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Opinion
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Multidisciplinary Management Algorithm for Snoring and Obstructive Sleep Apnea in Adults with Possible Treatment Models

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Abstract

Objective: Introduce a multidisciplinary snoring and Obstructive Sleep Apnea (OSA) management algorithm proposal with possible treatment models.

Conclusion: Snoring & OSA multidisciplinary team is the key to success in management of this category of patients. Communication between involved specialty clinics utilizing a planned treatment algorithm with tailored outcome treatment modules seems to be clinically sound and promising in management of these cases.

Keywords: Snoring; OSA; Management algorithm; Multidisciplinary team

Introduction

Obstructive Sleep-Disordered Breathing (OSDB) is a group of conditions characterized by an abnormal respiratory pattern during sleep that can occur alone or associated with other systemic diseases. In general, snoring is at one end of a clinical continuum with the opposite extreme of severe OSA. So, everyone suffering from OSDB snores but not everyone who snores has OSDB [1].

OSDB is a multi factorial and multilevel condition. Many risk factors may contribute to OSDB and may include obesity, increased neck circumference, craniofacial abnormalities, and hypothyroidism. Levels of upper airway obstruction include different causes of nasal obstruction, nasopharyngeal masses, hypertrophied tonsils, elongated and/or thickened palate and uvula, lingual tonsillar hypertrophy, macroglossia, acromegaly and micrognathia [2].

Treatment approaches include non-surgical and surgical modalities aiming at relieving the upper airway obstruction [3]. As for obesity-related sleep apnea, weight reduction may reduce obstructive episodes, improve blood oxygenation, and reduce daytime drowsiness [4,5].

The current proposal aims at addressing a management algorithm for snoring and OSA patients with patients' categorization into possible treatment models for better outcome results.

Discussion

Snoring and OSA management algorithm is a multidisciplinary team approaches that asses the different etiological factors and comorbidities and directs surgical treatment toward the specific regions of obstruction during sleep. The benefits of the management algorithm include:

1. Decreases possibility of incomplete preoperative assessment,
2. Categorize patients in a clear precised treatment model,
3. Decreases possibility of unnecessary operations and improves cure rates.

Generally, the otolaryngologist has been the reference medical clinic for patients suffering from OSDB. Patients may become confused from different opinions in different otolaryngology clinics. For proper diagnosis and management, the interaction of the multidisciplinary team members is deemed necessary and essential [6,7]. Stepnowsky C. [8] concluded in his study that, given the recent advances in OSA phenotyping and the large numbers of therapeutic options available across a wide variety of specialty areas, multidisciplinary management through dedicated sleep centers (and/or clinics) appear to represent the future of sleep apnea management. The American Academy of Sleep Medicine (AASM) recommended in its guidelines for OSA patients in 2009 that

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OSA should be approached as a chronic disease requiring long-term, multidisciplinary management [9].

Preoperative accurate history taking and clinical assessment (Figure 1) and a multi-disciplinary step by step algorithm (Figure 2) are the keys for success in snoring and OSA patients. The pre-operative treatment plan must be tailored for each patient.

The diagnostic pathway should include sleep-related history, physical examination, and objective testing. With different OSA screening questionnaires, there will be a considerable of false-positive results that really should not rule out OSA and referral to a sleep medicine specialist is recommended if there is ongoing doubt [10-13].

Patients with a history suggestive of OSA will have Polysomnography (PSG). A history in a patient suspected to have OSA should include snoring, apneas, and excessive daytime sleepiness not explained by other factors. Examination findings that should be evaluated include increased Body Mass Index (BMI) ≥ 30 kg/m^2, neck circumference (>17 inches in men, >16 inches in women), a Modified Mallampati score of 3 or 4, the presence of receding , macroglossia, tonsillar hypertrophy, redundant soft palate with long uvula, and nasal pathology. The presence or absence and severity of OSA, documented by polysomnography, must be initially determined to identify who will be at risk of developing sleep apnea complications, guide tool for accurate treatment plan selection, and to provide a baseline to the effectiveness of planed treatment.

