

ANESTHETIC MANAGEMENT FOR DRUG
INDUCED SLEEP ENDOSCOPY

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Introduction

Sleep endoscopy, also known as sleep nasoendoscopy (SNE) or drug-induced sleep endoscopy (DISE), is a powerful tool for studying the dynamic airway in a sleeping patient with obstructive sleep apnea (OSA). Using the knowledge gained from sleep endoscopy, the surgeon can tailor the operative procedure to the patient's specific condition.

Based on the level and pattern of airway obstruction in a patient with OSA, sleep endoscopy allows the physician to tailor the treatment plan to each patient. This can improve the results of surgical intervention and/or minimize the scope of intervention. Sleep endoscopy may also provide information that erases the need for surgery altogether. 70% of patients surveyed in an outpatient setting by Hewitt et al were determined to have a palatal cause of obstruction and were surgical intervention. However, after undergoing sleep endoscopy the number of patients deemed to need surgical procedures decreased to 54%¹.

The diagnosis and treatment of OSA is a complex and multidimensional due to the difficulty in establishing the site of obstruction in the awake patient who carries a diagnosis of Obstructive Sleep Apnea Hypopnea Syndrome (OSAHS). Croft and Pringle first proposed sleep endoscopy in 1991². Using midazolam as a sedating agent, they demonstrated the utility of passing a fiberoptic endoscope through a sleeping patient's nasal cavity to assess pharyngeal structures for evidence of obstruction and were able to induce the preexisting snoring in 95% of their patients².

Other investigators used propofol because it is a hypnotic drug with a very short half-life (approximately three minutes), and its eventual adverse effects are rapidly recovered as soon as administration is discontinued. Moreover, its effect on respiratory depression is lower than that observed with benzodiazepines, and it leads to a low incidence of side effects,(e.g. nausea, headache) and is considered to be a very safe drug for sedation³.

In 1993, Croft and Pringle developed a grading scale that utilized sleep endoscopy to categorize snoring and obstruction. Grading was based on whether the obstruction was palatal, multilevel, or tongue-based⁴. Sleep endoscopy, in combination with the grading scale, allows the physician to directly observe and record pharyngeal structures in the sedated patient with OSA and categorize the obstruction.

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Also, sleep endoscopy is enormously useful as a tool for teaching all levels of staff about airway management, and it is useful for anesthesiology and otolaryngology residents who are learning about airway anatomy and physiology.

The main indications of sleep endoscopy reported in the literature are: severe OSAHS, surgical failure, mismatch between awake endoscopic assessment and clinical features and suspected central nervous system diseases.

The aim of this review is to help anesthesiologists and ENT surgeons in management of DISE before, during and after DISE techniques.

Technique of DISE

All sleep endoscopies are carried out in an operation theater setting. The patients is placed in the supine position on their ward beds or operating theatre beds in comfortable ambient temperatures, dimmed lighting, with their eyes covered by a paper face mask and they are encouraged to sleep.

Prior to DISE, flexible nasal endoscopy is performed on the patient whilst awake, using the Müller maneuver (forced inspiratory suction with mouth and nose closed) that allows an estimation of different patterns of pharyngeal collapse. Endoscopic examination in both awake and asleep patients is performed using flexible nasopharyngoscope⁵.

Following this upper airway evaluation, further clinical assessment of the patients includes review of the sleep study report and preoperative medical clearance. Sedatives and narcotics are avoided before the procedure, and heart rate (HR), non-invasive blood pressure (NIBP), oxygen saturation (SpO₂), and bispectral index (BIS) are monitored, together with continuous monitoring BIS (a scale derived from cerebral electrical activity and that measures the effect of specific anesthetic drugs on the brain. The recommended range in anesthesia guided by BIS is 40–60)⁶.

Pharmacological regimen in adults

The 'ideal' drug for DISE, should have a short half-life and be available for IV and infusion with

minimal impact on respiratory drive, muscle tone and rapid eye movement (REM) sleep (Kezirian 2006)⁷. In addition, it should have a specific, rapidly acting antidote. There is no ideal agent but propofol is currently the drug of choice for DISE.

Propofol manual infusion for DISE

Sleep endoscopy is manually performed using a 20 ml syringe containing 1% or 2% propofol. An induction bolus of 1 mg/kg propofol is followed by 20 mg boluses every two minutes until the start of the so-called snoring-apnea cycle (SAC), through wide bore cannula in a large vein to prevent pain during injection⁵.

Propofol target-controlled infusion (TCI) for DISE- TCI

Sleep endoscopy is performed by a target-controlled infusion (TCI) system using Schnider model in effect-site (cerebral) targeted infusion 50 ml prefilled syringe of 1% propofol. The Schnider system is a complex pharmacokinetic/pharmacodynamic (PK/PD) model that allows obtaining different rates of drug from the values of age, height, weight, and lean body mass of the patient⁸. The initial target for propofol is 1.5 mcg/ml and increasing in increments of 0.2 mcg/ml every 2 minutes until the start of snoring-apnea cycle (SAC). The propofol rate will continue by last rate of infusion till the end of examination. and this is known as the 'slow' technique⁵. For 'rapid' technique, the initial target of propofol is 2.5 mcg/ml and increasing in increments of 0.2 mcg/ml every two minutes until the start SAC. The propofol rate will continue by last rate of infusion till the end of examination. During either procedure, the above mentioned vital parameters shall be monitored every two minutes together with any observed alterations in upper airways' (UA) opening or snoring-apneas events before the next injection of propofol.

