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Original Research Article

Role of Drug-Induced Sleep Endoscopy in the Diagnosis of Obstructive Sleep Apnoea Syndrome: A Clinical Study

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Abstract:

Background: Obstructive Sleep Apnea (OSA) involves recurrent partial or complete upper airway blockage during sleep, causing airflow reduction. This leads to frequent hypoxia, carbon dioxide buildup, and arousals to restore airway patency, disrupting sleep. Diagnosing OSA relies on clinical history, polysomnography, and drug-induced sleep endoscopy (DISE). This study aims to assess the anesthetist's role in DISE, addressing the limited existing data on this aspect.

Methods: This study included 30 patients with a history of snoring and night arousals selected for Drug-Induced sleep endoscopy (DISE) after taking informed consent. Inj. propofol 0.5mg/kg wt loading dose, followed by 200mcg/kg/min infusion given throughout the procedure, and upper airway nasal endoscopy performed to see the site of airway obstruction. Lowest SpO_2 apnoeic episodes, total propofol used, and DISE findings were recorded. The airway was managed after the procedure till the subject regained consciousness.

Results: In this study, BMI distribution revealed 16.67% of cases with normal BMI, 63.33% in the overweight category, and 20% with BMI >30 kg/m². SpO_2 ranged from 82.40% to 94.00%, with a mean fall of 81.40 ± 8.92%. Apneic episodes were assessed in 30 individuals with Obstructive Sleep Apnea, with 60% reporting no episodes. Age-wise analysis showed mean apneic episodes and SpO_2 variations. The mean dose of injection propofol was 1.52 ± 0.16 mg/Kg, varying across age groups. The comparison of the values aged between age, BMI, SpO_2, and total propofol dose requirement observed that there were significant correlations between age and low SpO_2 (p=0.001), BMI and low SpO_2 (P=0.0001), and BMI and inj. Propofol requirement (P=0.001).

Conclusion: Drug-induced sleep Endoscopy (DISE) is a dynamic, safe, and easy-to-perform technique that visualizes the anatomical sites of snoring or apneas and guides the design of a tailor-made treatment plan in individual cases. Lower readings of SpO_2 have been observed in patients with complete collapse at the tongue base and patients with floppy epiglottis. The anesthesiology personnel could benefit by documenting the DISE findings for further reference which would be useful during anesthesia for definitive corrective surgical maneuvers or other incidental surgeries.

Keywords: Drug-Induced Sleep Endoscopy (DISE), Obstructive Sleep Apnoea (OSA), Snoring.

Introduction

Obstructive sleep apnoea (OSA) is the most prevalent sleep disorder. OSA is characterized by repetitive partial or complete obstruction of the upper airway during sleep, resulting in reduction or cessation of airflow, despite ongoing respiratory effort. [1] This results in repetitive hypoxia and carbon dioxide retention, provoking arousals to restore upper airway patency and consequently fragmenting sleep. [2] Periodic airway obstruction leads to excessive daytime sleepiness, tiredness, reduction in exercise tolerance, and other cardiopulmonary symptoms. [3] Most of the patients will have obesity, altered lipid profile, hypertension, diabetes mellitus, cardiac arrhythmias, etc. placing them in the high-risk group as far as anesthesia is concerned. [4] These patients also tend to have excessive responses to depressants, opioids, and inhalational anesthetic agents. In the general population, it is estimated that 3.3 – 7.5% of men and 1.2 – 3.2% of women meet the diagnostic criteria for OSA syndrome. [5] Preoperative evaluation guides the anesthesiologist to anticipate and manage the peri-operative complications. Assessment of the airway and diagnosis of co-morbid medical problems are important tools in preoperative evaluation. Obstructive sleep apnoea

syndrome is a medical problem usually associated with obesity as obese individuals often present with difficult airways. Proper pre-anesthetic evaluation early diagnosis and treatment, anticipating the peri-operative complications, and prophylactic steps to avoid such complications intraoperative monitoring, and management improve OSA patients.