Kapur VK et al. [14] finalized the following recommendations as a guide for OSA diagnosis in adults. According to the Grading of Recommendations Assessment, Development, and Evaluation (GRADE), a STRONG recommendation means that clinicians should follow under most circumstances. A WEAK recommendation means lower chance for the outcome and suitability of the patient-care strategy for all patients. Recommendations include:

1. History and clinical examination, questionnaires, and planed algorithms not to be for diagnose OSA in adults, in the absence of polysomnography or home sleep apnea testing (STRONG).

2. Polysomnography, or home sleep apnea testing with a technically adequate device, to be used for the diagnosis of OSA in uncomplicated adult patients suspected to have moderate to severe OSA (STRONG)

3. If a single home sleep apnea test is negative, inconclusive, or technically inaccurate, polysomnography should take the upper hand for the diagnosis of OSA (STRONG)

4. Only polysomnography, be used for the diagnosis of OSA in patients with significant medical complications that known to occur because of OSA such as cardio respiratory disease, potential respiratory muscle weakness due to neuromuscular condition or other recorded complications (STRONG).

5. If clinically appropriate, a split-night diagnostic test, rather than a full-night diagnostic test for polysomnography be used for the diagnosis of OSA (WEAK)

6. When the initial polysomnogram is negative and OSA clinical suspicion remains, a second polysomnogram be considered for the diagnosis of OSA (WEAK) [14].

Also suspected OSA patients need to have internal medicine consultation to control any associated medical problems and evaluate high risk patients.

Figure 1: Outpatient snoring sheet

History

- Snoring severity scale: preoperative postoperative (3months)

How often do you snore?
3. Every night
2. Most (>50%) of nights
1. Some (<50%) of nights
0. Very rarely or not at all

How long do you snore?
3. All night
2. Most (>50%) of the night
1. Some (<50%) of the night
0. Hardly or not at all

How audible is your snoring (with the door shut)?
3. Can be heard down the hall
2. Can be heard in the next room
1. Can be heard in the same room
0. Barely audible

- Symptoms suggesting OSA:

- Epworth score preoperative postoperative (3months)
Less than 10 (normal)
More than 10 (considered sleepy)
More than 18 (very sleepy)

- Nasal symptoms

- Other ENT symptoms

- History of previous snoring surgery

- History of current medical problems

Examination

General examination
- BMI
- Vital signs

Local examination

- Maxillofacial deformity
- Nose:
anterior rhinoscopy & nasal endoscopy :
Nasal Septum
Inferior nasal turbinate
Para nasal sinuses
Nasopharynx
Cottle test
- Oral cavity:
Soft palate
Uvula
Tonsils 0 1 2 3 4
Tongue I II III IV
- Ear
- Head & neck

Recommendations

- Cephalometry
- Sleep lab
- DISE
- CT nose and paranasal sinuses
- Medical consultation
- Lab tests
- Diet control
- Bariatric Surgery

Figure 1: Outpatient snoring sheet.

Treatment options for the treatment of OSA include; medical, behavioral, and surgical options. Adjunctive therapies may be needed to support the primary treatment. The patient should share the decision on treatment type and aware about the details of his or her own disease.

Positive Airway Pressure (PAP) is the treatment of choice for all degrees OSA and should be suggested as an option to all patients. Alternative therapies may be offered depending on the severity of the OSA and the patient's upper airway anatomy, and preferences. PAP treatment team should include a sleep specialist, the referring physician, respiratory therapist, and sleep technologist. Close follow-up, especially important during the first few weeks, for PAP usage