During the DISE, the onset of the so-called CAS should be identified and reported in a specific data sheet. Moreover it is important to mark the different sites and patterns of UA collapses. Different endoscopic classification systems could be used for this purpose,

such as the nose, oropharynx, hypopharynx and larynx (NOHL) classification⁹ or the velum, oropharyngeal lateral wall, tongue base and epiglottis (VOTE) classification¹⁰.

Other techniques

IV midazolam (3–5 mg) IV and propofol (30–50 mg) can be titrated individually by an anaesthetist, with additional 20-mg boluses of propofol every two minutes to maintain a satisfactory level of sedation. However, benzodiazepines reduce muscle tone and respiratory drive and flumazenil may be needed for reversal of these side effects¹¹.

Dexmedetomidine may be useful for outpatient anesthesia, sleep nasendoscopy and sleep studies. It can be given as 1mcg/kg loading infusion over 10 min., followed by continuous IV infusion between 0.2–0.7 mcg/kg/h¹² which still under clinical trials.

Pharmacological regimen in pediatrics

The induction in children is performed by mask inhalational of sevoflurane. An IV cannula is then inserted, and anesthesia is maintained with an infusion of dexmedetomidine at 1–2 mcg/kg/hr without a loading dose, with additional ketamine (10mg/kg). Previously, a propofol infusion was used to maintain anesthesia. However, Aaron and Peter have found that, with this propofol technique in pediatrics, the muscle relaxation is less marked resulting in more prolonged expiratory effort. They also vasoconstrict and anesthetize the nose with a half and half mixture of oxymetazoline and 1% xylocaine delivered on a 1cm × 4cm cottonoid pledget. Spontaneous respiration is supported by oxygen (2L/min) delivered via nasal cannula. The child should be positioned in the supine position without a shoulder roll, mimicking the position of natural sleep as much as possible¹³.

Once a rhythmic pattern of respiration is established, a flexible fiberoptic laryngoscope is passed directly into the child's nose, passing posteriorly toward the nasopharynx. For visualization and documentation, a digital video camera is used with the endoscope.

At the nasopharynx, the adenoids are examined as a potential site of obstruction. The position of the

palate and uvula in relation to the posterior pharyngeal is identified. The scope is then passed into the oropharynx lingual tonsils, and pharyngeal tonsils (if still present) are examined. The position of the base of tongue, vallecula, and epiglottis in relation to the posterior pharyngeal wall are noted. In some cases, the tongue base can be seen collapsed against the posterior pharyngeal wall. In such cases, visualizing the improvement in airway patency by lifting the tongue base with jaw thrust can be quite dramatic. The dynamics of lateral pharyngeal wall motion can be seen. The scope is then passed under the epiglottis where the dynamics of the supraglottic soft tissues, as well as the motion of the vocal cords, are observed. At the completion of the sleep endoscopy, the scope is removed. Direct laryngoscopy and bronchoscopy can then be performed to complete the airway evaluation¹³.

Post procedure Management

The American Society of Anesthesiologist (ASA) guidelines states that, all patients should be monitored for three hours longer than non-obstructive sleep apnea patients. Oxygen saturation on room air should return to its preoperative baseline. Patients should not be hypoxemic or have signs of developing airway obstruction when left alone. As there is no pain during or after the technique there is no need for analgesia. The patients are usually drowsy after the procedure, so they must not drive, operate heavy machinery or work on the same day¹⁴.

Advantages of DISE: versus Polysomnography

Dynamic assessment of the effects of sleep on the airway.

Directly visualization of the source of obstruction and related structures

Precise identification of the relevant structures which enables the surgeon to define surgical treatment.

Complication of DISE

Complications associated with sleep endoscopy include the following:

Nasal bleeding induced by the flexible fiberscope

Laryngospasm
 Pulmonary aspiration
 Hypercapnea, desaturation and loss of the airway
 Need for intubation or a surgical airway
 Cardiac dysrhythmias
 Systemic hypertension

So, all resuscitation equipments, difficult airway trolley and trained personnel should be ready to manage these complications.

Contraindications of DISE

Relative contraindications include patients who are pregnant or who have a known history of propofol allergy or allergies to propofol components such as egg, lecithin, or soybean oil. Other contraindications are significant nasal obstruction that impedes passage of the flexible fiberoptic laryngoscope (FFL), an “unsafe” airway, a frank aspiration history, and patients are not fasting.