Diagnosis of obstructive sleep apnoea is based on clinical history, polysomnography, and drug-induced sleep endoscopy (DISE). Polysomnography helps detect the severity of obstruction and DISE is helpful to know the site of obstruction and guides towards surgical correction and permanent treatment. [6] The performance of DISE needs the active involvement of anesthesiologist and their knowledge of the inherent problems pertaining to sleep apnoea. As the chronicity of obstructive sleep apnoea syndrome increases the impact on major systems (Cardiovascular, central nervous system, etc.,) and metabolic endocrine derangements are more due to low blood oxygen levels. OSA syndrome has a grave social impact due to excessive daytime sleepiness causing more road traffic accidents and leading to more burden in society and the health care delivery system. [7] Identification of the site of obstruction and pattern of upper airway changes during sleep is a key point essential in guiding therapeutic approaches to obstructive sleep apnoea syndrome (OSAS). Several studies have demonstrated that DISE may help to specify therapy individually, leading to an increased surgical success rate. For these reasons. DISE has been an essential breakthrough in evaluation of OSA patients. [7] Population-based epidemiologic studies have uncovered the high prevalence and wide severity of undiagnosed obstructive sleep apnoea and have consistently found that even mild obstructive sleep apnoea is associated with significant morbidity. [8] DISE is a diagnostic tool with helps to know the exact site of airway obstruction and gives valuable information for surgical correction. Our specialty is now increasingly involved in providing anesthesia for sleep studies and this work has been undertaken to assess the role of anesthesiologists in the relatively new arena. Not many studies are available on the role of anesthesiologist in DISE and this study is an effort in that direction. The current study aimed to determine the degree of desaturation during the procedure to determine the site of airway collapse during drug-induced sleep and to identify individuals with graded risk for OSA.

Material and Methods

This prospective study was conducted in the Department of Anesthesiology, in collaboration with the Department of ENT, JSS Hospital Mysore. Institutional Ethical approval was obtained for the study. Written consent was obtained from all the participants of the study after explaining to them the nature of the study in the vernacular language.

Inclusion Criteria

1. Patients diagnosed with Obstructive Sleep apnoea syndrome
2. Patients subjected to polysomnography
3. Aged between 20 – 60 years
4. Voluntarily willing to participate in the study.

Exclusion Criteria

1. Patients with acute respiratory tract infections
2. Patients with uncontrolled diabetes mellitus
3. Patients with significant cardiovascular diseases
4. Not eligible as per the inclusion criteria

Based on the inclusion criteria and exclusion criteria a total of 30 cases of obstructive sleep apnoea syndrome were selected for the study.

The procedure of drug-induced sleep endoscopy: After doing a thorough preoperative evaluation consent was taken. Patients were kept nil by mouth for 6 hours before the procedure. All the equipment for difficult intubation was kept ready. The intravenous line was secured with an 18G cannula. Premedication with inj. Ondansetron 0.1 mg/kg and inj. Glycopyrrolate 0.2 mg. Induction was done with 0.5mg/kg propofol as a bolus dose and 200 mcg/kg was administered as infusion till the procedure was over. The patient was monitored till he regained complete consciousness. The procedure was carried out by an ENT surgeon in the endoscopy room. Parameters recorded were the degree of desaturation, lowest SpO_2, number of apnea episodes, the requirement of intubation, site of airway obstruction, complete or partial obstruction, the direction of obstruction (anteroposterior or lateral), and total requirement of propofol drug studied during the procedure.