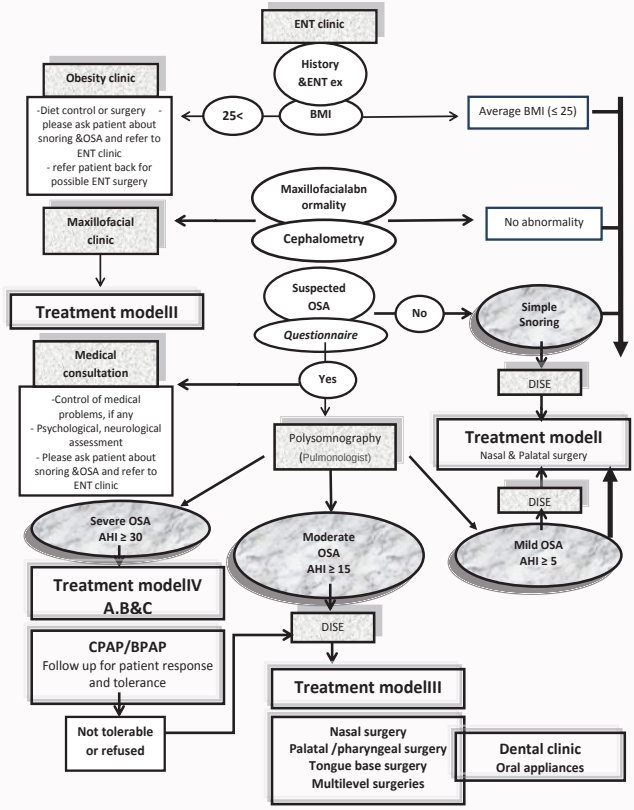

Figure 2: Snoring and OSA clinical pathway.

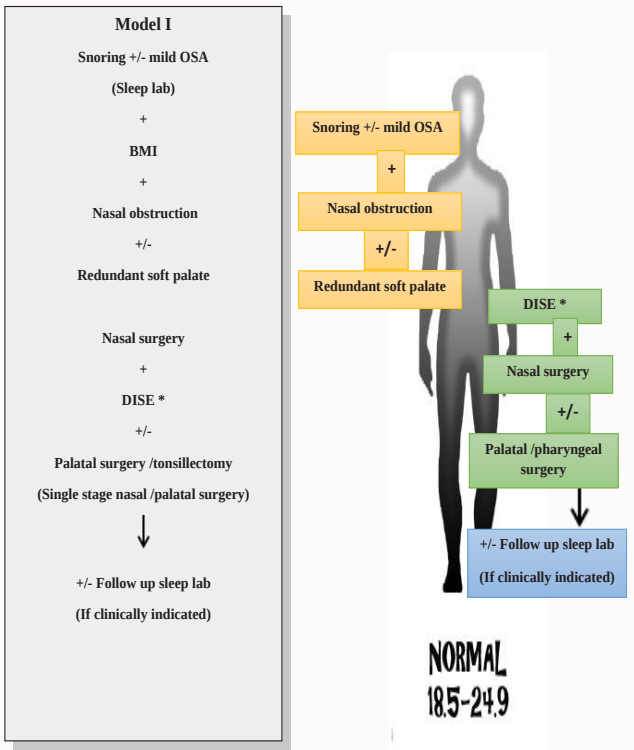

Figure 3: Treatment model I.
* DISE: Two scenarios were discussed, either to do DISE immediately prior to the proposed snoring /OSA surgery or DISE and nasal surgery and then perform the definitive surgery after the sleep endoscopy discussion in clinic

and problems for the maximum patient's benefit and improvement of PAP tolerance. Despite its effectiveness in resolving sleep-disordered breathing, adherence to CPAP therapy is approximately 50%. An alternative to the standard CPAP therapy may include other devices, such as Auto PAP (APAP) and bi-level therapies have not been shown to consistently improve adherence in OSA [15].

Surgical treatment of OSA can be considered under the following conditions:

1. Primary surgical treatment can be considered in patients with mild OSA who have surgically correctible anatomical abnormalities.

2. Failed PAP therapy, intolerable PAP or an inadequate treatment outcome with an oral appliance (OA) is an indication for surgical procedures as a secondary treatment for OSA.

3. An adjunct surgical therapy may be considered when obstructive anatomy or functional deficiencies compromise other treatment lines or to improve tolerance of other OSA treatments.

Surgical outcomes can vary, and it is therefore essential that all patients be re-evaluated after each phase is completed. This minimizes the possibility of unnecessary additional surgery and readily identifies those who require further attention.

Oral Appliances (OA) may improve upper airway patency either by enlarging the upper airway and/or by decreasing upper airway collapsibility. Mandibular Repositioning Appliances (MRA) acts through holding the mandible in an advanced position with respect to the resting position. One the other hand, Tongue Retaining Devices (TRD) holds only the tongue in a forward position with respect to the resting position, without mandibular repositioning [16].

Primary snorers are candidates for OAs as a first line of treatment when do not respond to, or are not appropriate candidates for, treatment with behavioral measures such as weight loss or sleep position change. Patients with mild to moderate OSA can be candidates to OAs, although not as efficacious as CPAP, in patients who prefer OAs to CPAP, or who do not respond to CPAP, are not appropriate candidates for CPAP, or who fail CPAP or behavioral measures. Other predictors of a more favorable response to oral appliance therapy include younger age, lower BMI, smaller neck circumference, and those with more positional OSA [17].

