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LARYNGOLOGY

Is sleep nasendoscopy a valuable adjunct to clinical examination in the evaluation of upper airway obstruction?

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Abstract The objective of the study is to assess the correlation between outpatient department (OPD) assessment and sleep nasendoscopy (SNE) in treatment planning for sleep related breathing disorders. The study design includes a blinded, cohort study comparing the treatment prediction based on OPD clinical evaluation with SNE in consecutive, adult patients by a single clinician with a specialist interest in snoring related disorders. Patients with moderate to severe obstructive sleep apnoea and those who had undergone previous treatment were excluded. The study was conducted in Royal National Throat, Nose and Ear Hospital, London and Queen's Hospital, Romford. Ninety-four patients were recruited as participants for the study. The main outcome measures include site of obstruction and treatment planning. The results show no significant correlation between the two groups with SNE recommending less surgical intervention and a choice of surgical and non-surgical management in greater number of patients. In conclusion, even in experienced hands, clinical prediction is significantly modified by SNE findings. The addition of SNE to the diagnostic pathway, to assess the three-dimensional dynamic anatomy of the upper airway, provides a valuable adjunct to the OPD assessment of upper airway collapse. This affords the clinician a greater accuracy of diagnosis and the patient a more focussed management strategy with increased choice of modality of treatment.

Keywords Sleep disordered breathing · Sleep nasendoscopy · Snoring · Surgery

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Introduction

The perfect diagnostic tool for the investigation and subsequent evaluation of upper airway dynamics has yet to be described. There are multiple methods that purport to achieve the most accurate diagnosis and management strategy. These include out-patient (OPD) based clinical assessments, haematological investigation, polysomnography, acoustic evaluation [1, 2], sleep nasendoscopy (SNE) [3–6], X-ray cephalometry, magnetic resonance scanning, spontaneous sleep videoendoscopy and multi-channel pressure measurements. Considerable controversy exists as to which method or combination of methods represents the gold-standard investigation.

The technique of SNE, developed in the late 1980s and further modified during the 1990s, has been the focus of both positive and negative opinion [6–8]. In our eyes it represents a repeatable, cost effective, and reliable adjunct to OPD findings. SNE provides two assessments of the upper airway which are not possible to evaluate in the OPD setting: firstly, a dynamic, three-dimensional, real time evaluation of the anatomical sites of upper airway collapse during sleep; and secondly, the effect of mandibular advancement on the airway and snoring [3]. In our institution this is essential in the development of a management strategy that incorporates surgical and non-surgical options allowing the patient to make the best available informed choice [9]. It is important to note that SNE, since its inception, represents an adjunct to clinical evaluation and is not designed to displace this.

This study aims to examine and compare the information derived from clinical evaluation with that derived from SNE in a blinded prospective study. By doing this we hope to establish whether SNE contributes to the diagnosis of snoring.

Method

The subjects for this prospective, blinded, cohort study were recruited at Queen's Hospital, Oldchurch and the Royal National Throat, Nose and Ear Hospital. They represent 94 consecutive patients, referred between May 2005 and August 2006 with sleep disordered breathing, to a single ENT consultant surgeon with a special interest in snoring related disorders. Patients who had the suspicion of OSA were sent for formal polysomnography and if proven excluded as were those who had had previous treatment. All patients underwent OPD evaluation and SNE by the same clinician. A diagnosis of anatomical site of obstruction and a subsequent prediction of treatment was made after OPD evaluation, and again after SNE with the clinician being blinded to the previous conclusions.

Clinical evaluation

In our department, OPD evaluation has been standardized using a set proforma recording detailed patient information broadly categorized as follows (see Appendix)

Patient demographics, patient history and, when present, partner history (nocturnal symptoms inter alia: restless sleep, sleep disruptions, choking, oesophageal reflux, nocturia, night sweats, morning headaches, mood alterations, sexual dysfunction, autonomic behaviour, short term memory loss); Epworth Sleepiness Scale [10]; the measurement of height and weight with the calculation of body mass index (BMI) [1, 11]; measurement of blood pressure; anthropomorphic measurement of neck circumference (collar size); examination of the architecture of the nose (inter alia, nasal septum deviations, inferior turbinate size and nasal polyposis), the oropharynx (inter alia, the size of the tonsils, uvula and soft palate, degree of overbite and nature of dentition), and the larynx and pharynx with a combination of flexible nasendoscopy, endoscopy and direct visualisation in combination with Müller's manoeuvre [12] and simulated snoring techniques [13]; haematological investigation including thyroid function tests and full blood count.