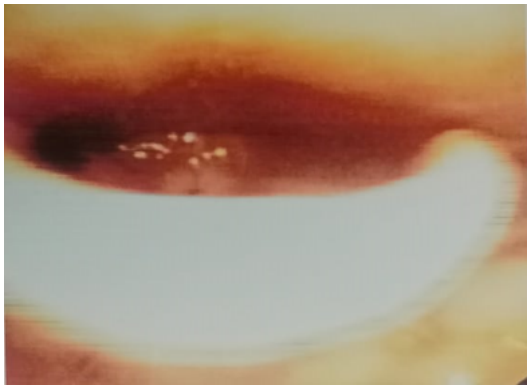

Figure 1: Airway obstruction due to AP collapse

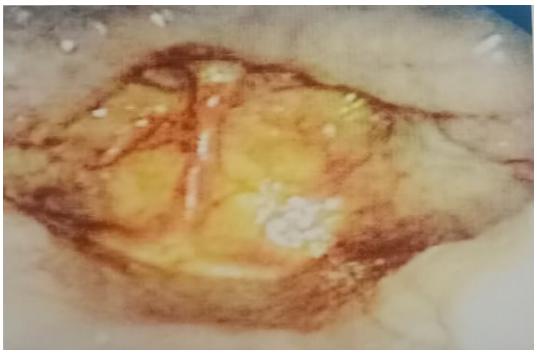

Figure 2: Airway obstruction due to floppy epiglottis

Statistical analysis: All the available data was uploaded to an MS Excel spreadsheet and analyzed by SPSS version 21 in Windows format. The continuous variables were represented as mean, standard deviation, and percentages, and categorical variables were represented by p values determined by the Kruskal-Wallis test, ANOVA, and Chi-square test, and values of p (<0.05) were considered significant.

Results

Out of the total 30 cases included in the study the majority of patients (83.33%) fall within the 31-50 age range, with the 31-40 group representing the largest proportion (43.33%). A smaller percentage of patients (16.67%) belong to the 21-30 age group (Table 1). Notably, there are no patients in the 51-60 age group in this sample. The mean age of the cohort was 37.3 ± 7.2 years. The total number of males were 27(90%) and females were 3(10%). The male-to-female ratio was 9:1.

Table 1: Age-wise distribution of cases with Obstructive Sleep Apnoea Syndrome included in the study

Age group in years	Frequency	Percentage
21 – 30	05	16.67
31 – 40	13	43.33
41 – 50	12	40.00
51 – 60	00	00.00
Total	30	100.0

The BMI distribution of the cases in the study showed patients with normal BMI (18.5 and 24.9 Kg/m^2) were 5(16.67%). Cases with BMI between (18.5 and 24.9 Kg/m^2) overweight category were 19(63.33%) and cases with BMI (>30 kg/m^2) were 6(20%). In our study, we found that the range of SpO_2 was 82.40 – 94.00% and the mean fall of SpO_2 was 81.40 ± 8.92%. The comparison of values of SpO_2 between different categories was found to be significant at 0.00012 (table 2)

Table 2: BMI and low SpO_2 levels in the cases of the study

	Low SpO_2 levels	P value
Normal	90.20 ± 2.77	0.00012
Overweight	83.05 ± 5.14	
Obese	68.83 ± 9.11	

* Significant

Table 3: Distribution of apnoeic episodes with Obstructive Sleep apnoea syndrome included in the study

Number of Apnoeic episodes	Frequency	Percentage
Nil	18	60.0
1.0	01	3.33
2.0	02	6.7
3.0	04	13.3
4.0	01	3.3
5.0	02	6.7
6.0	02	6.7

Table 3 shows the distribution of the number of apneic episodes per patient among 30 individuals diagnosed with Obstructive Sleep Apnea (OSA) included in a study. It categorizes the number of episodes and provides the corresponding frequency and percentage of patients within each category. Almost two-thirds (60%) of the patients reported no apneic episodes during the study period. This may indicate milder OSA severity or limitations in the monitoring method used. The remaining patients experience varying numbers of apneic episodes, with the largest groups falling within the 1-2 (13.3%) and 3-4 (13.3%) episode categories. Smaller proportions had 5-6 episodes (6.7%) or higher. We compared age with the number of apneic episodes and observed that the mean apneic episodes according to age group were 0.4 ± 0.9 in the 21 – 30 years age group. 1.2 ± 1.9 in the 31 – 40 age group and 2.2 ± 2.4 in 41 – 50 years age group.

