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Original Research Article

A STUDY TO UNDERSTAND THE ROLE OF DRUG-INDUCED SLEEP ENDOSCOPY IN THE DIAGNOSIS AND MANAGEMENT OF OBSTRUCTIVE SLEEP APNOEA SYNDROME

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Abstract

Background: Drug-induced sleep endoscopy enhances the diagnosis of obstructive sleep apnoea by providing real-time visualisation of airway collapse under sedation. It offers a personalised approach for identifying obstruction sites and complementing polysomnography. This study aimed to evaluate the role of DISE in diagnosing OSAS and assess its impact on management strategies, particularly in determining the most appropriate intervention for each patient. **Materials and Methods:** This prospective clinical study included 100 patients treated at Madurai Medical College and Rajaji Government General Hospital, Madurai, for one year. Patients were evaluated using the ESS and Berlin Questionnaire, followed by otolaryngological examination and full-night polysomnography. DISE was performed under sedation in a controlled setting with sedation levels monitored using the bispectral index. **Result:** Most patients (73.3%) were >20 years old, with a mean age of 30.93±13.2 years. The common symptoms included snoring (96.7%), nasal obstruction (66.7%), and daytime sleepiness (60%). The ESS scores significantly improved in patients aged < 20 years (21-13.63, p<0.001) and >20 years (17.41-12, p<0.001). Males decreased from 17.6 to 11.8 (p<0.001), and females from 19.9 to 13.7 (p<0.001). BMI groups also showed significant reductions, with BMI <25 from 16.9 to 14.1 (p<0.001), 27.1-30 from 17.5 to 11.7 (p<0.001), and >30 from 21.5 to 11.4 (p<0.001). Mild snoring dropped from 19.86 to 9.07 (p<0.001), whereas severe snoring increased from 17 to 20.67 (p<0.001). **Conclusion:** DISE offers valuable insights into airway dynamics and enables the personalised treatment of OSAS. Although it improves surgical planning and therapeutic selection, challenges in standardisation and accessibility remain, requiring consensus guidelines for its broader implementation.

INTRODUCTION

Obstructive sleep apnoea (OSA) is considered a significant public health problem, affecting approximately 1 billion people. It is associated with repetitive partial or complete obstructions of airways during sleep and leads to breathing interruptions and fragmented sleep associated with oxygen desaturation.[1] Interruptions can occur up to hundreds in a single night and cause high degrees of both physical and cognitive impairment in a patient. Over time, untreated OSA has been implicated in a range of serious health conditions including cardiovascular disease, hypertension, stroke, type 2 diabetes, and premature death. Similarly, the economic burden is profound, with indirect costs through increased healthcare utilisation and decreased work productivity.[2]

Traditionally, OSA diagnosis has depended on PSG as the gold standard for measuring the severity of apnoea, which includes measuring apnoea and hypopnoea events during the entire night.[3] PSG provides valuable information regarding physiological changes that occur during an apnoeic event. However, it cannot provide direct visualisation of the upper airway or information regarding the precise anatomical sites of the obstruction. Therefore, PSG alone cannot be used to guide targeted therapies.[4]

Drug-Induced Sleep Endoscopy, a new complementary diagnostic tool, was introduced to overcome the shortcomings identified above. It involves a sleep-like state in the patient while using an endoscope to visualise and assess dynamic airway collapse directly.[5] The technique thus gives immediate anatomical and functional information, allowing clinicians to detect levels of obstruction, including retropalatal, retroglossal, or hypopharyngeal collapse, when tailoring interventions accordingly. The diagnosis made about DISE could determine surgical interventions such as uvulopalatopharyngoplasty and hypoglossal nerve stimulation, the use of oral appliance therapy, or positional changes.[6] Despite the clinical promise, the current evidence remains limited to establishing diagnostic accuracy for DISE, standardising the interpretation protocols, and assessing its effects on long-term treatment outcomes.[7]

This study attempted to fill this gap by examining the role of DISE in diagnosing OSA and improving management strategies. By correlating the findings from DISE studies with PSG results and clinical outcomes, this study aimed to determine how DISE enhances the precision of therapeutic decision-making, thus improving patient care and reducing the burden of untreated OSA.

Aim

This study aimed to evaluate the role of drug-induced sleep endoscopy in diagnosing OSA syndrome and assess its impact on management strategies, particularly in determining the most appropriate intervention for each patient.

MATERIALS AND METHODS

This prospective clinical study included 100 patients treated at the Department of ENT, Madurai Medical College, and Rajaji Government General Hospital, Madurai, for one year. This study was approved by the Institutional Ethics Committee before initiation, and informed consent was obtained from all patients.

Inclusion Criteria

Patients of both sexes aged ≥ 18 years diagnosed with OSA syndrome were included.

Exclusion Criteria

Patients with a high American Society of Anaesthesiologists (ASA) score, pregnancy, severe OSA (AHI > 70 events/h), and severe obesity were excluded, as these patients were regarded as poor candidates for sleep, surgery, and those who did not provide informed consent.

