ELSEVIER

Sleep Medicine 1 (2000) 319–320

SLEEP MEDICINE

www.elsevier.com/locate/sleep

Journal search and commentary

Article reviewed: A simplified method for monitoring respiratory impedance during continuous positive airway pressure ☆

Mark H. Sanders[a,b]

[a]*Pulmonary Sleep Disorders Program, Division of Pulmonary, Allergy and Critical Care Medicine, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA*

[b]*Pulmonary Service, Pittsburgh Veterans Affairs Healthcare System, Pittsburgh, PA, USA*

Category

Sleep-disordered breathing

Objectives

To assess the potential efficacy of measuring respiratory system impedance (Zrs) by the forced oscillation technique (FOT) to indicate the presence of upper airway obstruction during continuous positive airway pressure (CPAP) therapy.

Study design

Bench study comparing various methodologies employing FOT to measure Zrs: data were also recorded in one awake normal subject during volitional upper airway occlusion

Methods

Employing an experimental 'bench' CPAP circuit delivering from 5 to 15 cmH_2O, the FOT reflected application of low frequency forced oscillations into the CPAP circuit, super-imposed on the airflow delivered at the designated pressure. Utilizing the mathematical relationships between pressure and flow recorded at various locations in the CPAP circuit (e.g. inlet, outlet, mask entrance), the investigators calculated the impedance (Z) of the system. In addition, the specific impedances of the CPAP tubing and the exhalation valves were calculated and estimates of system impedance were compared with and without correction for tubing and exhalation valve impedance.

Estimates of Zrs by FOT were also recorded during application of 10 cmH_2O CPAP to an awake subject during voluntary upper airway occlusion.

Results

FOT methodology which introduces low frequency oscillations at 5–10 Hz into the CPAP system, estimates changes in Zrs from variables recorded at the inlet of the CPAP circuit tubing, after correcting for tubing and the exhalation valve impedance.

Conclusion

The authors conclude that measurement of Zrs from pressure and flow variables recorded at the inlet of the CPAP circuit, after appropriate correction for tubing and exhalation valve impedance, may be a useful tool

☆ Navajas D, Duvivier C, Farré R, Peslin R. A simplified method for monitoring respiratory impedance during continuous positive airway pressure. Eur Respir J 2000;15:185–191.

E-mail address: sandersmh@msx.upmc.edu (M.H. Sanders).

1389-9457/00/$ - see front matter © 2000 Elsevier Science B.V. All rights reserved.
PII: S1389-9457(00)00057-5

for monitoring upper airway patency during sleep. This provides a critical part of the algorithm for automatic adjustment of CPAP level in the treatment of patients with obstructive sleep-disordered breathing.

Comment

Although this is a technical article, clinicians who treat sleep-disordered breathing should be aware of FOT in as much as it is likely to be the subject of future papers describing its application in controlling automatic titration of CPAP. FOT has been a long-recognized technique to measure respiratory system impedance and the article under discussion is not the first to introduce this methodology in the context of sleep-disordered breathing. Several earlier papers have described its potential diagnostic utility. One of the confounding issues regarding use of FOT in the setting of CPAP therapy however, has been measurement of flow and pressure downstream, at or near the mask, as well as the potential errors introduced by variously positioned exhalation valves. Sensing pressure and flow at or near the mask may encumber patient use of CPAP and therefore, the current investigation demonstrating that respiratory impedance (Zrs) can be calculated from variables recorded at the CPAP inlet and that corrections can be made for tubing and valve impedance, provides encouraging information regarding the potential clinical application of FOT. A number of clinically relevant issues remain to be addressed however. How do mask or mouth leaks influence FOT in this context? How reliable is the FOT as a reflection of upper airway patency in patients with underlying emphysema, bronchitis or asthma? These persistent questions highlight the fact that FOT is not currently suited for the routine clinical care of patients with sleep-disordered breathing, but it is clearly a technique that warrants further examination and refinement. Undoubtedly, we will be hearing more about it.