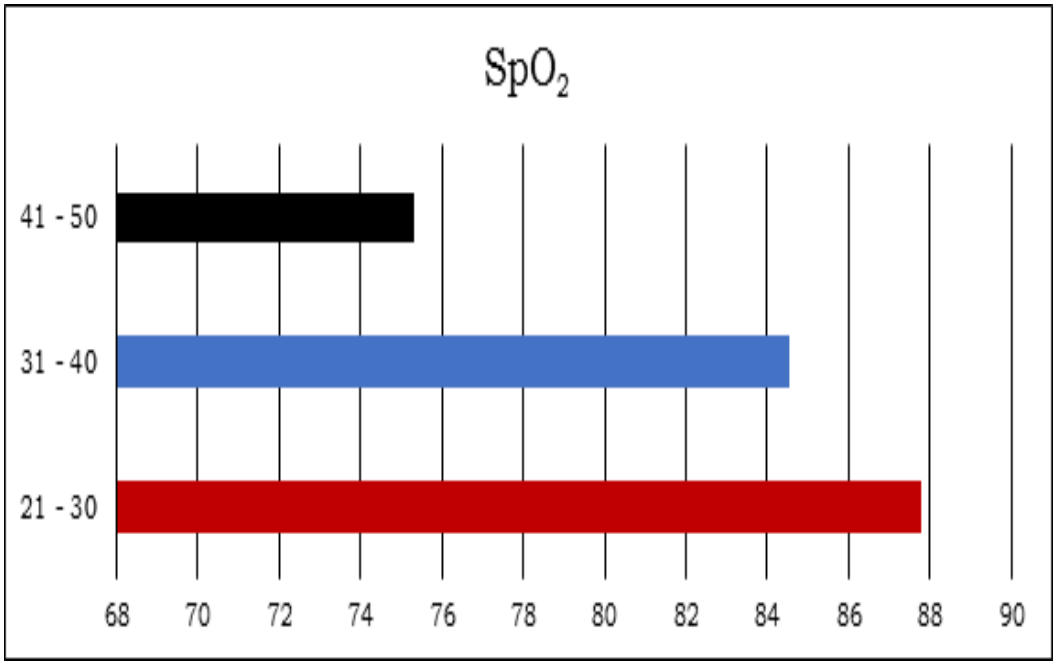

Figure 3: Depicting the age group-wise mean values of SpO_2 recorded

The mean decrease of SpO_2 showed that the highest fall in SpO_2 was in the age group of 41 – 50 years 75.33 ± 9.47% followed by the age group 31 – 40 years with a mean fall of 84.54 ± 6.06% and the lowest fall in SpO2 was in the group 21 – 30 year 87.80 ± 5.07% respectively. The mean dose of injection propofol used in this study was 1.52 ± 0.16 mg/Kg body weight (Figure 3).

On comparing age group with a dose of Inj. Propofol we observed that the mean dose of Inj. Propofol was 1.58 ± 0.13 mg/Kg in the 21 – 30 age group 1.58 ± 0.11 mg/kg 31-40 age group and 1.43 ± 0.19 mg/kg in the 41 – 50 age group was required.

Table 4: BMI and total propofol mg/kg used in the cases of the study

	Total propofol mg/kg	P value
Normal	1.62 ± 2.77	0.006*
Overweight	1.55 ± 0.12	
Obese	1.35 ± 0.22	

* Significant

The comparison of BMI and dose of inj. Propofol and observed that the mean requirement of Inj. Propofol in normal subjects was 1.62 ± 0.8mg/Kg, in the overweight category it was 1.55 ± 0.12 mg/kg, and in obese it was 1.35 ± 0.22mg/kg. The comparison of the values by ANOVA revealed p values were < 0.006 hence considered as significant.

The comparison of the values aged between age, BMI, SpO2, and total propofol dose requirement observed that there were significant correlations between age and low SpO2 (p=0.001), BMI and low SpO_2 (P=0.0001) (Figure 4), and BMI and inj. Propofol requirement (P=0.001).

