Retrograde Air Flow through the Lacrimal Drainage System with Valsalva Maneuver

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Summary
We present a series of three clinical videos of retrograde air flow through the lacrimal system with Valsalva maneuver that illustrate the hypothesized dysfunctions at various points within the lacrimal valvular system.

Abstract
Background: Under normal physiologic conditions, the lacrimal excretory system has a series of valves that prevent retrograde flow of fluid and air. Therefore, while performing the Valsalva maneuver, increased intranasal pressure is not transmitted to the nasolacrimal system; however, trauma, lacrimal surgery, and positive airway pressure can disrupt the normal valve system and allow air to enter the lacrimal system.

Methods: A 35-year-old patient presented with complaint of tear duct expansion. Additionally, a 42-year-old patient and his son, a 9-year-old patient, presented with sensation of air near the ocular region upon performing Valsalva maneuver.

Results: There was air regurgitation from the lacrimal excretory system in the absence of known predisposing factors. These possibly represent variations in the lacrimal valvular system with characteristic physical exam findings that can best be appreciated through videos.

Conclusion: A small population of patients without predisposing factors may have retrograde air regurgitation due to unknown etiologies.

Keywords
Valsalva, Nasolacrimal, Lacrimal valve, Regurgitation

Abbreviations
NLD: Nasolacrimal Duct; DCR: Dacryocystorhinostomy

Report of the Cases
The following information was collected and evaluated after obtaining informed consent from the patients in order to comply to HIPAA. The report also adheres to guidelines as outlined by the Declaration of Helsinki.

A 35-year-old man presented with a complaint of “tear duct expands.” He denied tearing, infection, or trauma. On examination, when he compressed his nostrils externally and induced a Valsalva maneuver, there was expansion of the lacrimal sac with deflation of the sac upon release of Valsalva (Figure 1A and Video 1). His tear lakes were normal and irrigation of the lacrimal system was normal with no stenosis or regurgitation bilaterally. CT scan revealed that the right lacrimal sac was distended by air (Figure 1B). There was no evidence of disease or fracture. We hypothesize dysfunctional valve of Hasner allowing pneumatocele formation via retrograde airflow with increased nasal airway pressure. The patient was otherwise asymptomatic, and the decision was made to not intervene surgically.

A 42-year-old man and his 9-year-old son both presented with a sensation of air on the ocular surface with forced expiration while closing the nose. Upon examination of both patients, a Valsalva maneuver resulted in air and a small amount of tears exiting the puncta, creating a high-pitched sound. These sounds were likely produced by turbulent airflow in a small diameter canal at high pressure. Both the patients had no tearing symp-
positive airway pressure, sleep apnea, and punctal plug insertion [3-6].

The prevalence of Valsalva-induced air regurgitation in patients with no predisposing factors is unknown, though many clinicians may have anecdotal experience with such patients. Our cases illustrate variations in clinical presentation that match presumed variations in valvular dysfunction. In addition to routine lacrimal evaluation by clinical exam and irrigation, CT scan or dacryocystography can be useful. While most patients can be simply monitored, DCR is an option for those patients who are symptomatic.

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Author’s Contribution

All authors have contributed to this manuscript.

References
