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Validity Of Sleep Nasendoscopy in the Investigation of Sleep Related Breathing Disorders

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Objective: **To validate the technique of sleep nasendoscopy using target controlled infusion in symptomatic patients and a control group of asymptomatic individuals.** ***Design:*** **Prospective cohort study.** ***Setting:*** **Department of otolaryngology—head and neck surgery and anesthesia in a teaching hospital.** ***Participants:*** **Two groups of patients were compared and matched for their body mass index. The first group consisted of 53 patients with a history suggestive of obstructive sleep apnea. The second group consisted of 54 patients with partner-confirmed history of no snoring. These patients were undergoing anesthesia for other reasons. Both groups of patients were free of associated otorhinolaryngologic symptoms.** ***Main Outcome Measure:*** **Assessment of production of snoring or obstruction in patients with no documented history of snoring when sedation was administered as part of general anesthesia using target controlled infusion with propofol.** ***Results and Conclusions:*** **None of the patients in the asymptomatic group snored or obstructed at any level of propofol, and this was clearly significant on comparison with the symptomatic group ($P < .001$). All of the symptomatic patients were induced to become symptomatic (snoring/obstruction).** ***Key Words:*** **Sleep nasendoscopy, target controlled infusion, snoring, propofol.**

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INTRODUCTION

Croft and Pringle[1] introduced the technique of sleep nasendoscopy for use in the assessment of snoring to aid proper case selection for surgical intervention. The attraction of sleep nasendoscopy lies with its ability to provide a dynamic visualization of the anatomic areas responsible for the generation of noise (snoring) or obstruction under conditions that mimic sleep. Before the introduction of sleep nasendoscopy, various methods including lateral cephalometry, computerized tomography, and the Muller maneuver had been used in an attempt to achieve the above objective.[2]

Sleep nasendoscopy has been criticized for not being a true reflection of normal physiologic sleep in view of the sedation process involved. Various techniques of sedation have been used.[3–5] Bolus injections of sedatives are commonly used and may lead to fluctuating blood, plasma, and tissue levels, leading in turn to fluctuating drug effects. The correct level of sedation is crucial to produce sufficient muscle relaxation to recreate snoring but not cause respiratory depression.[3] Roblin et al.[2] adopted a computer controlled infusion system that use the concept of target controlled infusion (TCI) using propofol as the sedating agent. Propofol has the attraction of possessing a rapid onset of action and recovery period, with minimal side effects.[6] In addition, it allows for standardization and reproducibility between different operators. A prospective study was thus carried out to validate this technique.

PATIENTS AND METHODS

Two groups of patients were examined and compared on various baseline parameters such as body mass index (BMI) and Epworth score. The first group consisted of 53 patients who were being investigated for symptoms of sleep breathing disorders. The second group consisted of 54 patients who did not give a history of snoring or obstruction, as further confirmed by their partners. These patients were having general anesthesia for other reasons. In both groups, no patient had a history or clinical evidence of nasal or pharyngeal disease.

In both groups sedation was administered as part of the induction by one anesthetist who was familiar with TCI using propofol. The anesthetist was blinded to the patients' history.

The procedure was carried out in the operating theater. The TCI system (Zeneca Pharma, Wilmslow, Cheshire, UK), incorporating an electronically tagged prefilled syringe of 1% propofol placed into a Graseby 3500 dedicated infusion pump, was connected to a size 14 G cannula in the patient's vein. Pulse oximetry, blood pressure, and heart rate were monitored continuously. A starting dose of 2 mcg/mL was chosen, with the microprocessor component within the pump determining the infusion rate required to attain the desired concentration by calculating the absorption, distribution, and excretion of propofol. The blood concentration was increased in incremental doses of 2 mcg/mL every

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90 seconds. The presence of snoring, obstruction, or neither, was evaluated by one of the senior clinical authors who was blinded to the individual's history. If snoring was not reproduced by 8 mcg/mL concentration of propofol in patients in the nonsnoring group, intubation was performed and the planned surgery carried out.

A proforma was designed that included patient's age, BMI, history of snoring, otorhinolaryngologic details, American Society of Anesthesiologists grade, concentration of propofol administered, and notes of any desaturation. These were recorded for both groups of patients.

TABLE II.
Cumulative Proportion of Snoring.

Propofol Concentration	Snoring Group (Symptomatic)	Nonsnoring Group (Asymptomatic)	*P* Value
2	3/53	0/54	.076
4	27/53	0/54	<.001
6	50/53	0/54	<.001
8	53/53	0/54	<.001

RESULTS

The symptomatic group comprised 53 patients, whereas 54 patients made up the nonsymptomatic group. The various relevant characteristics are summarized in Table I. Categorical variables (sex) were assessed using the chi-square test, whereas continuous variables (BMI and Epworth Score) were analyzed using tests for normality; differences were compared by the paired t test. After taking sex into account, both groups are reasonably matched.