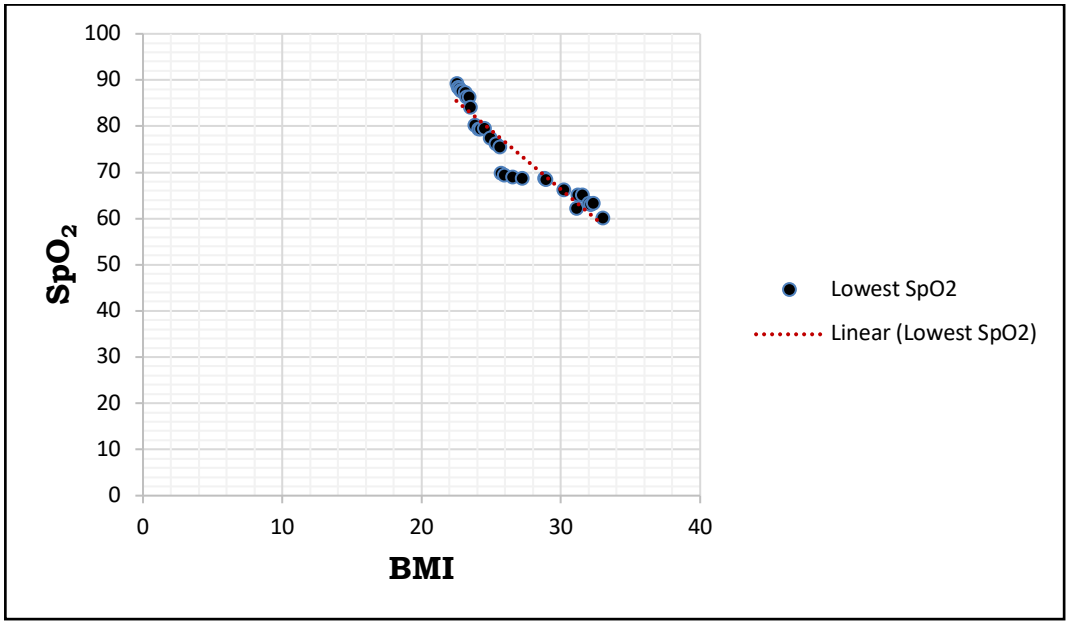

Figure 4: Correlation of BMI with SpO_2 recorded in the cases of the study

Discussion

We conducted a prospective study on thirty patients aged between 20 – 60 years with obstructive sleep apnoea syndrome who fulfilled inclusion criteria after undergoing polysomnography. Out of these thirty patients, 90% were males and 10% were females. We observed that 66.67% of males and 40.7% of females belonged to age 31 – 40 years. The effect of BMI showed that 63.3% of patients were overweight 20% were obese and 5% were normal weight. The mean BMI of the patients was 27.71 ± 2.38. Iwanga K et al. [9] reported a tendency towards an increased incidence of BMI > 30 in circumferential palatal or palatal obstruction in combination with a base of tongue collapse. Effect of SpO_2: in our study, we observed that the mean fall of SpO_2 was 81.40 ± 8.92%. Pulse oximetry is probably most useful in patients with high suspicion of OSAHS based on the clinical features. The combination of a high ODI and high pretest clinical suspicion can be regarded as sufficient to make a diagnosis of OSA. During DISE we prepared for a difficult airway and hence even after a fall in saturation we were able to manage the airway successfully. [10] Effect on apnoea episodes: we observed that 60% of the patient population had no apnoeic episodes 3.3% had one episode and 6.7% had two episodes and 3.3% had four episodes. Similarly, 6.7% had 5 and 6 episodes respectively. We observed that the mean apnoeic episode in the female group was 0 and in the male group 1.6 ± 2.1 similar observation was found in other study. [11]

Relationship between age and lowest SpO_2: The mean fall in SpO_2 according to age group and 87.80 ± 5.07 in the 21 – 30 years age similarly it was 84.54 ± 6.06 in the 31 – 40 years age group and 75.33 ± 9.47 in 41 – 50 age group. The lowest was observed in the age group 41 – 50 years. The relationship between age and the total propofol among the study subjects revealed the dose of inj. Propofol was 1.58 ± 0.13 mg/Kg in the 21 – 30 years age group 1.58 ± 0.11 mg/kg in the 31 – 40 years age group and 1.43 ± 0.19 mg/kg in the 41 – 50 age group. Relationship between age and number of apnoeic episodes in DISE: we compared the age with the number of apnoeic episodes and observed that the average apnoeic episodes according to age group were 0.4 ± 0.9 in the 21-30 age group and 1.2 ± 1.9 in 31 – 40 age group and 2.2 ± 2.4 in 41 – 50 age group. Relationship between BMI and lowest SpO_2 We compared the BMI with SpO_2 and observed that the mean fall in SpO_2 was 90.20 ± 2.77 in normal subjects, 83.05 ± 5.14 in overweight subjects, and 68.83 ± 9.11 in obese subjects. Relationship between BMI and number of apnoeic episodes we compared BMI with apnoeic episodes and observed that normal subjects had 0.4 ± 0.9 apnoeic episodes.

Relationship between BMI and total propofol: We compared BMI and dose of inj. Propofol and

observed that the mean requirement of inj. Propofol in normal subjects was 1.62 ± 0.8 mg/kg, in overweight it was 1.55 ± 0.12mg/Kg, and in obese it was 1.35 ± 0.22 mg/kg. Correlation of age BMI and lowest SpO_2 and total propofol dose in DISE the relationship between age, BMI, SpO_2, and total propofol dose requirements and observed that there were significant corrections between age and low SpO_2 (p=0.001). BMI and low SpO_2 (p=0.0001) and BMI and inj. Propofol requirement (p=0.001).

