Pneumocephalus Associated with Nasal Continuous Positive Airway Pressure in a Patient with Sleep Apnea Syndrome

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We report a new potentially dangerous complication of nasal continuous positive airway pressure applied for the treatment of obstructive sleep apnea syndrome. A middle-aged woman had cerebrospinal fluid leak after using nasal CPAP, with generalized seizures and pneumocephalus. She did fine with conservative therapy for the CSF leak and discontinuation of nasal CPAP. (Chest 1989; 96:1425-26)

Obstructive sleep apnea syndrome is characterized by periodic upper airway obstruction and hypoxemia during sleep with daytime hypersomnolence. In severe cases, polycythemia and cor pulmonale may develop. Nasal CPAP was introduced as a treatment for obstructive sleep apnea by Sullivan et al in 1981, and has been shown to be very effective in obviating obstructive sleep apnea in most of those who can tolerate it. During sleep the tongue and soft palate collapse against the posterior wall of the hypopharynx, thereby causing air flow obstruction. Application of nasal CPAP maintains a continuous positive intra-airway pressure along the upper airway, thus acting as a pneumatic splint that prevents the occlusion of the upper airway by the tongue and soft palate. The nasal CPAP unit consists of an airflow generator that blows air into a mask tightly fitted over the nose. A release valve is added to the circuit to maintain the set pressure that has been shown to be optimal in eliminating episodes of apnea on a previous polysomnography study. Intolerance to the nasal CPAP is usually related to nasal congestion, dryness, headaches and mask discomfort. In this report, we present a new and potentially serious complication associated with the use of nasal CPAP.

CASE REPORT

A 55-year-old woman with a history of snoring, daytime hypersomnolence and obesity, was evaluated in our pulmonary clinic in February 1987. Other medical problems included moderate COPD, predominantly bronchitic type, and chronic postnasal drip attributed to sinusitis. She also had a right mastoidectomy for mastoiditis complicating right otitis media in 1985. Physical exam revealed an obese white female woman with a pulse of 78 per minute, blood pressure, 130/80; respiration rate, 20 per minute; height, 160 cm; and weight, 150 kg. A short fat neck and small oropharynx were noted. No signs of cor pulmonale were detected. Hematocrit value was 51 percent; arterial blood gas values on room air were as follow: pH 7.40; PaO2, 62 mm Hg; PaCO2, 43 mm Hg; HCO3, 27 mm Hg; and O2 saturation, 91 percent. Sinus x-ray series were unremarkable. Polysomnography revealed severe obstructive sleep apnea syndrome with apnea/hypopnea index of 63 episodes per hour of sleep and severe oxygen desaturation. Sleep pattern was marked by virtual absence of stages 3 and 4 of NREM sleep, and numerous brief awakenings associated with the abnormal respiratory events.

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FIGURE 1. Sinus roentgenogram at the time of patient admission. Note the air collection inside the cranium.

A repeat polysomnography study was done on nasal CPAP, which demonstrated its efficacy in resolving obstructive apneas at pressure level of 12.5 cm H2O, with dramatic improvement in sleep pattern; however, persistence of significant O2 desaturation (90 percent) required the addition of a continuous flow of oxygen at 1 L/min.

The therapy was started with nasal CPAP, 12.5 cm H2O pressure and continuous flow of oxygen at 1 L/min, with marked subjective improvement. A few weeks after starting this therapy, the patient complained of increasing nasal congestion with clear nasal secretions that did not respond to decongestants or nasal steroids. The patient continued to use nasal CPAP irregularly, and started to notice that applying the mask was followed by a rush of clear nasal discharge. In February 1988, she was admitted to a local hospital with a new generalized grand mal seizure. After complete clinical and neurologic evaluation, EEG, and CT scan of the head, no etiology was found for her seizure, and she was discharged. In March 1988, she was admitted to the University of Wisconsin Hospital after she presented with headaches and persistent clear nasal discharge. Sinus roentgenogram showed pneumocephalus (Fig 1). There were no signs of meningitis or cranial nerve abnormalities. She was treated with acetaminophen, bed rest and CSF drainage by a lumbar catheter (for three days). Shortly after admission, rhinorrhea stopped and on the seventh hospital day, she was discharged, advised to discontinue nasal CPAP and to use nocturnal supplemental low flow oxygen.

On follow-up, the patient continued to do well and a repeat sinus roentgenogram showed resolution of pneumocephalus (Fig 2).

DISCUSSION

Pneumocephalus has been reported to occur as a complication of mask-CPAP or manually operated oxygen powered resuscitator applied via face mask in head trauma victims, and in a young previously healthy male scuba diver while ascending to the water surface.

Air within the cranium usually implies a connection with the atmosphere, directly or via air containing structures. Positive pressure in the upper airway achieved with nasal CPAP is assumed to have forced air into the skull through a weak spot in the cranial structure, most likely the cribriform plate. Congenital fistulas across the cribriform plate are often implicated in spontaneous CSF leaks that occur typically in adult women.

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The usual manifestations of pneumocephalus are headache, dizziness, cranial nerve palsy, and seizures. Management includes bed rest, analgesia, avoidance of coughing, sneezing, nose blowing and straining due to physical activity, and laxative use to minimize the increase in intra-abdominal pressure during a bowel movement. Most effective in decreasing intracranial pressure is repeated lumbar taps with the removal of CSF which is best achieved with an indwelling lumbar subarachnoid catheter.* The course is generally benign since the majority will heal during the first week; however, those who do not are at higher risk for meningitis and may require surgical repair.

The majority of patients with obstructive sleep apnea tolerate CPAP therapy fairly well, but in most series, there were some patients (5 percent) who did not. The causes included mask discomfort, nasal dryness or congestion, diffuse chest discomfort, nasal abrasion,* ear pain, and conjunctivitis. The last two complications may be caused by barotrauma to the inner ear or the conjunctiva (through a leak in the mask or via the lacrimal duct).* There have been no reports of pulmonary barotrauma, and to our knowledge, this is the first case of CSF leak and pneumocephalus associated with the application of nasal CPAP.

We believe that this complication associated with nasal CPAP is uncommon. However, it needs to be considered in those with persistent nasal discharge, especially when associated with new neurologic abnormalities like dizziness, headaches, seizures and cranial nerve palsies.

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A Muscle-Saving Posterolateral Thoracotomy Incision*

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A posterolateral thoracotomy incision which spares the latissimus dorsi and serratus anterior muscles and provides adequate exposure for major thoracic procedures and structures in the posterior hylum is described. Preservation of these accessory muscles of respiration results in improved respiratory dynamics, decreased postoperative pain, and early recovery. (Chest 1989; 96:1426-27)

A posterolateral thoracotomy is the incision of choice for the majority of thoracic procedures. The standard approach results in division of the latissimus dorsi and serratus anterior muscles and paralysis of the caudal portion of the transected muscle. Alveolar hypoventilation and "frozen shoulder" are not uncommon sequelae.†

TECHNIQUE

Twenty-five consecutive patients underwent a muscle-preserving thoracotomy for a variety of intrathoracic procedures. These patients were subjectively evaluated with respect to pain, respiratory mechanics, incisional disfigurement, and recovery.

The incision in the skin is made from the anterior axillary line coarsing two finger-breadths below the tip of the scapula heading posterosuperiorly between the scapula and spine (Fig 1A). Flaps of skin are raised along the posterior edge of the latissimus dorsi muscle using electric cautery. The musculofascial triangle is identified, and the posterior margin of the latissimus dorsi is identified and dissected superolaterally and inferorly (Fig 1B). Having mobilized the latissimus dorsi, the surgeon is ready to mobilize the serratus

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