

SLEEP MEDICINE PEARLS

## An unusual case of PAP-related eye dryness

Scott Ryals, MD<sup>1</sup>; Surina Sharma, MD<sup>1</sup>; Susheela Hadigal, MD<sup>1</sup>; Mary Wagner, MD<sup>2</sup>; Richard Berry, MD<sup>1</sup>

<sup>1</sup>Division of Pulmonary, Critical Care, and Sleep Medicine, University of Florida, Gainesville, Florida; <sup>2</sup>Division of Pediatric Pulmonology, University of Florida, Gainesville, Florida

A 68-year-old woman with a history of hypothyroidism, hypertension, and obstructive sleep apnea (OSA) not on current treatment was referred to the sleep clinic for treatment of OSA. She was diagnosed with OSA in 2008 and started on continuous positive airway pressure (CPAP). On PAP she slept much better and was well rested. Subsequently she had problems with eye dryness attributed to a mask leak that could not be corrected, so she stopped CPAP. In the clinic, she reports loud snoring, witnessed apneas, difficulty maintaining sleep, and a desire to have her OSA treated. Epworth Sleepiness Scale was 2 of 24. On examination, the Mallampati score was 4, neck circumference was 16 in., and body mass index was 45.52 kg/m<sup>2</sup>. An oral examination was significant for normal dentition, no missing teeth, and orthognathic bite. Medications included lisinopril and levothyroxine.

A diagnostic polysomnography was performed; the results are shown in **Table 1**.

The patient was started on automatic PAP at a lower range of pressures (4–8 cmH<sub>2</sub>O) hoping to avoid a mask leak and the resultant eye dryness. Unfortunately, on automatic PAP, the eye dryness recurred. Further history yielded that previously after the initial initiation of PAP, she developed excessive watering of the eyes (epiphora) for which bilateral Jones tubes were placed.

**QUESTION: What is the cause of eye dryness in this patient? Is there a test that can be done to confirm this diagnosis? What are other treatment options to treat this patient's OSA without complications?**

**ANSWER: The eye dryness in this patient is caused by the reflux of air into the eyes via Jones tubes. A bubbling test (described below) is diagnostic and easy to perform. Both non-PAP and PAP treatment options remain.**

**DISCUSSION**

With normal anatomy, tears drain from the eye via the upper and lower canaliculi to the lacrimal sac and then via the nasolacrimal duct to the nasal cavity (Figure 1). In patients with damage to these channels or with congenital absence, epiphora results. When the level of obstruction is at the canaliculi, a conjunctivodacryocystorhinostomy bypasses the blockage, creating a new drainage channel from the medial canthus to the nasal

cavity; a Jones tube maintains patency in this new channel (Figure 2). When the level of obstruction is distal to the canaliculi, a dacryocystorhinostomy creates a channel from the lacrimal sac to the nasal cavity. Jones tubes are small Pyrex tubes introduced by Lester Jones in 1962 that are inserted at the medial canthus.<sup>1</sup> The success rate of Jones tubes has varied in different patient populations, and postoperative complications are common. The most common complications are extrusion/malposition of the tube and air/mucus regurgitation.<sup>2,3</sup> CPAP intolerance from air regurgitation has been described in a few patients as a complication of dacryocystorhinostomy with or without Jones tube placement. Cannon postulated that, in patients with prior lacrimal duct manipulation, positive pressure in the upper airway forces air through the enlarged naso-lacrimal ostium in the absence of normal anatomical valves or through the Jones tubes, causing air regurgitation.<sup>4</sup>

Bachour et al described a bubbling test to confirm CPAP-associated retrograde air escape via the nasolacrimal system (CRANS). The awake patient is placed supine, and a few drops of saline are applied at the medial eye. CPAP is then initiated; one eye is tested at a time. Bubbling through the saline from the lower lacrimal punctum is diagnostic for CPAP-associated retrograde air escape via the nasolacrimal system. The video is seen here (<https://ars.els-cdn.com/content/image/1-s2.0-S1389945716302349-mmc2.mp4>).<sup>5</sup> When Jones tubes are present, bubbles are seen emerging from the opening of the Jones tube(s).