Sleep nasendoscopy

All subjects underwent SNE, performed by the senior author who was not made aware of the previous conclusions reached. This was made possible by the nature of the time delay between OPD assessment and SNE imposed by the hospital waiting list for elective surgery. In accordance with the technique described by Croft and Pringle [7], subjects lay supine with a representation of their usual size of pillow. A light phase of sleep was induced, by the same anaesthetist in each case, using intravenous midazolam (0.05 mg/kg) and propofol (1.5 mg/kg), titrated individually with the subjects heart rate, blood pressure and blood oxygen saturations being continuously monitored. The desired level of sedation, with all reflexes present, was maintained with further boluses of Propofol [4].

A flexible nasendoscope was introduced and any snoring noted with all levels of obstruction graded according to the grading system described by Pringle and Croft [14]. In cases of multisegmental obstruction the percentage contribution of the soft palate and tongue base was noted. The jaw was then lifted by 3–5 mm to simulate the effect of a mandibular advancement splint and any changes to the snoring again and upper airway were documented [3].

Statistics

The data was recorded on to an excel spreadsheet and analysed using the Statistical package for social sciences (SPSS).

Results

Ninety-four patients (77 male and 17 female) were recruited into the study with a mean age of 45 (Fig. 1), an average Epworth Sleepiness Score of ten (standard deviation 5.3) and average BMI of 28.5 (standard deviation 4.6). Two patients with known OSA were included in the study as they declined management with continuous positive airway pressure (CPAP). On OPD evaluation one was felt to be suitable for a Laser assisted uvulopalatoplasty (LAUP) and the other CPAP. However, both subsequently went on to have CPAP based on SNE findings (Fig. 3).

Examination revealed: nasal septal deviation in 65.6%; a prominent uvula in 50%; a lax soft palate in 81%; tonsils in 69.5% of which 43.7% were Grade I, 48.4% Grade II and 7.8% Grade III; redundant oropharyngeal in 55.9% and retrognathia (Class III malocclusion) in 3.2%.

Simulated Snoring demonstrated a palatal cause in 80.9% and a tongue base cause in 2.1%. About 12.7% of patients were unable to simulate a snore.

Müllers manoeuvre attempted in all patients but only circa 46% patients were able to adequately perform the manoeuvre and these showed no correlation with the final OPD or SNE prediction.

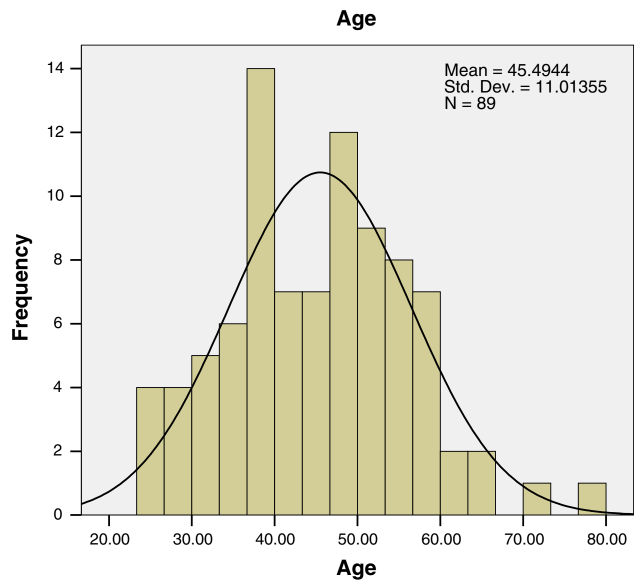

Fig. 1 Age distribution

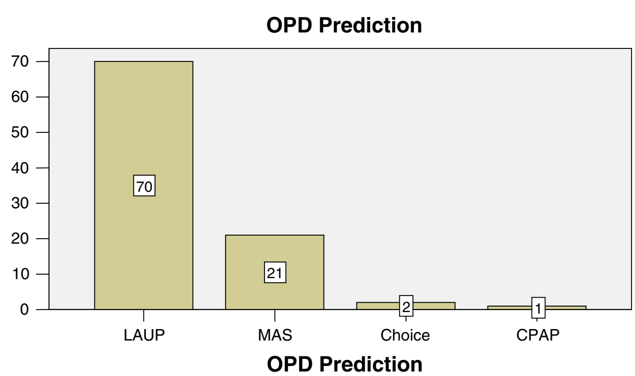

Fig. 2 OPD treatment modality prediction

Overall OPD evaluation predicted that a palatal intervention LAUP was indicated in 74.4% ($n = 70$) and mandibular advancement splint/device (MAS) in 22.3% ($n = 21$) (Fig. 2).

SNE predicted LAUP in 47.8% ($n = 45$) and a Mandibular advancement splint (MAS) in 41.4% ($n = 39$) and a choice of modalities in 8.5% ($n = 8$) (Fig. 3).