Challenges of DISE for Anesthesiologist

No O₂ Supplement
 No Guedel’s airway allowed
 Anti-cholinergic not allowed
 Risk of aspiration
 Sedation for patients who are by nature sensitive for sedatives
 All patients are done as day care

Discussion

Propofol is an ‘ideal’ agent because it is a hypnotic drug with a very short half-life (approximately three minutes), and any adverse effects are rapidly reversed immediately after administration is discontinued. Moreover, its effect on respiratory depression is lower than that observed with benzodiazepines, and associated with a low incidence of side effects such as nausea and headache¹⁵⁻¹⁷.

Berry et al performed propofol sedation in two different groups, those with and those without history of snoring and apnea. They observed that no asymptomatic subject presented snoring during

sedation, whereas snoring occurred in all patients in the “snoring and apnea” group. The authors concluded that propofol sedation does not induce snoring or apneas in patients without snoring or apneas during regular sleep¹⁸.

Similarly, Fábio et al. did not observe snoring in asymptomatic patients, compared with 100 percent of OSA patients w/w did snore²⁰. Such consistency was also observed by Croft and Pringle² Berry et al¹⁸, and Llatas et al¹⁹.

Fábio et al. were the first investigators to observe that, for these procedures, propofol distorts the EEG structure, and REM sleep is replaced by N3 sleep in every sedated patient²⁰. The mechanism(s) of action of propofol have not been fully clarified, although it is known that the drug interacts with the gamma-aminobutyric acid (GABA)A–benzodiazepine receptor complex¹⁸. This interaction would consequently reduce the firing rate of cholinergic neurons in the frontal cortex and hippocampus, which are important during wakefulness and REM sleep²¹.

Nasoendoscopy under propofol sedation using an infusion pump has been reported, but the plasma levels of the drug vary in literature from 2 to 8 ug/mL²²⁻²⁴. In 2005, Jones et al²¹ reported that the minimal plasma concentration of propofol for the patient to tolerate this examination was 1.5 ug/mL.

Conclusion

In OSAHS patients, the observation of apneic events is mandatory for diagnostic accuracy, especially for patients undergoing surgical therapy. Sleep endoscopy represents a remarkable diagnostic tool, but all efforts to increase the accuracy, stability and safety of the technique applied should be implemented.

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* Train-of-four

† Post-tetanic counts

‡ Second twitch

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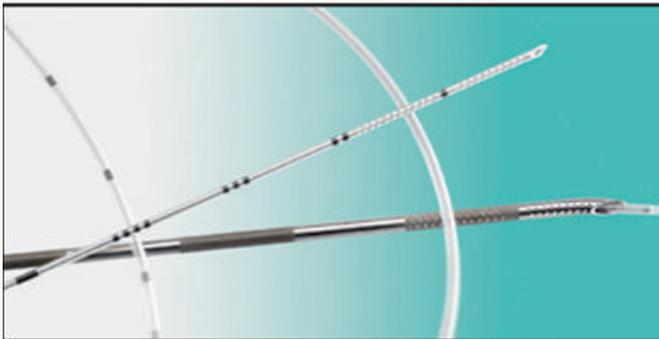
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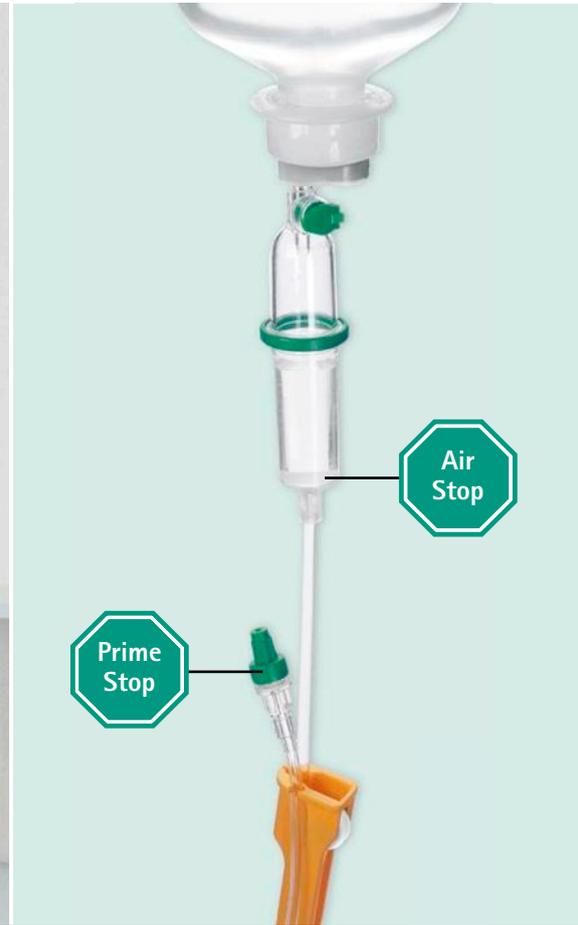
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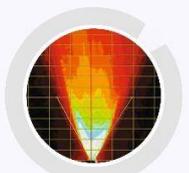
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