Bariatric surgery is an effective tool to achieve major weight loss and is indicated in patients with a Body Mass Index (BMI) ≥ 40 kg/m^2 or those with a BMI ≥ 35 kg/m^2 with comorbidities and in whom dietary control measures have been ineffective [18]. Bariatric surgery may be adjunctive in the treatment of OSA in obese patients with the concomitant use of the less invasive and rapidly active first-line therapies such as PAP [19]. The remission rate for OSA few years after bariatric surgery, related to the amount of weight lost, is 40%, emphasizing the need for ongoing clinical follow-up of these patients [20].

The multi-disciplinary team should include many professionals from different areas; ENT evaluation, obesity evaluation, maxillofacial evaluation, internal medicine evaluation, and sleep laboratory specialist.

The multi-disciplinary step by step algorithm should be starts with the ENT clinic evaluation. As a part of general examination, patients having Body Mass Index (BMI) more than 25 will be referred to an

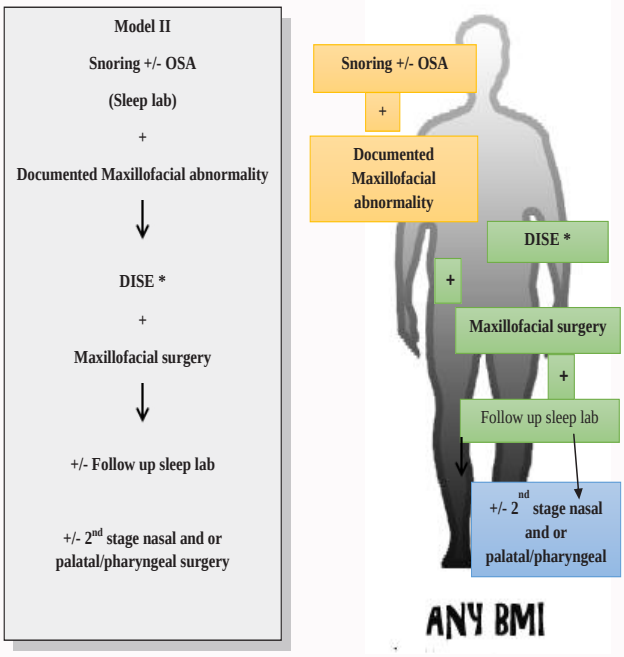

Figure 4: Treatment model II.
* DISE: Documentation of site of obstruction for any future upper airway surgery

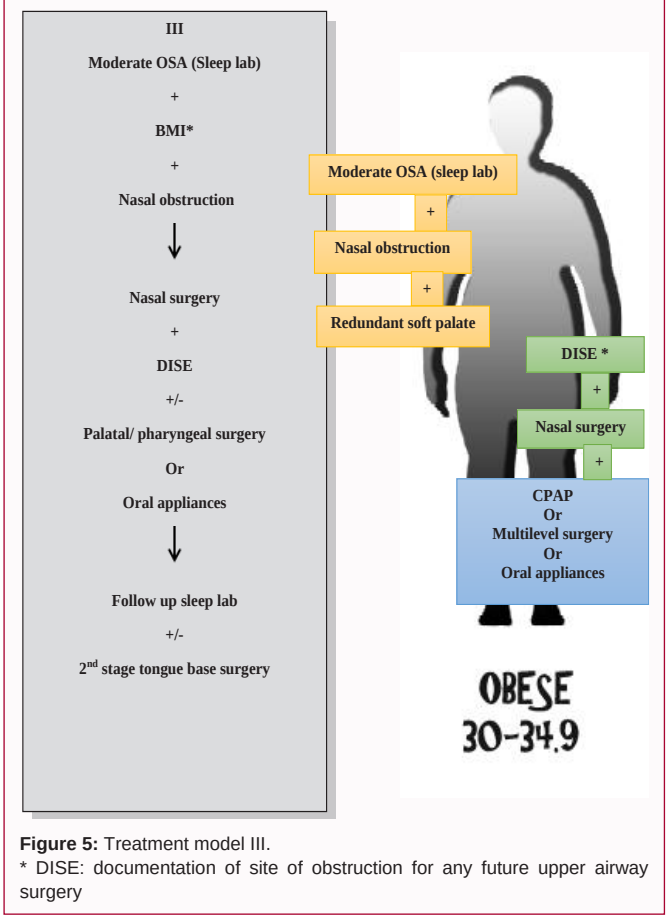

Figure 5: Treatment model III.
* DISE: documentation of site of obstruction for any future upper airway surgery

