Obstructive Sleep Apnea Syndrome as a Complication After Tracheal Surgery

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Abstract: We describe a case of obstructive sleep apnea syndrome that occurred after tracheal surgery. The patient refused a tracheal stent placement and any surgical procedure aimed at stabilizing the tracheal walls. She was treated with a continuous positive airway pressure.

Obstructive sleep apnea syndrome (OSAS) is caused by a decrease in tone in the upper-airway muscles during sleep and by anatomic abnormalities that lead to a reduction in the caliber of the upper airway. Cartilaginous rings preserve the tracheal patency, but operations involving the trachea that lead to a decrease in this rigid support may result in airway collapse, similar to the collapse that occurs with tracheobronchomalacia.

REPORT OF CASE

A 58-year-old obese woman (body mass index, 31 kg/m²) had been previously treated by an otolaryngologist for a laryngotracheal stenosis of unknown origin. Attempts to treat the stenosis using laser procedures had been unsuccessful. Therefore, the progressively worsening stenosis had been surgically treated, including (1) ablation and excision of cicatrices of the posterior tracheal wall, (2) reconstruction of the larynx and trachea by means of a cutaneous flap supported with a graft of costal cartilage, (3) thyroid resection, and (4) tracheostomy. The patient was subsequently referred to the sleep laboratory for evaluation of orthopnea, snoring, choking, and daytime sleepiness which had first occurred a few weeks after the closure of the tracheostomy. Her bed partner reported that the patient had not habitually snored before the laryngotracheal operation. The patient had no history of endocrine, cardiac, or neurologic disorders. Chest radiographs showed no abnormality. Cardiovascular and thyroid function, lung volume, and arterial gas exchange were within normal values. The maximal flow-volume curve, showing an inspiratory flow reduction with a fairly normal expiratory flow, indicated a variable extrathoracic airway obstruction.

Polysomnography revealed an apnea-hypopnea index (AHI) of 104, with abnormalities in oxyhemoglobin saturation (a mean SaO₂ of 92%, an SaO₂ nadir of 85%, and 13.7% of time spent with an SaO₂ < 90%) and sleep parameters (sleep efficiency of 67.7%; 85.1% of sleep time spent in stage 1 and 2 non-rapid eye movement (REM), 5.0% in stage 3 and 4, and 9.9% in stage REM). During physical examination, we noted that the patient had a respiratory-related movement (inward during inspiration and outward during expiration) at the level of suprasternal notch, where the cutaneous flap had been grafted. A computed tomographic (CT) scan of the upper airway showed a discontinuity of the thyroid cartilage, missing anterior portion of the upper tracheal rings, and a subglottic laryngotracheocele. A cutaneous flap comprised the anterior wall of the trachea (Figure 1). The patient refused an endoscopic study of the upper airway and refused placement of a tracheal stent or any surgical procedure aimed at stabilizing the tracheal walls.

We instituted treatment of the sleep-related apneic events with continuous positive airway pressure (CPAP) at 5 cm H₂O; however, the laryngotracheocele increased, creating a very thin cutaneous flap (Figure 1). When we decreased the CPAP to 3 cm H₂O, the apneic events resolved (AHI of 2), and the oxyhemoglobin (mean SaO₂ of 94%, an SaO₂ nadir of 89%, and 1.3% of time spent with an SaO₂ < 90%) and sleep parameters (sleep efficiency of 72.8%, 60.8% of sleep time spent in stage 1 and 2 non-REM, 22.5% in stage 3 and 4, the 16.6% in stage REM) improved. The patient was discharged from the hospital with a diagnosis of OSAS and a prescription for CPAP at 3 cm H₂O. She has continued using CPAP at home for 6 months for 5 hours per night, as shown by the CPAP clock-time counter. She denies having any apnea-like symptoms. No lesion can now been seen on the cutaneous graft.

DISCUSSION

Our patient showed 2 unusual features of OSAS: (1) symptoms...
occurred after the closure of her tracheostomy and (2) the anterior wall of the trachea was made of a cutaneous flap without any rigid support. The cartilaginous rings of the trachea prevent the airway from collapsing as the result of either gravity, while in the supine position, or the negative inspiratory pressure, while asleep. Granular tissue, stenosis, dehiscence, malacia, hemorrhage, infections, air leak, and fistulas have been described as complications at the surgical site following tracheal surgery. In our patient, surgical interventions resulted in the formation of a laryngotracheocele, after which the collapsing effect of both gravity and negative inspiratory pressure occurred, as did the orthopnea and OSAS. Higher levels of CPAP, such as those employed to treat severe tracheobronchomalacia and OSAS, resulted in a progressive increase in the size of pharynx but also caused a thinning of the lateral pharyngeal walls, which is the most compliant structure of the upper airway.

In our review of the literature, we found only 1 other case report of a patient with OSAS and tracheal stenosis and bilateral recurrent paresis being successfully treated with a CPAP, in that case, at 12 cm H$_2$O. In our patient, the nighttime CPAP treatment was aimed at preventing the apneic events by stabilizing the tracheal walls destroyed by surgery. We began our treatment with CPAP at 5 cm H$_2$O; however, we subsequently discovered that the level of positive pressure applied to a compliant trachea may be a hazard for dehiscence of the cutaneous graft, based on the findings from CT. Therefore, we lowered the CPAP to 3 cm H$_2$O, the minimal level delivered by CPAP devices, a level that is lower than the usual therapeutic range of CPAP for OSAS (5-15 cm H$_2$O), and found that the apneic events resolved. Ours is the first report of a patient with OSAS that resulted from a tracheal surgery and in whom a very low positive pressure proved to be a safe and effective treatment.

**REFERENCES**


**Figure 1** — Computed tomography scan of the upper airway. The thick arrow points to the laryngotracheocele; the thin arrow points to the cutaneous flap. CPAP refers to continuous positive airway pressure: R, right; A, anterior; T, trachea; S, sternocleidomastoid muscle; J, internal jugular vein; C, common carotid artery; E, esophagus; CV, cervical vertebra.