Statistical analysis of the predictions from OPD and SNE when evaluated by Pearson χ^2 test shows a statistically significant difference between the two groups with a p value of less than 0.001.

Analysis of the Correlation between OPD and SNE prediction showed a statistically significant level of disagreement (kappa = 0.199; phi = 0.0001) (Table 1; Figs. 4, 5).

Discussion

The relevance of SNE is the subject of much debate and its use remains controversial. Criticism centers on a number of points: Firstly, SNE represents a snapshot of snoring and critics would argue that this does not provide a representative picture as acoustic crest factor analysis has suggests that the dynamics of snoring change during the sleep cycle [15]. Secondly, that sedation-induced sleep, including target controlled infusion (TCI), may not correlate with natural, physiological sleep as it can cause a greater degree of muscle relaxation leading to the potential for false

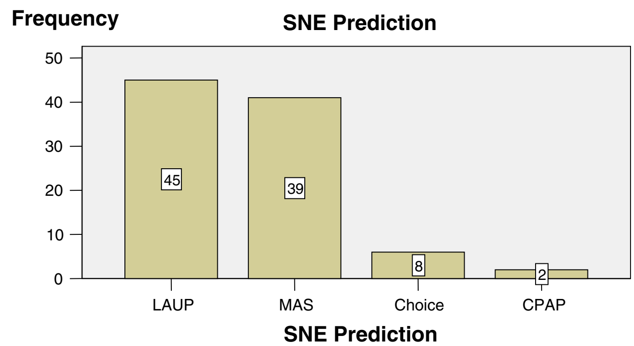

Fig. 3 SNE treatment modality prediction

Table 1 Cases in which predictions were altered by SNE

OPD vs SNE	*n*
LAUP to MAS	25
MAS to LAUP	7
LAUP to CHOICE	6
CHOICE to MAS	2
LAUP to CPAP	1

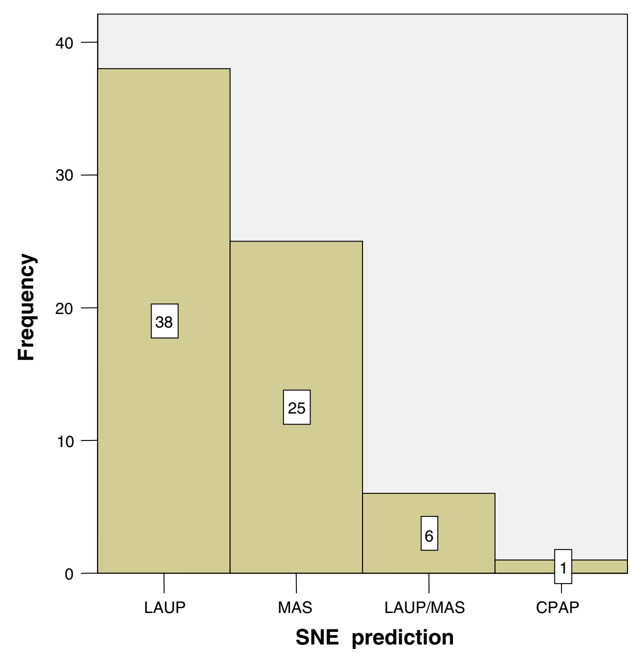

Fig. 4 SNE analysis of OPD predicted LAUP

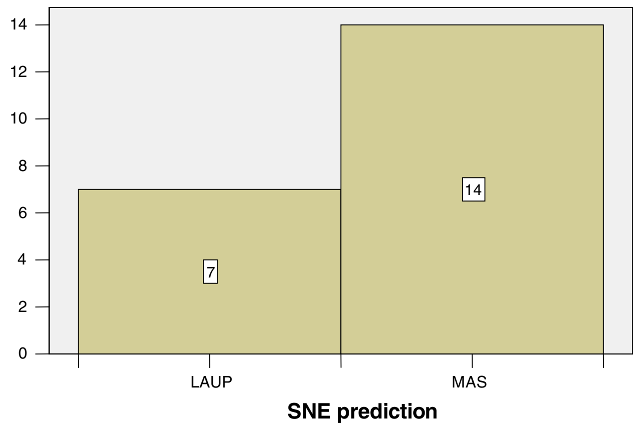

Fig. 5 SNE analysis of OPD predicted MAS

positive obstructive breathing [2, 16]. And thirdly, that SNE is subjective and open to inter-observer and inter-anaesthetist related error.

