Muller's Maneuver in Patients with Obstructive Sleep Apnea

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Abstract

Background and Objective: Numerous anatomical abnormalities or pathological conditions can cause upper airway obstruction in obstructive sleep apnea syndrome (OSAS). Muller's maneuver (MM) is one of diagnostic modalities investigating the obstruction site in patients with OSAS. This study aimed to investigate the obstruction sites of patients with OSAS based on MM.

Materials and Methods: This was a case-series study. A total of 145 patients were enrolled in this study. The awake MM (a flexible fiberoptic endoscopy of the upper airway while patients perform forced inspiration against a closed oral and nasal airway) was performed by a single surgeon with the patient in a supine position. Endoscopic findings were classified using the modified velum, oropharyngeal lateral walls, tongue base, and epiglottis (VOTE) classification criteria.

Results: Mean ± standard deviation age of patients was 41.5 ± 10.1 years old. Mean respiratory disturbance index was 29.7 ± 24.3/hours. The most common site of obstruction in all patients was velum. About 72% of the patients had more than 75% obstruction in the velum area while most patients had < 50% obstruction in oropharyngeal lateral walls (41.4%) and tongue base (55.2%). 69% of the patients had no obstruction in epiglottis according to the modified VOTE classification.

Conclusion: Simple awake diagnostic test before surgery would help physicians to identify obstruction sites of OSAS patients.

Introduction

As the rate of obesity and immobility increased during recent decades, the prevalence of the obstructive sleep apnea syndrome (OSAS) increased as well. OSAS as a sleep-related breathing disorder is characterized by repetitive episodes of obstruction of the upper airway during sleep, and is also associated with several cardiovascular and neurocognitive consequences (1-3).

Although snoring occurs in 40% of men and 20% of women, the literature report that 4% of men and 2% of women above the age of 50 years, experience symptomatic sleep apnea (4). OSAS is usually diagnosed by the history and physical examination and confirmed by the polysomnography.

Numerous anatomical abnormalities or pathological conditions can cause upper airway obstruction such as septal deviation, turbinate hypertrophy, nasal polyposis, adenoid hypertrophy, palatine tonsil or lingual tonsil hypertrophy, tongue hypertrophy, epiglottis deformity, and tumors (5, 6).

Proper surgical or medical management of the OSAS depends on the identification of the level(s) of upper airway obstruction in patients. The most common surgical procedure for patients with OSAS is uvulopalatopharyngoplasty (UPPP). Unless correct identification of the obstructed site the surgery would not improve clinical signs and symptoms. In other words, UPPP would be highly beneficial for patients with mere retropalatal obstruction; while it is much less helpful to patients

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with tongue-based collapse (response rate: 83% vs. 19%; respectively) (7).

There are at least 10 diagnostic modalities investigating the obstruction site in patients with OSAS, the most common methods include (1) lateral cephalometry, (2) Muller's maneuver (MM) (e.g., a flexible fiberoptic endoscopy of the upper airway while patient performs forced inspiration against a closed oral and nasal airway), and (3) drug-induced sleep endoscopy (DISE) which is performed in the operating room (8).

The aim of this study was to evaluate the site(s) of upper airway obstruction in the patients with OSAS using the MM.

Materials and Methods

This was a case-series study. 145 patients during May 2014 to September 2016 at the Imam Khomeini Hospital were enrolled in this study. Informed consent was obtained from all of the patients, and the study was approved by the Ethical Committee of Tehran University of Medical Sciences.

All adult patients (more than 18-year-old) referred to our tertiary center were included in this study. Patients with history of allergic reactions, tumors, diabetes, cardiac diseases, and central nervous system diseases were excluded.

All the patients underwent polysomnographic study as a routine OSAS evaluation at sleep clinic of Imam Khomeini and Baharloo Hospitals. Respiratory disturbance index (RDI; which consists of apnea, hypopnea and respiratory effort related arousal), body mass index (BMI), mean and lowest oxygen saturation levels were evaluated.

MM: The awake MM was performed by a single surgeon while the patient was in a supine position. Before the main performance, the procedure was explained to all patients and was practiced. Then administration of the 2% lidocaine for local anesthesia in the nasal cavity and phenylephrine solution for decongestion was performed. Flexible fiberoptic nasal endoscopy through nostril into the upper airway was performed, and the patients were asked to perform MM at each level to determine the degree of obstruction.