Both groups contained similar numbers of males and females, but there was a predominance of males in the snoring group, whereas females were predominant in the nonsnoring group (Table I). The mean age of the patients in the second group was 47.4 years, whereas in the first group, it was 51.7 years.

There was a difference ($P = .046$) between the means of the Epworth score in the two groups: nonsnorers 5.32 (SD 3.473), against snorers 7.36 (SD 3.346). However, sex difference, whether considered alone or as a second factor, was not significantly different (Table I).

BMI was effectively matched between the two groups overall and between males and females within these groups. A difference ($P = .038$) between the means of the BMI values was observed in the two groups: nonsnorers 27.11 (SD 3.984) against snorers 28.83 (SD 4.462), and there was also a difference ($P = .027$) between the means of the BMI values for men (mean 28.75, SD 3.902) and women (mean 26.91, SD 4.604) (Table I).

All patients in the symptomatic (snoring) group snored or obstructed at different concentrations of propofol (Table II). There was no statistically significant difference ($P = .401$) in the distributions of concentrations of propofol at which snoring started between men and women.

In comparison, all patients in the asymptomatic (nonsnoring) group could not be induced to snore or obstruct at incremental levels of propofol, and this was clearly significant statistically ($P < .001$).

DISCUSSION

Sleep nasendoscopy has the potential to be a valuable investigation for making an accurate dynamic anatomic assessment in patients with snoring and obstructive features. Determination of the anatomic site of the obstruction in this way allows for an appropriate or targeted choice of treatment options to be made.[1] Although commonly used, questions have been raised regarding the potential for false-positive results, that is, the production of symptoms (snoring/obstruction) in individuals with no history of sleep disordered breathing.

During sleep endoscopy, the correct level of sedation is vital to induce symptoms of snoring with or without obstruction but not cause respiratory depression.[3] This window of sedation can be narrow, differ from patient to patient, and difficult to maintain for any length of time.

TCI technology uses pharmacokinetic modeling to control the infusion rate of the pump, thus providing the operator with a direct control of the blood and brain concentration of the drug rather than an indirect control with infusion rate. It maintains blood concentration at a set level (and therefore the effective brain concentration) and

TABLE I.
Demographic Data for Two Groups of Patients.

		Snoring Group (Symptomatic)		Nonsnoring Group (Asymptomatic)	*P* Value
Male/Female		42/11		19/35	<.001
Age (n/mean/sd)	53	51.7 (11.37)	54	47.4 (14.09)	.088
BMI (n/mean/sd)					
Overall	53	28.83 (4.46)	54	27.11 (3.98)	.038
Males	42	29.17 (4.28)	19	27.84 (2.79)	.156
Females	11	27.55 (5.13)	35	26.71 (4.49)	.607
EPWORTH SCORE (n/mean/sd)					
Overall	22	7.36 (3.35)	25	5.32 (3.47)	.046
Males	18	7.33 (3.55)	9	6.22 (2.82)	.422
Females	4	7.50 (2.65)	16	4.81 (3.78)	.200

BMI = body mass index.

allows the operator to achieve and control a desired depth of sedation by setting and adjusting predicted blood concentrations.[2]

This system ensures that the patient receives an appropriate bolus dose followed by an increase rate of infusion when the target concentration is attained. When the target concentration needs to be lowered, the pump will stop infusing until the system predicts that the new concentration has been reached and then starts once again at a lower rate.[7]

Propofol is used as the sedating agent for target control infusion because it has a rapid onset of action, is metabolized quickly, giving a fast recovery phase, and has a low incidence of postoperative nausea, vomiting, and headache.[8] The combination of TCI and propofol allows a more accurate and reproducible (between different operators) control of sedation during sleep nasendoscopy.

Earlier authors who have noted false-positive results with sleep endoscopy did not use this technique. Different individuals may have administered the sedating agent or agents used in these studies. The sedating agents indeed differed between operators in such studies, and no measure of sedation effect was used.[3–5] This difference in technique is perhaps an explanation for the encouraging and obvious differentiation of symptomatic from asymptomatic patients demonstrated in this study.

CONCLUSION

Sleep nasendoscopy allows for a targeted management of snoring or obstructive sleep apnea in suitable individuals by clarifying the underlying contributing anatomic sites. The procedure has previously been questioned for not being a true reflection of normal sleep in view of the sedation process required and for the possibility of inducing false-positive results.

This study does, however, confirm the authors' clinical impression that sleep nasendoscopy performed by a target controlled technique is a useful, specific, and sensitive means of assessing patients with sleep related breathing disorders. It should therefore perhaps be considered for a more prominent role in the investigation of such cases, particularly when selection for surgical intervention may be assisted by the anatomic targeting information that may be provided. It may also prove helpful in individuals with obstructive sleep apnea who have proved intolerant of nasal continuous positive airway pressure. Such cases may be further assisted by further judicial intervention dependent on the anatomic information provided by sleep endoscopy. The authors recommend this technique to others involved in the management of such cases where there is appropriate anesthetic interest and availability.

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