obesity clinic for assessment and decision making either to keep on dietary protocols or to have bariatric surgery. Patients with possible maxillofacial abnormalities will be referred to the maxillofacial clinic to evaluate the patency of the post-lingual space and the need for any possible surgery.

Patients with an average BMI, with no maxillofacial abnormality, with nasal obstructing pathology, with or without tall redundant soft palate and complaining from simple habitual snoring will be categorized as treatment model I (Figure 3). The rationale for treatment model I is to improve the nasal airway patency and manage the redundant soft palate. This can be performed as a single-stage nasal and palatal surgery or as staged operations. DISE will be performed as a routine step to assess the upper airway collapse.

Patients with maxillofacial abnormalities will be categorized as treatment model II (Figure 4). The rationale for treatment model II is to open the retrolingual pharyngeal airway. DISE will be performed immediately before the maxillofacial surgery and the patient will be followed up with a postoperative PSG and re-evaluated for possible 2nd stage palatal or palatopharyngeal surgery. Santos JF et al. [21] concluded in their study that genioplasty for genioglossus advancement is an option in patients with OSAHS and mandibular retrognathia. Metes [22] described a patient with retrognathia who underwent sagittal mandibular osteotomy with hyoid bone advancement and resulted in the resolution of snoring and sleep apnea.

Patients with a history suggestive of OSA will have Polysomnography (PSG) and will be categorized as mild, moderate and sever.

Mild OSA patients will be included in treatment model I. Mild OSAHS is defined as a Respiratory Disturbance Index (RDI) of 5 to 15 per hour, lowest oxygen saturation 86% to 92% and mild or no daytime sleepiness [9]. Moderate OSA patients will undergo Drug-Induced Sleep Endoscopy (DISE) and will be categorized as treatment model III (Figure 5). Moderate OSAHS is defined as a Respiratory Disturbance Index (RDI) of 15 to 30 per hour, lowest oxygen saturation 70% to 85% and moderate daytime sleepiness [9]. Rationales for treatment model III are to treat the nasal obstruction, locate the site of upper airway obstruction by DISE in one session, and proceeds for correction of the nasal pathology with either concomitant upper airway surgery or postoperative PAP for oral applicants according to parent's preference. The author's technique for palatal surgery, soft palatal webbing flap Palatopharyngoplasty without tonsillectomy is a good surgical alternative for patients having both soft palate and lateral pharyngeal wall collapse and non-collapsing tonsils, mostly grade 1, with promising surgical outcomes [23]. The author applied the same technique for tonsil sizes 2, 3, and 4 by performing extra capsular coblation tonsillectomy down to the capsule in conjugation with the original technique [24]. Severe OSA patients will be categorized as a treatment model IV (A, B &C) (Figure 6, 7). Sever OSAHS is defined as a Respiratory Disturbance Index (RDI) more than 30 per hour, oxygen saturation below 70%, and severe daytime sleepiness [9]. Treatment model IV will be categorized according to the presence of morbid obesity. Treatment model IVA was concerning with severe OSA associated morbid obesity (Figure 6). For patients suffering from severe OSA without morbid obesity, will be categorized as model IV B&C. Patients with nasal blockage will have nasal surgery with DISE to evaluate the upper airway and will fix the CPAP and followed up (Figure 7A). Patients who refused or cannot tolerate the CPAP, will undergo DISE and included in treatment model III (Figure 7B). OSA patients, model III & IV, will be treated according to the results of the PSG and DISE.