Endoscopic findings were classified according to the modified VOTE classification criteria (9). VOTE is a questionnaire classifying upper airway into four levels: (1) Velum (soft palate and uvula), (2) oropharyngeal lateral walls, (3) tongue base, and (4) epiglottis. Modified classification of degrees of obstruction in VOTE include no obstruction, < 50%, 50%-75% obstruction, and 75%-100% obstruction graded as 0-3, respectively.

Configuration of obstruction also can be assessed and classified into concentric, anteroposterior (A-P), and lateral. Statistical analysis was performed using IBM SPSS Statistics (version 22; SPSS Inc., Chicago, IL, USA).

Results

Of 145 patients, 127 (87.6%) were male. Mean age of patients was 41.5 ± 10.1 (range: 18-61) years. Mean RDI was 29.7 ± 24.3/hours; and mean BMI was 28.0 ± 3.9 kg/m^2. Mean percentage and lowest oxygen saturation were 93.0 ± 2.6 and 81.9 ± 7.3; in respect. Table 1 summarizes the baseline characteristics of the patients.

About 72% of the patients had more than 75% obstruction in the velum area while most patients had less than 50% obstruction in oropharyngeal lateral walls (41.4%) and tongue base (55.2%). 69% of the patients had no obstruction in epiglottis. The endoscopic findings according to the modified VOTE classification are illustrated in table 2. The most common site of obstruction in all patients was velum, whereas the most common configurations of obstruction were concentric in the velum area, and A-P in the epiglottis area.

Table 1. Baseline characteristics of the patients

Variables	Mean ± SD
Age (year)	41.5 ± 10.1
Gender (male/female)	127/18
BMI (kg/m^2)	28.0 ± 3.9
RDI/hours	29.7 ± 24.3
Mean oxygen saturation (%)	93.0 ± 2.6
Lowest oxygen saturation (%)	81.9 ± 7.3
Sleep time (minute)	387.6 ± 96.7
Sleep efficacy (%)	78.3 ± 15.7

SD: Standard deviation; BMI: Body mass index; RDI: Respiratory disturbance index

Table 2. Modified VOTE classification

Degree of obstruction	Velum	Oropharynx lateral walls	Tongue base	Epiglottis
No obstruction	2 (1.4)	6 (4.1)	17 (11.7)	100 (69.0)
< 50% narrowing	6 (4.12)	60 (41.4)	80 (55.2)	43 (29.7)
50%-75% narrowing	32 (22.1)	50 (34.5)	38 (26.2)	2 (1.4)
> 75% narrowing	105 (72.4)	29 (20.0)	10 (6.9)	0 (0)

Data are given as "frequency of the patients (%)". VOTE: Velum, oropharyngeal lateral walls, tongue base, and epiglottis

Discussion

This study highlighted the role of the MM in determining the site of obstruction in patients with OSAS, and revealed that the most common site of obstruction was velum area. Airway collapse may be located at various levels in patients with OSAS and diagnosis of each obstruction site is, therefore, a critical point for proper surgery. MM first described in 1977 (10), and since then it has been widely used as a diagnostic modality in patients with OSAS.

There are also other diagnostic modalities to reveal the obstruction site including DISE, lateral cephalometry, fluoroscopy, computerized tomography scan, magnetic resonance imaging, manometry, and acoustic reflections (8). Due to the accuracy of diagnosis, DISE has gained more popularity nowadays, and since it evaluates patients during induced sleep, different studies showed its superiority especially in the lower airway collapse (retrolingual area) (11-13). However, administration of sedative medication during DISE arises the debate regarding possible overestimation of the degree of airway obstruction by this method (13).

MM could efficiently help surgeons to diagnose the site of upper airway obstruction correctly, and would contribute to the decision for surgical technique before going to the operating room. MM is performed in awake patients and there is no need for sedation, however, efforts made by the patient and different positions might affect it.

Future studies comparing different diagnostic studies in patients with OSAS and investigation of the best method for diagnosis of obstruction site are warranted.

Conclusion

Simple awake diagnostic test before surgery could be beneficial for physicians to identify the obstruction sites of patients with OSAS.

Conflict of Interests

Authors have no conflict of interests.

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