We documented the differences in the site of airway obstruction and degree of collapse in the study population with mild, moderate, and severe OSA. We observed that 6.7% of the patient population had enlarged tonsils, 23.3% had retropalatal airway obstruction at the nose base, 40% had complete airway obstruction at the base of the tongue, 3.3% had lateral pharyngeal wall collapse and 0% had complete airway obstruction with floppy epiglottis. Among 30 subjects those with floppy epiglottis and complete airway obstruction saturation were maintained with 100% oxygen external laryngeal maneuver, and jaw thrust. In those with minimal airway obstruction, the saturation was maintained with 100% oxygen after the procedure. Obstructive sleep apnoea was clinically recognized more than 30 years ago [12] but awareness of this condition outside the field of sleep medicine was slow to develop. The situation changed drastically when population-based studies uncovered an unexpectedly high prevalence of OSA in adults. [13, 14] Healthcare systems around the world were not prepared to cope with the extremely large number of people expected to have OSA, and attention appropriately turned to the health significance of nightly exposure to frequent episodes and hypopnea.

The results of this small-scale study help us understand the pathogenesis of OSA and the various associations between PSG outcomes and DISE results as well as assisting the sleep surgeon to tailor surgery for the patient. While OSA is a prevalent condition with the potential to cause significant adverse effects in the perioperative setting, the majority of patients remain with a diagnosis [15] this necessitates screening during the preoperative assessment to facilitate the implementation of strategies to minimize the post-operative risk. Since clinical history is an unreliable indicator of the presence of OSA a more effective screening modality is necessary. [16] DISE is reliable and studies on its safety and utility are promising. Nevertheless, it needs to be improved to reach the level of excellence expected of gold standard tests used in clinical practice. In particular, additional research is required to determine the correlations between data obtained during DISE and the results of standard clinical evaluation.

After DISE the anesthetic management plan is determined by the severity of sleep apnoea, how it has been managed before anesthesia, the planned surgical procedure, and the likely postoperative analgesia requirements. Provision for the worst-case scenario of persistent upper airway obstruction should be even with patients with mild OSA and a breathing circuit capable of delivering CPAP should always be available when the presence of OSA is suspected. The choice of anesthetic technique is important. The problem of airway maintenance intra and postoperatively and suppression of arousal responses can be circumvented by the use of regional anesthesia. Preparation for possible difficult intubation should be made along with strategies to manage it. Anesthesiologists fit into a responsible role in screening patients for sleep apnoea. A clinical suspicion may be first developed at the time of preoperative evaluation intraoperatively or postoperatively with the snoring and obstruction observed in the recovery room. OSA by definition is an airway problem and its presence may indicate a predisposition to difficulty with intubation and maintenance under anesthesia. DISE could be used as a diagnostic tool in OSA patients to know the upper airway anatomy and site of obstruction which can guide anesthesiologists toward successful airway management

Conclusion

This study included stage-wise induction of sleep, direct visualization of the airway during pharmacologically induced sleep, and airway management after the procedure. DISE is a dynamic, safe, and easy-to-perform technique that visualizes the anatomical site of snoring of apnoea and guides the design of a tailor-made treatment plan in individual cases. Lower readings of SpO_2 have been observed in patients with complete collapse at the tongue base and patients with floppy epiglottis. Adequate assessment of the severity of obstruction, with the use of DISE, improves perioperative outcomes. Further large-scale studies are needed to confirm prospectively the performance of the aforementioned variables in predicting perioperative outcomes. Understanding the relative paucity of specific information, knowledge of their physiological effects strongly suggests that anesthetic, sedative, and analgesic agents will aggravate or precipitate OSA by decreasing pharyngeal tone, and depressing ventilator responses to hypoxia and hypercapnia. These letters' effects frequently result in varying degrees of central respiratory depression. A variety of surgical factors also contribute to morbidity. The anesthesiology personnel could benefit by documenting the DISE findings for further reference which would be useful during anesthesia for definitive corrective surgical manoeuver or other incidental surgeries.

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