Methods: Each patient was evaluated using the baseline Epworth Sleepiness Scale (ESS) and Berlin Questionnaire. All patients underwent a full otolaryngologic examination to assess the awake status of the upper airway, with particular attention to the size of the uvula, soft palate, tonsils, tongue base, and vallecula, as well as the size and shape of the epiglottis and the Mallampati Score. Following this preliminary evaluation, full-night comprehensive PSG with cardiorespiratory monitoring was performed. All patients underwent DISE performed by an ENT specialist in a controlled, monitored setting, with the assistance of an anaesthesiologist. The sedation levels were monitored using bispectral indices.

Statistical analysis:

Data are presented as mean, standard deviation, frequency, and percentage. Continuous variables were compared using an independent-sample t-test. Significance was defined as $p < 0.05$, using a two-tailed test. Data analysis was performed using IBM-SPSS version 21.0 (IBM-SPSS Corp., Armonk, NY, USA).

RESULTS

Most patients (73.3%) were older than 20 years, with a mean age of 30.93±13.2 years. Males accounted for 66.7% of the patients, while females accounted for 33.3%. Regarding BMI, 40% of patients had a BMI between 27.1 and 30.0 kg/m², followed by 33.3% in the 25.1-27.0 kg/m² range and 26.7% with a BMI above 30 kg/m². Among the symptoms, snoring was the most prevalent, reported in 96.7% of patients. Nasal obstruction was observed in 66.7% of patients, followed by excessive daytime sleepiness (60%). Obstructive episodes and arousal/nocturnal choking were present in 46.7% of the patients, while morning headaches were noted in 33.3%.

Table 1: Demographic, clinical, and laboratory findings.

		Frequency (%)
Age in years	< 20	8 (26.7)
	> 20	22 (73.3)
	Mean	30.93±13.2
Gender	Male	20 (66.7)
	Female	10 (33.3)
BMI (kg/m²)	25.1-27.0	10 (33.3)
	27.1-30.0	12 (40.0)
	> 30	8 (26.7)
Symptoms	Snoring	29 (96.7)
	Positional variation of snoring	7 (23.3)
	Obstructive episodes	14 (46.7)
	Arousal/nocturnal choking	14 (46.7)
	Excessive daytime sleepiness	18 (60.0)
	Intellectual deterioration	1 (3.3)
	Personality changes	6 (20.0)

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	Abnormal motor movements	3 (10.0)
	Morning headaches	10 (33.3)
	Nocturnal enuresis/impotence	1 (3.3)
	Nasal obstruction	20 (66.7)
Severity of snoring	Mild	14 (46.7)
	Moderate	13 (43.3)
	Severe	3 (10)
Hb (g/dL)	< 11	19 (63.3)
	> 11	11 (36.7)
RBS (mg/dL)	< 100	16 (53.3)
	> 100	14 (46.7)
Urea (mg/dL)	< 21	13 (43.3)
	> 21	17 (56.7)
Creatinine (mg/dL)	< 1	22 (73.3)
	> 1	8 (26.7)

In terms of snoring severity, 46.7%, 43.3%, and 10% of patients had mild, moderate, and severe snoring, respectively. Regarding laboratory parameters, 63.3% of the patients had haemoglobin levels < 11 g/dL, whereas 36.7% had levels > 11 g/dL. A total of 53.3% had random blood sugar levels < 100 mg/dL, whereas 46.7% had levels > 100 mg/dL. Of the patients, 56.7% had urea levels > 21 mg/dL, and 43.3% had urea levels < 21 mg/dL. Creatinine levels were < 1 mg/dL in 73.3% of the patients, whereas 26.7% had levels > 1 mg/dL [Table 1].

Table 2: Interpretation of ESS scores

		ESS score		P-value
		Before	After	
Age in years	< 20	21	13.63	< 0.001
	> 20	17.41	12	
Gender	Male	17.6	11.8	< 0.001
	Female	19.9	13.7	
BMI (kg/m²)	25.1-27.0	16.9	14.1	< 0.001
	27.1-30.0	17.5	11.7	
	> 30	21.5	11.4	
Severity of snoring	Mild	19.86	9.07	< 0.001
	Moderate	17.08	14.15	
	Severe	17	20.67	

Patients aged < 20 years showed a decrease in ESS scores from 21 to 13.63 ($p<0.001$), whereas those older than 20 years experienced a reduction from 17.41 to 12 with a significant reduction ($p<0.001$). Regarding gender, males had a decline in ESS scores from 17.6 to 11.8, whereas females showed a decrease from 19.9 to 13.7 with a significant difference ($p<0.001$).

Patients with a BMI between 25.1 and 27.0 kg/m² had reduced ESS scores from 16.9 to 14.1. Patients with a BMI between 27.1 and 30.0 kg/m² showed a decrease from 17.5 to 11.7. Patients with BMI > 30 kg/m² showed the most significant improvement, with scores dropping from 21.5 to 11.4 ($p<0.001$). In terms of snoring severity, patients with mild snoring showed a reduction in ESS scores from 19.86 to 9.07, while those with moderate snoring had a decline from 17.08 to 14.15. However, in patients with severe snoring, the ESS score increased from 17 to 20.67 ($p<0.001$), indicating worsening daytime sleepiness [Table 2].

