Polysomnography: Assessment of Decannulation Readiness in Chronic Upper Airway Obstruction

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ABSTRACT

Objectives: To evaluate the clinical value of polysomnography (PSG) testing in patients with a tracheotomy path to chronic upper airway obstruction (UAO) prior to attempting decannulation.

Study Design: Retrospective chart review.

Methods: Possible subjects were identified using a clinical database as having been assessed by the senior author for chronic UAO between 2000 and 2010. All subjects had a tracheotomy, were assessed by the senior author in a tertiary care academic center, underwent PSG prior to (or attempted) decannulation and the majority required at least one surgical procedure prior to decannulation. Results: 15 patients were identified. The majority (87.5%) of patients were successfully decannulated after PSG showed acceptable (not normal) results when carried out with the tracheotomy cuffed. Continuous positive airway pressure was initiated in 44.4% (4/9) of patients who passed their first PSG. Of the remaining 6 patients were decannulated after PSG demonstrated improvement with CPAP and 2 required an additional airway procedure. Patients who did poorly on the PSG and could not tolerate cording of the tracheotomy either went on to further treatment or no attempt was made to decannulate.

Conclusions: Chronic upper airway obstruction (UAO) requiring tracheotomy can be challenging to treat and successfully decannulate safely. Indirect laryngoscopy is essential to evaluate the dynamic airway anatomy and mobility of the vocal folds. However, laryngoscopy does not evaluate airflow quantitatively or assess potential airway obstruction during sleep. PSG evaluation was used to demonstrate acceptable oxygenation and apnea indices during sleep prior to decannulation. The study demonstrated the using PSG was helpful in determining those patients who would be successfully decannulated and likely in part by identifying patients who would benefit from CPAP in the setting of chronic upper airway obstruction.

INTRODUCTION

Tracheotomy is a method of surgically by-passing life-threatening airway obstruction by creating a patent for a number of anatomical and neurological pathologies or to facilitate prolonged airway and ventilatory support in critically ill patients. The decision which patients with chronic UAO (Fig. 1) can be safely decannulated is challenging. Given the serious complications, decannulation failure imposes on patients.6,7 At present the decision is clinical relying on history, physical, and endoscopy.8 Criteria have been established for decannulation readiness for patients in hospital, but decannulation failure is still seen in approximately 4-28% of these patients.9,10 Furthermore, the applicability of these criteria to out-patients with chronic airways abnormalities such as glottic and subglottic stenosis and bilateral vocal cord paralysis are not well studied. Such patients often require admission to the ICU or monitored “step-down” settings to be monitored overnight. Given the increasing limitations of health care resources, these options are not available to many patients. Finally, few of these criteria take into account the dynamic airway changes that occur during sleep.5,8 Sleep disordered breathing appears to play an important role in patients who exhibit difficulty weaning from prolonged mechanical ventilation and is found in up to 50% of patients with no previous history of OSA after tracheotomy decannulation2,9,10. Taken together, these findings suggest a role for polysomnography (PSG) in assessing readiness for decannulation in chronically-tracheotomized patients with airway abnormalities. Previous studies have revealed that PSG provided a useful tool in assessing decannulation readiness in the pediatric population but to our knowledge this has not yet been evaluated in the adult population.

METHODS AND MATERIALS

Following institutional REB approval, a retrospective chart review was performed of all patients presenting with tracheotomy and UAO to be considered for decannulation from 2000-2010 in a tertiary care center. Subjects were identified using a clinical database as having been assessed by the senior author for chronic upper airway obstruction. Patients near decannulation i.e. tolerated at least 6 waking hours of tracheotomy occlusion (cording), were assessed in conjunction with a speech language pathologist. All participants underwent PSG prior to decannulation (Fig. 2). PSG results were formally reviewed by 1 of 2 staff respirologists who were aware of the PSG indication. PSG results were used to determine the presence of sleep disordered breathing and the need for CPAP. Patients were excluded if they passed standard institutional decannulation protocols, did not undergo PSG or had severe obstructive sleep apnea as the primary indication for tracheotomy at the time of evaluation.

RESULTS

During the study period, 15 patients were identified with chronic UAO and tracheotomy who were assessed at a tertiary center for decannulation. Demographic information can be seen in Table 1. Etiologies and endoscopic findings can be seen in Table 2 and Fig. 3. Decannulation had been attempted previously in 5 (33.3%) of patients prior to referral. Urgent decannulation was required in 2 patients and 2 patients required reintubation. All 5 patients required admission to the ICU. Patients required median of 1 surgical intervention in addition to their tracheotomy (range 3-3). All patients were assessed by flow volume loop but only 7/15 were able to complete testing, which showed either severely flattened/truncated inspiratory limbs suggesting significant extrathoracic obstructions. All patients were assessed with PSG. 60% passed their initial PSG. CPAP was initiated in 44.4% of those patients, 87.5% of those patients passing PSG went on to successful decannulation. CPAP was initiated in 5/6 patients who failed their initial PSG. One patient could not tolerate CPAP and was never decannulated. PSG was repeated a mean of 6 months after CPAP was initiated and titrated in 4 patients. 2/4 patients had an additional surgical intervention. All 4 passed subsequent PSG and were decannulated. One patient who had started CPAP was not retested with PSG at the close of the study period and as such was not decannulated. Only a single patient with a passing PSG result required decannulation. No patients required intubation or ICU admission for airway obstruction following the aforementioned protocol.

DISCUSSION

Chronic UAO requiring tracheotomy can be challenging to treat and successful decannulation surgery. Indirect laryngoscopy is essential to evaluate the anatomy of the larynx and mobility of the vocal folds. However, laryngoscopy does not evaluate airflow quantitatively or assess the dynamic anatomical and physiological airways abnormalities that occur during sleep. PSG evaluation was used to demonstrate acceptable oxygenation and apnea indices during sleep prior to decannulation in a group of patients with significant UAO. The study indicates that PSG can assist with the evaluation of decannulation readiness in patients with chronic upper airway obstruction as an adjunct measure in addition to imaging and laryngoscopy. Moreover, it was able to detect patients who would benefit from CPAP who were not known to have sleep disordered breathing. It is known that decannulation can have significant implications on respiratory mechanics, including increased dead space and increased work of breathing.5,11. In one study, upper airway abnormalities were formally excluded by endoscopy.11. In our study, all patients had some form of UAO compounding these physiological changes. Moreover, emerging evidence suggests that sleep disordered breathing may under-appreciated in patients with failure to wean from prolonged mechanical ventilation and in patients following decannulation.2,9. Taken together, these findings suggest a role for polysomnography (PSG) in assessing readiness for decannulation in tracheostomized patients.

CONCLUSIONS

Safe decannulation of patients chronic UAO requiring tracheotomy is a difficult clinical decision with an element of risk. One option is to admit patients to monitored-in-patient settings during this transition; which is not resource efficient nor does it in address the physiological abnormalities that occur during sleep. This study demonstrated the using PSG was helpful in determining those patients who would be successfully decannulated and likely in part by identifying patients who would benefit from CPAP in the setting of chronic upper airway obstruction.

REFERENCES