Pneumocephalus after Orbital Decompression Surgery for Thyroid Eye Disease

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Abstract:
A cerebrospinal fluid (CSF) leak is a rare complication after orbital surgery. We reported a 49-year-old man who presented with CSF leakage after transcaruncular medial wall decompression for proptosis due to thyroid eye disease. He underwent an endoscopic endonasal approach to surgical repair of the defect with nasoseptal flap. Rhinorrhea was stopped immediately after endoscopic repair.

Keywords:
Orbital decompression, pneumocephalus, thyroid eye disease

Introduction
A cerebrospinal fluid (CSF) leak is a rare complication after orbital surgery, and every surgeon should be familiar with its manifestations to prevent other potential problems. Herein, we report one case of CSF leak with pneumocephalus following medial orbital decompression for thyroid eye disease which has been managed with transnasal endoscopic orbital roof repair.

Case Report
A 49-year-old man presented with bilateral proptosis due to thyroid eye. His best-corrected visual acuity was 20/20 in both the eyes. Intraocular pressure was 19 and 22 mmHg in the left and right eye, respectively. Eye movement examination revealed a bilateral limitation of upgaze, without subjective diplopia. The left eye was more proptotic, showing 25 mm with Hertel’s exophthalmometer, as compared with 23 mm for the right side. His orbital computed tomography (CT) scans confirmed extraocular muscle enlargement. Informed consent was obtained. He underwent left transcaruncular medial wall decompression. During fracture of the lamina papyracea, a gush of clear fluid from the orbital roof was sensed. Given the poor visibility of the leakage area from transcaruncular incision, no further action was performed intraoperatively. At the 1st postoperative day visit, he had noted continuous drainage of fluid from his left nose without headache. He was admitted to the hospital with a suspected CSF leakage, and CT scan showed a bony defect near the orbital roof and interruption of postcreromedial orbital roof and pneumocephalus in the anterior cranial fossa [Figure 1a and b]. We first managed conservatively with bed rest status and prophylaxis antibiotics for meningitis. Two days later, CSF leakage continued, and we performed an endoscopic endonasal approach to surgical repair of the defect with nasoseptal flap. Immediately after the surgery, the rhinorrhea was stopped, and the CT scan showed that the pneumocephalus was resolved [Figure 2a and b].

How to cite this article: Ghahvehchian H, Sadrhosseini SM, Fard MA. Pneumocephalus after orbital decompression surgery for thyroid eye disease. Middle East Afr J Ophthalmol 2020;27:142-4.
The results in two meta-analyses suggest that the incidence of pneumocephalus in the anterior cranial fossa may decrease venous back pressure leading to reduced CSF pressure.\[^9\] Neurosurgery and otolaryngology consulting might be necessary. Postural headaches, neck tenderness, nausea, vomiting, photophobia, blurry vision, and sixth cranial nerve palsy can indicate CSF hypotension syndrome, and patients should be checked for these signs and symptoms regularly.\[^9\] Acetazolamide decreases CSF production, and it can be useful in CSF leakage management and improves success rates following primary endoscopic repair.\[^10\] Prophylactic antibiotics are mostly used, but their efficacy remains unclear. The occurrence of meningitis is believed to decrease with penicillin in adults and ampicillin in children; however, there is no sufficient evidence to support the use of antibiotic prophylaxis in CSF leakage cases.\[^9,11\] The results in two meta-analyses suggest that the literature is not in agreement with antibiotic prophylaxis.\[^12,13\] In this case, we proceeded to early surgical intervention despite the fact that conservative management was failed only for 2 days, given the obvious site of displaced orbital roof fracture associated with extensive pneumocephalus in the anterior cranial fossa.

Overall, various surgical approaches have been described if CSF leakage persists.\[^8,14\] Lynch incision, extracranial approaches, intracranial approach, and less invasive approaches like fibrin glue consumption are some of them.\[^15\] In our case, endoscopic endonasal approach with nasoseptal flap was used to repair the defect. While pedicled nasoseptal flap has been used for closure of large skull base dural defects,\[^16\] we used this technique in our case with the presence of pneumocephalus with successful outcomes. Nachtigal et al.\[^17\] evaluated the endoscopic approach and mentioned that 10 of 12 patients with CSF leakage got healed with this method. CSF leaks can be repaired by other endoscopic techniques such as the bath-plug technique or composite flap or graft from the nasal septa or the turbinates with a high success rate.

Overall, CSF leakage is a rare and serious complication of orbital decompression that should be diagnosed and treated betimes. The endoscopic endonasal approach for repair of this complication is a less morbid method with a remarkable success that can be tried before aggressive approaches.

**Discussion**

The CSF leakage is a rare but worrying complication of orbital surgeries. Its incidence has been reported <2% in studies.\[^1\]

Diagnosis of CSF leakage can be complicated if CSF is mixed with blood intraoperatively or mixed with nasal secretion postoperatively. While the presence of glucose in secretion indicates that liquids contain CSF, the glucose oxidase test has poor positive predictive value for CSF detection.\[^2\] Therefore, the presence of beta-2 transferrin is considered as the gold standard test.\[^3\] In addition, CSF leakage sites may be localized with high-resolution, noncontrast CT as our case with 70% sensitivity. Alternative techniques such as CT or magnetic resonance imaging cisternography, radionuclide cisternography, and intrathecal fluorescein injection can also be used for CSF leakage detection.\[^4\]

When CSF leakage is encountered intraoperatively, it is crucial to examine the dural damage site properly in case of the visibility of the leakage site. If there is a minimal leakage in the area, it may seal spontaneously because orbital fat could shield the damaged dura and facilitate the sealing process. Primary wound repair is usually recommended to reduce the risk of chronic leakage.\[^5\] If a large amount of leakage is observed and the dural is visible and its borders can easily be apposed, suturing with 5-0 nylon or polyglactin can be carried out to create a waterproof wound. Some authors recommend that the exposed dural injury could be covered using a graft to reduce the risk of postoperative CSF leakage. Fascia, temporalis muscle, or fat can be used for this purpose.\[^6\] Fibrin glue, dural adhesives, and other alloplastic materials have also been used successfully.\[^7\]

In this case report, we first selected a conservative strategy because of intraoperative poor visibility of the leakage site. Patients with CSF leakage without impaired consciousness and no associated cranial pathology could initially be managed conservatively for 3–7 days.\[^8\]

Conservative treatment consists of preventing compressive efforts, for example, coughing, sneezing or nose blowing, and the use of laxatives. Head elevation may decrease venous back pressure leading to reduced CSF pressure.\[^9\] Neurosurgery and otolaryngology consulting might be necessary. Postural headaches, neck tenderness, nausea, vomiting, photophobia, blurry vision, and sixth cranial nerve palsy can indicate CSF hypotension syndrome, and patients should be checked for these signs and symptoms regularly.\[^9\] Acetazolamide decreases CSF production, and it can be useful in CSF leakage management and improves success rates following primary endoscopic repair.\[^10\] Prophylactic antibiotics are mostly used, but their efficacy remains unclear. The occurrence of meningitis is believed to decrease with penicillin in adults and ampicillin in children; however, there is no sufficient evidence to support the use of antibiotic prophylaxis in CSF leakage cases.\[^9,11\] The results in two meta-analyses suggest that the literature is not in agreement with antibiotic prophylaxis.\[^12,13\] In this case, we proceeded to early surgical intervention despite the fact that conservative management was failed only for 2 days, given the obvious site of displaced orbital roof fracture associated with extensive pneumocephalus in the anterior cranial fossa.

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Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

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