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CASE REPORT

Reporting a case of spontaneous ocular hypotony after the neurosurgical procedure

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Spontaneous ocular hypotony is a rare entity. So far in the literature, there have been few cases that report on ocular hypotony in non-ocular surgery. The most common non-ocular surgery causing hypotony is coronary arterial bypass grafting. It is due to wide fluctuations in blood pressure, central venous pressure, and the use of mannitol intraoperatively. In neurosurgery, previously reported cases were post-thrombectomy and post-aneurysm clipping. In one case, there was a complete occlusion of ophthalmic artery due to emboli, and in another case, it was due to a wide fluctuation in blood pressure. We are reporting a case of ocular hypotony in a patient who underwent right frontal craniotomy and excision of a metastatic lesion. In our case, intraoperatively, mannitol was used, but there were no fluctuations in blood pressure and central venous pressure. The use of mannitol was slated to be the reason for ocular hypotony.

Keywords: ocular hypotony, globe collapse, mannitol

Introduction

Ocular is a potential cause for acute vision loss. It is classified as acute and chronic. There are various causes for ocular hypotony, the most common being iatrogenic like post-ocular surgery and traumatic ocular injury (1). Spontaneous globe collapse is a rare entity in non-ocular pathology. Such cases were reported after coronary arterial bypass grafting (CABG), thrombectomy of common/internal carotid artery, and one case of aneurysm clipping. In above mentioned cases, the common finding was the use of hyperosmotic agents with a fall in central venous pressure (CVP) and blood pressure. We are reporting the first case of ocular hypotony in the literature, in which the patient underwent brain tumor excision along of intraoperative mannitol.

Case report

A 63-year-old gentleman with no known comorbidities presented with memory disturbances and altered behavior for 3 months, ideomotor apraxia for 2 months, and urinary incontinence for 1 month. The patient was evaluated with MRI brain contrast, which showed lesions in both the frontal lobes favoring secondaries, the right frontal lesion being 38 × 33 × 34 mm in size with grade 2 perilesional edema and a midline shift of 6.5 mm toward the left, while the left frontal lesion measuring 8 × 8.2 mm with grade 1 perilesional edema. Further evaluation with positron emission tomography and computed tomography showed a lesion in the right lower lobe of the lung that was suspected to be the primary. On examination, the patient had bilateral 6/12 vision, and the bilateral fundi were normal. The right frontal lesion was planned for a radical excision in view of its mass effect. The patient has not undergone any eye surgery for cataract or glaucoma in the past.

During surgery, the patient was positioned supine with the head turned toward the left with a slight extension at the neck using the 3-pin Mayfield system. Lacrigel was applied in both eyes and covered with cotton pads. After right frontal craniotomy, we noticed the dura to

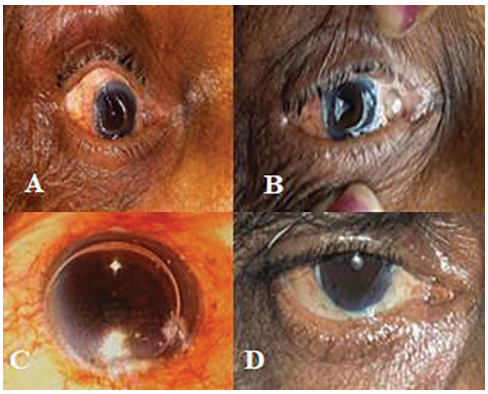

FIGURE 1 | (A–C) Intraoperative images. **(A,B)** Showing globe collapse with folds in cornea with conjuctival congestion. **(C)** Microscopic examination of cornea following air instillation. **(D)** Image taken on postoperative day 28, showing normal globe with well-formed anterior chamber with resolution of conjuctival congestion.

be tense; hence, 200 ml of 20% mannitol was given intravenously to lax the dura. The patient underwent complete excision of the tumor. Intraoperative findings were suggestive of secondary injuries to the brain. The mean arterial blood pressure was maintained around 80–90 mm Hg, and CVP was around 10 cm H_2O. Otherwise, the intraoperative period was uneventful. Blood loss was around 400 ml, and no blood products were transfused. Biopsy was metastatic adenocarcinoma.

