the inferior orbital fissure, lidocaine can affect the ciliary ganglion and abducens nerve quite easily. The ciliary ganglion is immediately beside the inferior orbital fissure, while the abducens nerve is located most inferiorly in the posterior portion of the fissure (Figure 3).

Considering that the high pressure sphenopalatine ganglion block may be performed by a resident in training or beginner, more cases of abducens nerve palsy with mydriasis might have occurred. However, we did not find any such case reported in the literature. This can be explained by the fact that FESS is usually performed under general anesthesia. As such, even if the patient develops such complications, most of these would have resolved by the end of the procedure. In this case, FESS was performed under local anesthesia, without closing the patient's eyes, and we could therefore identify the complications. The lateral gaze limitation in our patient also slackened at the moment the photo was taken.

We report the first case of lateral gaze limitation and mydriasis occurring simultaneously during FESS. The prognosis of the patient was good,

and the nerve palsies resolved spontaneously. However, every complication, especially orbital complications, can be stressful for ENT surgeons. We hope that this case will be helpful to otolaryngologists and ophthalmologists who may encounter a similar situation, and we also hope that ENT surgeons will know to be attentive to the potential of hitherto unknown complications that may occur during the local infiltration of anesthesia.

Conclusion

Concomitant lateral gaze limitation and mydriasis can occur concurrently due to inadvertent injection into the short ciliary and abducens nerve during sphenopalatine block. Although the patient had a good prognosis, more attention should be paid to avoiding such complications when performing local infiltration.

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