Treatment of patients with OSA on CPAP with air regurgitation from the nasolacrimal system include both non-PAP

**Table 1—Diagnostic polysomnography data.**

	Diagnostic
Total sleep time	288 min
Sleep efficiency	60%
Apnea-hypopnea index	8.1
Supine AHI	0.0
Nonsupine AHI	8.3
Percent total sleep time supine	2.4%
Obstructive apneas (no.)	2
Mixed apneas (no.)	0
Central apneas (no.)	0
Hypopneas (no.)	37

**Figure 1—The lacrimal system.**

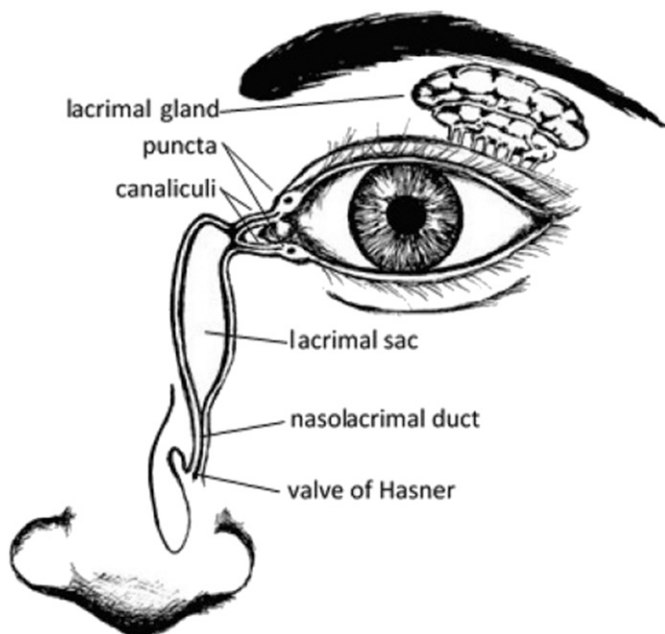


Illustration courtesy of Rebecca Kim, MD.

**Figure 2—A Jones tube placed at the medial canthus bypassing the lacrimal system and draining into the nasal cavity.**

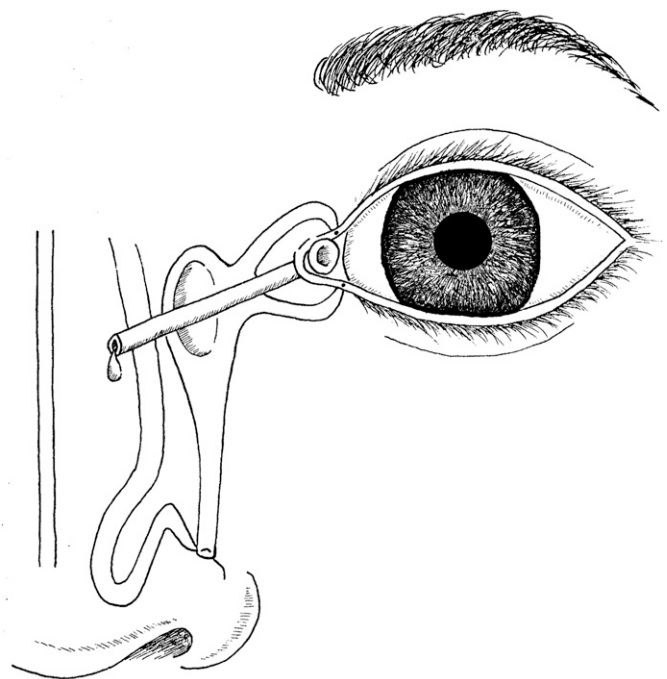


Illustration courtesy of Laura Bell, PhD.