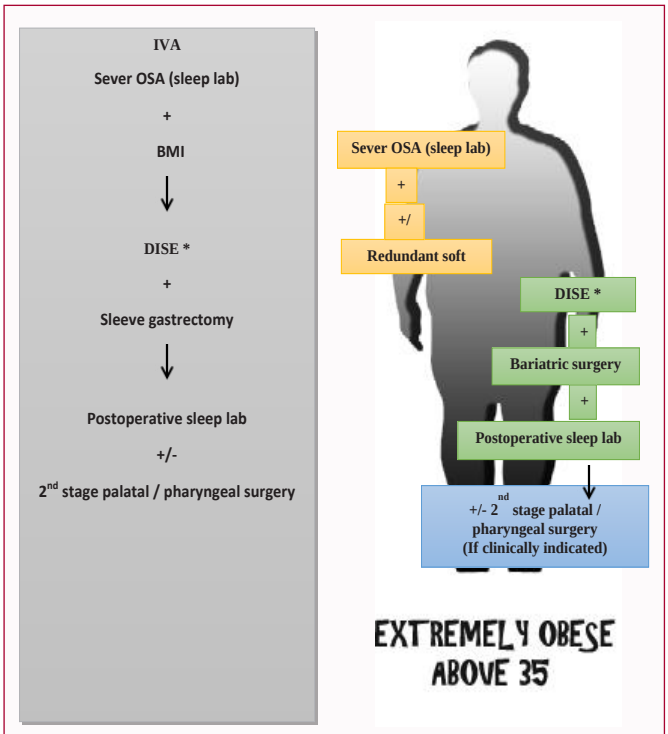

Figure 6: Treatment model IV A.
*DISE: Documentation of site of obstruction for any future upper airway surgery

The rationale for treatment model IV is to treat severe OSA either conservatively with CPAP or surgical treatment for the tongue base alone or as a part of multilevel surgery. Bariatric surgery can be considered. Severe OSA patients, treatment model IVA, Bariatric surgery indicated in patients with BMI 40 kg/m^2 or those with BMI 35 kg/m^2 with important comorbidities and in-home dietary control regimens at weight control have been ineffective. A lot of studies found that OSA significantly improved after bariatric surgery. Haines KL et al. [25] concluded in their study that OSA is prevalent in at least 45% of bariatric surgery patients, preoperative BMI correlates with the severity of OSA and bariatric surgery significantly improves obesity related OSA and sleep quality. Zhang Y et al. [26] concluded in their study that bariatric surgery is effective at improving nocturnal hypoxemia and reducing the number of apnea events in obese patients with OSA. For patients suffering from severe OSA without morbid obesity, model IV B&C, Continuous Positive Airway Pressure (CPAP) will be considered as the first line of treatment. Patients will be followed up to assess CPAP tolerance. Safe and acceptable CPAP compliance is defined as regular use of CPAP 4 h/day and at least 5 days/week [27]. If intolerance was detected in such cases, patients will be included in model III to be scheduled for DISE & surgical intervention or oral appliances according to DISE results. Oral appliances may be useful in selected patients with sleep apnea who cannot tolerate CPAP or do not want to undergo surgery [28]. Related medical problems were assessed and controlled. Nasal surgery improves the nasal airway and at the same time facilitates the use of postoperative CPAP [29].

At the end of evaluation process, all date will be discussed with the entire multidisciplinary team. Opinions from all members on the management team are obtained, as well as the necessary complementary examinations. From this point, the patient is referred to the specialties to continue the planed treatment.

Patient education should be addressed as part of a multidisciplinary management team. The results of objective testing should be reviewed with the patient, including education on the nature of the disorder and treatment options. Treatment options should be discussed

