Commercial Air Travel With a Small Intravitreous Gas Bubble

Although the risks of air travel with an intravitreous gas bubble have been well documented, there have been suggestions in the literature that such a flight may be safe under certain conditions, especially with small bubbles. We report a case of significant visual field loss following commercial air travel in a patient with a 10% intravitreous perfluoropropane gas fill.

Report of a Case. A 64-year-old man with a history of retinal detachment in the left eye visited his ophthalmologist with a 24-hour history of an “explosion” of floaters in the right eye. His history was also remarkable for glaucoma, for which he was receiving 2 medications but had no glaucomatous damage evident in the right eye on optical coherence tomography and visual field testing (Figure 1A and Figure 2A).

On dilated fundus examination, a large superotemporal retinal tear was found in the right eye. The patient was referred emergently to the on-call retinal specialist. The tear progressed to a superotemporal macula-on detachment despite laser retinopexy, and the patient underwent vitrectomy and gas-fluid exchange with 10% perfluoropropane. Treatment with oral acetazolamide was started as the intraocular pressure was found to be 27 mm Hg OD 1 day postoperatively; the intraocular pressure remained within normal limits thereafter.

On a postoperative visit exactly 1 month later, the patient’s cup-disc ratio was recorded as a stable 0.3 and treatment with acetazolamide was discontinued. The gas bubble was noted to be well above the pupil on examination in the sitting position and was approximately one-third of the height from the ora serrata to the equator, thus indicating less than a 10% fill remaining. The risks of air travel with an intraocular gas bubble were explained, but the patient declined to have the gas removed before his planned flight the following week.

Soon after takeoff on a commercial aircraft, the patient noted moderate discomfort in the right eye followed by a complete loss of vision in this eye. The discomfort and loss of vision did not subside until shortly after landing. He did not experience similar symptoms 2 weeks later on the return flight.

On examination immediately following his return to Canada, the cup-disc ratio of his right optic nerve had increased from 0.3 to 0.5. His optical coherence tomographic scan demonstrated a striking loss of the nerve fiber layer from an average thickness of 96.99 µm before the flight to 85.55 µm afterward (Figure 1B). This change was accompanied by a corresponding new supranoval visual field defect demonstrated on Goldmann visual field examination (Figure 2B).

Comment. Vitreoretinal surgery often involves the use of air or medical gases, primarily perfluoropropane or sulfur hexafluoride, injected directly into the vitreous cavity. As resorption of these gases is first order, small gas volumes may be present for weeks or months. Although the risks of air travel with intraocular gas have been well documented, there have been some suggestions in the literature that under certain conditions (e.g., low-altitude flight or small gas bubbles) flight with intracoarcular gas may be safe, if inadvisable.

As an aircraft gains altitude, the atmospheric pressure decreases. Commercial flights routinely reach altitudes up to 40,000 feet above sea level, with cabin pressures typically maintained at less than 9000 feet. As the atmospheric pressure decreases, an intraocular gas bubble will undergo expansion following Boyle’s law: $P_1V_1 = P_2V_2$, where $P$ indicates the pressure of the system and $V$ indicates the volume of the gas. The eye has several compensatory mechanisms including limited choroidal flattening, scleral expansion, and increased aqueous outflow, but these mechanisms are limited in their ability to accommodate expansion of the intraocular gas bubble. Once the globe’s maximum capacity is reached, the intraocular pressure increases, which may result in acute glaucoma and even central retinal artery occlusion.

Although the patient likely had diminished compensatory capacity for increasing intraocular pressures due to underlying glaucoma, we report this case as evidence that flight with even a small gas bubble is not without risk.

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Figure 1. The most recent preflight Goldmann visual field (A) compared with the postflight Goldmann visual field demonstrating a new superonasal defect (B). Colors have been uniformly altered to black and white. RNFLT indicates retinal nerve fiber layer thickness; S, superior; N, nasal; I, inferior; and T, temporal.

Figure 2. The most recent preflight optical coherence tomographic scan (A) compared with the postflight scan demonstrating significant loss of nerve fiber layer tissue (B). Colors have been uniformly altered to black and white.
Complete, Pupil-Sparing Third Nerve Palsy in a Patient With a Malignant Peripheral Nerve Sheath Tumor

Pupil-sparing but otherwise complete oculomotor nerve pareses (OMNPs) usually are caused by ischemia, whereas pupil-involved OMNPs or incomplete, pupil-sparing OMNPs usually require an evaluation for a compressive or infiltrative process. There are, however, exceptions. For example, Lustbader and Miller reported a case of a complete, pupil-sparing OMNP caused by a giant basilar tip aneurysm. Herein, we report a case of a complete pupil-sparing OMNP caused by a malignant peripheral nerve sheath tumor (MPNST) that arose in the sphenoid sinus.

**Report of a Case.** A 72-year-old man with controlled hypertension had a 5-week history of left ptosis and diplopia. The patient had normal visual acuity, color vision, and visual fields in each eye. The pupils were isocoric and equally and normally reactive to light and near stimulation. The right upper eyelid was in normal position and the right eye moved fully in all directions. The left upper eyelid was completely ptotic. The left eye had no elevation, depression, or adduction, but there was normal abduction and intorsion on attempted downgaze in abduction. The rest of the examination revealed no abnormalities. Magnetic resonance imaging revealed a hyperintense, heterogeneous, multilobulated mass centered in the sphenoid sinus on T2-weighted and fluid-attenuated inversion recovery images (Figure 1A), with heterogeneous enhancement and central nonenhancing parts with evidence of bilateral cavernous sinus invasion on contrast-enhanced T1-weighted images (Figure 1B). The patient underwent a gross total resection of the lesion, which was diagnosed as an intermediate-grade MPNST with the neoplastic cells staining strongly and diffusely for S-100 protein (Figure 2). No mutations were detected in the 4 KIT exons analyzed; ultrastructural analysis revealed no melanosomes.

Within a month after surgery, the patient’s eyelid had returned to a normal position and his double vision had resolved. Examination at that time revealed normal visual sensory function, full extraocular movements, and no ocular misalignment in any field of gaze.

![Figure 1. Magnetic resonance images. A, Coronal T2-weighted image showing a sphenoid sinus mass. B, Coronal contrast-enhanced T1-weighted image.](https://example.com/fig1)

![Figure 2. Immunohistochemical analysis of a malignant peripheral nerve sheath tumor. A, The lesional cells show both paucicellular and hypercellular zones and display a proclivity to proliferate in the subendothelial zones as seen in the vessel in the center of the field (hematoxylin-eosin, original magnification ×10). B, In this case, there is strong diffuse immunolabeling, an unusual feature for malignant peripheral nerve sheath tumor, which typically displays weaker, more focal S-100 protein expression. This finding prompted the consideration of both spindle cell melanoma and cellular schwannoma, both of which were excluded (S-100 protein immunohistochemistry, original magnification ×20).](https://example.com/fig2)