and PAP options. Use of an oral appliance to treat OSA in the setting of CPAP-associated retrograde air escape via the nasolacrimal system has been reported.<sup>6</sup> PAP is still an option for these patients, and Wrede et al described using a total face mask to equalize the pressure on both sides of the nasolacrimal system.<sup>7</sup> Goldberg described first diverting air away from the eye via a silicone tube placed at the opening of the Jones tube. However, this resulted in displacement of the tube. The Jones tube was replaced, and the patient used a small wet cotton ball taped over the external opening of the Jones tube while on PAP with success.<sup>8</sup> Use of punctal plugs while using PAP has also been reported for lacrimal regurgitation<sup>9</sup> but would be limited by the individual patient's ability to place the plugs. Hurwitz described using punctal plugs at the opening of the Jones tube while PAP is in use<sup>10</sup>; however, repeated inward pressure on the tube risks extrusion into the nose.<sup>8</sup>

In our patient, a bubbling test revealed bubbles emerging from the bilateral Jones tube openings. Because of the patient's prior negative experience with CPAP, she desired a non-PAP option and was referred for construction of an oral appliance. On follow-up, she tolerated this appliance well, with resolution of symptoms.

### SLEEP MEDICINE PEARLS

1. Reflux of air via Jones tubes is an uncommon but potential cause of eye dryness; taking a detailed surgical history including prior lacrimal surgery with or without Jones tube placement is vital.
2. One can test for air reflux via placing saline at the medial canthus while the patient is laying supine and then initiating PAP; resultant air bubbling through the saline is diagnostic for reflux.
3. In this situation, PAP treatment can be accomplished using a total face mask that equalizes pressure on both sides of the nasolacrimal system to avoid reflux of air into the eyes or a non-PAP modality such as oral appliance or sleep apnea surgery.

### CITATION

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### REFERENCES

1. Jones LT. The cure of epiphora due to canalicular disorders, trauma and surgical failures on the lacrimal passages. *Trans Am Acad Ophthalmol Otolaryngol*. 1962; 66:506–524.
2. Pushker N, Khurana S, Shrey D, Bajaj MS, Chawla B, Chandra M. Conjunctivodacryocystorhinostomy using a high-density porous polyethylene-coated tear drain tube. *Int Ophthalmol*. 2013;33(4): 329–333.
3. Steele EA. Conjunctivodacryocystorhinostomy with Jones tube: a history and update. *Curr Opin Ophthalmol*. 2016;27(5):439–442.
4. Cannon PS, Madge SN, Selva D. Air regurgitation in patients on continuous positive airway pressure (CPAP) therapy following dacryocystorhinostomy with or without Lester-Jones tube insertion. *Br J Ophthalmol*. 2010;94(7): 891–893.
5. Bachour A, Maasilta P, Wares J, Uusitalo M. Bubbling test to recognize retrograde air escape via the nasolacrimal system during positive airway pressure therapy. *Sleep Med*. 2017;29:35–36.
6. Plum M, Pfirman K, Endara-Bravo A. Lacrimal duct air regurgitation in an adult patient on continuous positive airway pressure therapy. *J Lung Pulm Respir Res*. 2016;3(6):00107.
7. Wrede JE, Parsons EC, Watson NF. A novel treatment for nasolacrimal air regurgitation into the eye with CPAP: the total face mask. *J Clin Sleep Med*. 2018; 14(8):1415–1417.
8. Goldberg DS. Management of air regurgitation through a Jones tube in a patient using continuous positive airway pressure. *Ophthalm Plast Reconstr Surg*. 2011;27(3):e76–e77.
9. Göktas O, Haberman A, Thelen A, Schrom T. [The punctum plug as an option for treating retrograde air flow from the lacrimal sac]. *Laryngorhinootologie*. 2007; 86(10):732–735.
10. Hurwitz JJ. *The Lacrimal System*. Philadelphia, PA: Lippincott-Raven; 1996.

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Address correspondence to: Scott Ryals, MD, Pulmonary, Critical Care, and Sleep Medicine Administration, PO Box 100225, Gainesville, FL 32610-0225; Email: Scott.Ryals@medicine.ufl.edu

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