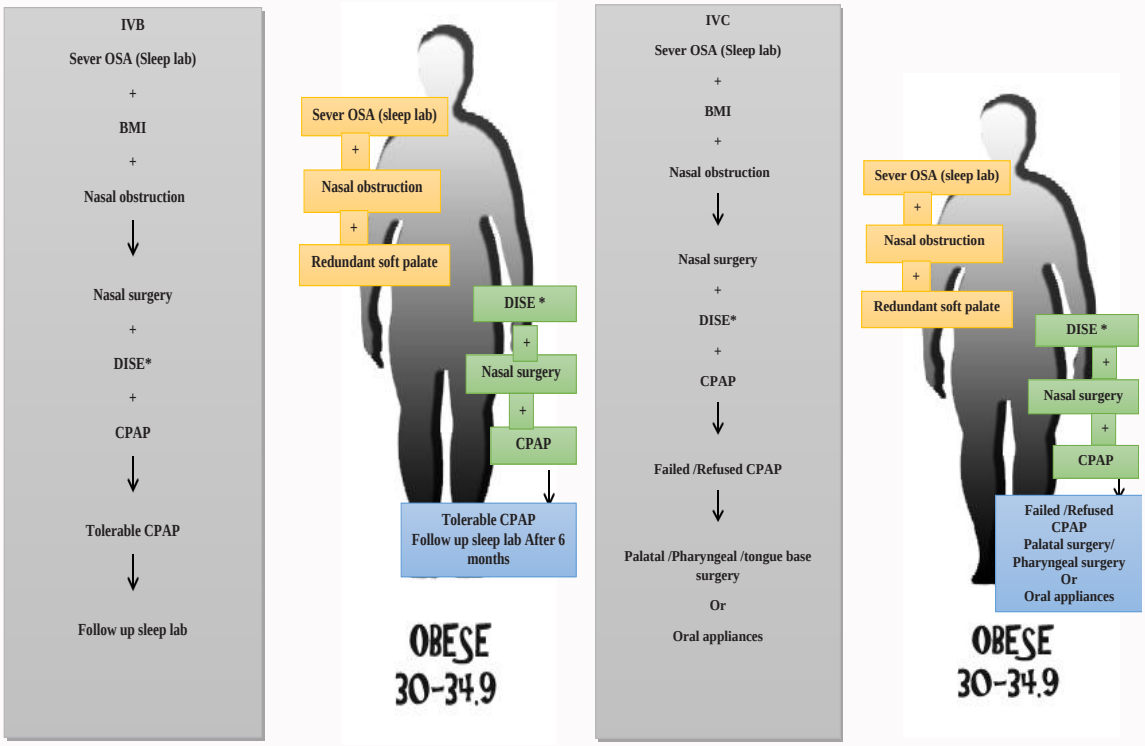

Figure 7: A) Treatment model IV B, B) Treatment model IVC.
*DISE: Documentation of site of obstruction for any future upper airway surgery

regarding the severity of the patient's OSA, their risk factors; any associated medical problems, and the patient's expectations.

As for all the patients who are candidate for nasal surgery, DISE will be performed to assess the upper airway collapse. Two scenarios were discussed, either to do DISE immediately before the proposed snoring/OSA surgery [30] or DISE and nasal surgery and then perform the definitive surgery after the sleep endoscopy discussion in the clinic. The simplicity and high success rate of nasal reconstruction make this procedure a very valuable technique in the management of OSDB. Although it is very unlikely to cure OSDB as a stand-alone procedure, correction of any defects at this level minimizes mouth breathing and can decrease negative pressure breathing during sleep. The documentation of collapse at palatal and lateral pharyngeal levels well established is having been found to be the most compliant of the upper airway. However, results vary with the experience of the surgeon, the patient's anatomy, the severity of the OSDB, and the technique selected. The careful removal or repositioning of obstructive soft palate tissues is essential to the improvement of OSDB at this level [31]. Tongue base surgery is rarely done alone but usually, it is a part of multilevel surgery. Tongue base procedures are an integral part of multilevel surgery for the treatment of OSA. A lot of surgical approaches have been described for the treatment of tongue base obstruction. The mid portion of the tongue base can be directly reduced in size, or it may be addressed by making more room for the tongue using skeletal advancements [32-36]. Obstruction at the tongue base may be bypassed by tracheotomy [37].

For each treatment option, appropriate outcome measures and long-term follow up should be outlined. Those on chronic therapy (PAP, OA, positional therapy) should have close follow-up to monitor adherence to therapy, usage drawbacks, and continued resolution of related problems. Each patient who underwent one of the treatment models will be re-evaluated by PSG if needed and reassessed clinically at 4 to 6 months.

Finally, this study aimed to introduce a management algorithm with treatment models and establish the concept of snoring multidisciplinary teams for better patient service and avoidance of unnecessary surgical procedures.

Conclusion

Snoring & OSA multidisciplinary team is the key to success in management of this category of patients. Communication between involved specialty clinics utilizing a planned treatment algorithm with tailored outcome treatment modules seems to be clinically sound and promising in management of these cases.

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