A study often quoted in the case against SNE is that of Badawey et al., which concluded that SNE was not of value in the assessment of the habitual snorer. However we feel that their use of intra nasal co-phenylacaine and the differing anaesthetic protocol may well account for the differences in results between our unit and theirs [17]. Not withstanding these criticisms there has been much literature published in support of the use of SNE in the identification of the site of upper airway collapse and snoring [4, 18].

This study aims to compare the diagnosis, predicted management strategy and treatment choice offered to the patient from outpatient clinical assessment and SNE.

The main finding of the study is that the information derived from SNE significantly modifies the OPD prediction of treatment option offered to the patient. OPD assessment recommends a palatal intervention in the majority of cases 74.4% ($n = 70$), however, if this cohort is assessed with SNE only 54% of these ($n = 38/70$) demonstrate a palatal cause for their obstruction. This means that potentially, unnecessary surgery is avoided 46% of patients recommended surgery by in the OPD ($n = 32/70$).

SNE allowed for the consideration of more than one modality of treatment for the patient so that a choice between a surgical intervention or a conservative one, such as MAS, can be offered. Based on SNE findings: six cases predicted a LAUP were offered a choice between MAS or LAUP; 25 cases predicted a LAUP were modified to a non-surgical intervention (MAS); and a non-surgical solution was offered to 32 patients (33%) who were only offered a surgical option from OPD evaluation. However, seven (7.4%) cases offered MAS at OPD were recommended to have a LAUP at SNE and two (2.1%) cases recommended a choice in OPD were recommended a MAS at SNE.

SNE also highlighted one patient, with no history of OSA, who dramatically collapsed their upper airway and desaturated to a point that a sleep study was instigated and moderate to severe OSA was subsequently diagnosed.

The analysis of the OPD Simulated Snoring test shows that it predicts a palatal cause in 81% of patients compared to 47.8% by SNE. This highlights the benefit of comparing the dynamics in the asleep versus the awake state where the muscle tone of the upper airway differs. Müllers manoeuvre was found not to correlate with prediction from OPD or SNE and only a small percentage of patients were able to perform the manoeuvre satisfactorily. This agrees with previous published literature [19].

Conclusion

Even in experienced hands, clinical prediction is significantly modified by SNE findings. SNE has been proven to be a reliable assessment tool in snoring evaluation in some studies and disputed in others [14, 20–22]. Clearly, the dynamics of the upper airway cannot be fully assessed in the clinical setting. The addition of SNE to the diagnostic pathway, to assess the three-dimensional dynamic anatomy of the upper airway, provides a valuable adjunct to the OPD assessment of upper airway collapse in spite of its additional cost. Whilst the gold standard assessment tool is yet to be defined, we believe that SNE affords the clinician a greater accuracy of diagnosis and the patient a more focussed management strategy with increased choice of modality of treatment.

Conflict of interest The authors declare that they have no conflict of interest.

Appendix

ADULT SNORERS AND APNOEICS ASSESSMENT FORM

Name:
Date of Birth:
Occupation:

Sex:

Hospital No:

Spouse or Partner present

HISTORY

Presenting Complaint:

Snoring
Apnoea
Somnolence
Other

NOCTURNAL SYMPTOMS:

Abnormal Motor Activity Y/N

	Never	Sometimes	Always
Restlessness			
Sleep Walking			
Awakenings			

Autonomic Events Y/N

Night sweats
Reduced Libido
Enuresis

DAYTIME SYMPTOMS:

Morning Headache
Unrefreshing sleep
Excessive daytime somnolence

Cognitive Changes:

Reduced Concentration
Memory Lapses

Epworth Score

SOCIAL HISTORY:

Accidents	Y/N	No of Driving Accidents in last 5 years
Alcohol	Y/N	No of units per week
Drugs	Y/N	Specify
Smoking	Y/N	No per day

PAST MEDICAL HISTORY:

Operations Y/N

Medical Conditions:

Cardiac	Y/N	Hypertension IHD Angina M.I. C.V.A.
Pulmonary	Y/N	Asthma Bronchitis Emphysema
Endocrine	Y/N	Specify

Nasal Symptoms Y/N

EXAMINATION:

Height
Weight

Body Mass Index Wt/Ht Kg/m

Neck Circumference

Nose

Oropharynx:	Tonsils:	Y/N	Grade	
	Palate:	Thickened	Congested	Prominent uvula
	Pharyngeal Wall:	Redundant Folds Y/N		
Nasendoscopy:	Normal	Y/N		
	If No specify	Nasal cavity Soft palate Larynx	Nasopharynx Oropharynx	
Muller:	Collapse	Y/N		

Sites and degree of collapse	>25%	>50%	>75%	>100%
Soft palate				
Oropharynx				
Tongue base				

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