Before extubation, we generally check pupils as per department's protocol; we noticed the right globe deflated with limbal congestion and the anterior chamber was flat with a vertical depression suggestive of hypotony. On table, ophthalmological consultation was obtained. Microscopic examination of cornea and conjunctiva was done, which did not reveal any evidence of a breach. On injecting 0.5 ml of air via limbus into the anterior chamber, it was filled up. There was no leak of air, cyclodialysis, or iridodialysis noted. The patient was extubated, and his right eye was covered for further evaluation. Antibiotic eye drops were applied as a precaution. On postoperative day 2, vision was checked and found to be intact. Indirect ophthalmoscopy and optical coherence tomography were found to be normal. The patient is under regular follow-up. On postoperative day 28, the patient was examined; the globe had come back to its previous size without any anterior collapse or conjunctival congestion (**Figure 1**).

Discussion

Ocular hypotony is defined as three standard deviations below the mean intraocular pressure (IOP) (<6.5 mm Hg) or an average IOP of 5 mm Hg in a non-physiological IOP, according to World Glaucoma Association guidelines. Ocular hypotony may lead to the following complications like shallow anterior chamber, corneal damages, cataract, retinal and choroidal folds, choroidal detachment, maculopathy, macular edema, or optic disk edema, leading to transient or permanent visual loss (1–3).

Decreased aqueous humor production or increased drainage of aqueous humor can be the cause for acute globe collapse. The causes of decreased production are intraocular inflammation, hypoperfusion, drug-induced like beta blockers or alpha adrenergic, which act as aqueous humor suppressants, decreased ciliary body perfusion like ischemia, damages to ciliary body following trauma, uveitis, and cyclodestructive procedure. The causes for increased aqueous humor drainage are glaucoma drainage devices, iatrogenic creation of cyclodialysis cleft, post-trauma, or ocular surgeries. Other causes include the use of hyperosmotic agents like mannitol (2, 3).

The possible mechanisms for reduction in IOP following mannitol administration are vitreous dehydration and an indirect effect on the preoptic nucleus through the third ventricle. Mannitol is routinely used in ocular surgeries. A 100 ml of 20% mannitol intravenously given 30 and 60 min before surgery lowers the IOP and increases the depth of anterior chamber (4, 5).

Among previously reported cases in non-ocular surgeries causing globe collapse, the most common were CABG and hypothermic cardiopulmonary bypass. In addition to hyperosmolar drugs like mannitol and sodium bicarbonate, the mean arterial pressure and CVP were also lowered; all these factors contributed to ocular hypotony (6, 7).

In neurosurgery, Fong et al. (8) reported two cases of ocular hypotony. In the first case, mechanical thrombectomy was performed for acute left MCA infract who had an intraoperative rupture of the left internal carotid artery, following which the patient had globe collapse. The possible hypothesis was ophthalmic artery occlusion. In the second case, the patient underwent right pterional craniotomy and clipping of posterior communicating artery aneurysm, following which the patient developed bilateral hypotony right more than left. Intraoperatively, the patient had wide variations in blood pressure, and mannitol also was given at the beginning of surgery, which were believed to cause transient ophthalmic artery occlusion resulting in transient ciliary body shutdown, leading to acute globe collapse in the right eye (8).

In our case, we used 200 ml of 20% mannitol instead of routine 100 ml in view of the brain bulge. A high dose of mannitol may be the reason for sudden globe collapse. In previously reported cases other than those involving mannitol, all those patients had intraoperative fluctuations in blood pressure. In our case, blood pressure and CVP were maintained throughout.

Conclusion

Intravenous mannitol has been routinely used for reducing IOP while performing ocular procedures, which helps in dehydrating the vitreous humor and increasing the depth of anterior chamber. In non-ocular surgeries like CABG, thrombectomy, and intracranial procedures where intravenous 20% mannitol is used for various reasons, one should be aware of this potential condition and its complications. Ocular hypotony can be easily diagnosed at the end of surgery by a simple inspection of both eyes before extubation.

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