DISCUSSION

Obstructive sleep apnoea syndrome is a complex disease with repeated episodes of upper airway obstruction during sleep, causing important health consequences such as cardiovascular diseases, hypertension, and metabolic disorders.[8] The OSAS diagnosis and treatment of OSAS have been upgraded with the introduction of DISE, which plays a crucial role in explaining the condition and designing personalised treatment approaches.

The Importance of Accurate Diagnosis

Traditionally, the diagnosis of OSAS remains heavily dependent on PSG, which detects a variety of physiological parameters during sleep such as airflow, oxygen saturation, and respiratory effort. However, though PSG is a critical tool for OSAS, it does not reveal information about the site(s) of obstruction.[9] DISE fills this gap by allowing direct visualization of airway collapse under sedation, thereby being informative on the pattern and site of obstruction.

Recent studies have reported the benefits of DISE compared with awake endoscopy. Kezirian et al. showed that DISE was more accurate in predicting surgical results than awake endoscopy because it enabled the observation of airway dynamics in a state closely approximating natural sleep. This dynamic assessment reveals complex patterns of airway collapse that may be missed at presentation when the patient is awake, such as positional changes or effects of muscle tone on airway patency.[10,11]

Tailoring Treatment Strategies with DISE

The first aim of the management of OSAS is to restore airway patency during sleep. Treatments

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range from conservative measures, such as lifestyle modifications and continuous positive airway pressure (CPAP) therapy, to more invasive surgical approaches. DISE is fundamental in selecting the most appropriate surgical approach because it identifies anatomical sites where obstruction occurs.[12]

1. **Surgical Planning:** DISE can help precisely plan the surgery by unveiling the patterns of collapse of the upper airway. For instance, patients who suffer from retropalatal obstruction may respond to uvulopalatopharyngoplasty (UPPP), while patients with retrolingual obstruction may benefit from procedures such as genioglossus advancement or tongue-base reduction.[11] In the case of multilevel obstruction, DISE can help decide which combination of procedures may result in the best outcome.
2. **Outcome Prediction:** Evidence shows that DISE-driven surgical interventions achieve better results than those guided by PSG alone. According to a systematic review by Certal et al., patients treated by DISE-guided surgery showed a more substantial decrease in AHI and a better quality of life score.8 Also, post-surgical follow-ups revealed a smaller incidence of remaining sleep-disordered breathing if DISE is employed during the assessment before surgery.[12,13]
3. **Patient Selection for Alternative Therapies:** Apart from surgery, DISE is useful for ascertaining the suitability of alternative therapies such as HNS. The effectiveness of HNS lies in the selection of patients who are intolerant of CPAP, especially those with moderate-to-severe OSAS. DISE would be helpful to identify potential candidates for HNS by establishing particular sites of obstruction that could be amenable to this form of treatment.[14]

Limitations of DISE: Although DISE is beneficial, it has several limitations. One major limitation of DISE is the lack of standardised protocols within institutions, leading to variability in the techniques employed for sedation, scoring systems, and interpretation of findings. This variability may affect the reliability of DISE results and their clinical application. DISE requires specialised training and resources, which limits its availability in some settings. The procedure involves sedation, which poses risks, particularly for patients with comorbidities. Selection of the right patient and proper preoperative assessment are important.

Future Directions: The future of DISE in the management of OSAS appears promising with some potential advancements. Further research must focus on standardising protocols to enhance the reliability and reproducibility of the findings. The integration of DISE with advanced imaging techniques, such as dynamic MRI or CT, will be able to provide complementary information regarding the airway structure and function, allowing for more accurate treatment decisions. Exploring virtual reality or three-dimensional modelling in DISE could offer more comprehensive insights into airway dynamics and patient-specific anatomy. Such advancements may improve patient selection for surgical intervention and help predict the outcomes more accurately.

CONCLUSION

DISE significantly enhances the diagnosis and management of OSA by visualising dynamic airway collapse and enabling personalised interventions. Unlike polysomnography, DISE identifies precise obstruction sites (e.g. retropalatal and retroglossal), guiding targeted therapies such as surgery, HNS, or oral appliances. In this study, DISE was correlated with improved ESS scores post-intervention, particularly in patients with a higher BMI or moderate snoring, although severe snoring cases showed paradoxical worsening. Although DISE optimises surgical planning and outcome prediction, the standardisation of protocols and accessibility remains a challenge. Future integration with advanced imaging (e.g. dynamic MRI) and 3D modelling could refine the precision. Addressing the variability in sedation techniques and their interpretation is critical for maximising DISE's clinical utility of DISE. Despite these limitations, DISE represents a transformative tool in OSA care, bridging diagnostic gaps and fostering patient-specific strategies to reduce disease burden.

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