Kulak Burun Bogaz Ihtis Derg
2006;16(5):200-204

ORIGINAL ARTICLE

Comparison of two endoscopic examination methods, the Muller maneuver and fiberoptic pharyngoscopy during sleep, in patients with obstructive sleep apnea

Obstrüktif uyku apnesi olan hastalarda iki endoskopik muayene yönteminin karşılaştırılması: Müller manevrası ve uyku sırasında fiberoptik farengoskopi

Ahmet Emre SÜSLÜ, M.D., Oğuz ÖĞRETMENOĞLU, M.D.,
Tevfik Metin ÖNERCİ, M.D., Ömer Taşkın YÜCEL, M.D.

Objectives: This study was designed to compare two endoscopic examination methods, the Muller maneuver (MM) and the fiberoptic pharyngoscopy during sleep, both of which are used to detect obstructed segments in patients with obstructive sleep apnea.

Patients and Methods: The study included 28 patients (23 males, 5 females; mean age 44.6 years; range 28 to 59 years) who underwent uvulopalatopharyngoplasty (UPPP) for snoring or obstructive sleep apnea. Obstruction was examined both at the level of soft palate and tongue base while the patients were awake and asleep and was scored. The Muller maneuver was performed in the sitting and supine positions. In addition, fiberoptic pharyngoscopy was performed right after induction of anesthesia. The results of the two methods were compared.

Results: Changes in body position were not associated with significant differences in the results of MM. The two methods were found to be highly discordant, in that a greater degree of obstruction was noted especially at the level of the soft palate by fiberoptic pharyngoscopy.

Conclusion: It was concluded that the degree of obstruction might be underestimated by MM.

Key Words: Endoscopy/methods; obstructive sleep apnea; snoring; diagnosis.

Amaç: Bu çalışmada, obstrüktif uyku apnesi olan hastaların üst havayollarındaki daralma bölgelerini tespit etmek için kullanılan endoskopik muayene yöntemlerinden olan Müller manevrası (MM) ile uyku sırasında fiberoptik farengoskopi uygulaması karşılaştırıldı.

Hastalar ve Yöntemler: Horlama veya obstrüktif uyku apnesi nedeniyle uvulopalatofarengoplasti (UPPP) yapılan 28 hasta (23 erkek, 5 kadın; ort. yaş 44.6; dağılım 28-59) çalışmaya alındı. Tüm hastalarda obstrüksiyon, yumuşak damak ve dil kökü seviyelerinde hem uyanıklıkta hem de uyku sırasında incelenerek derecelendirildi. Hastalara MM oturur ve yatar pozisyonlarda uygulandı; buna ek olarak, tüm hastalara ameliyathanede anestezi indüksiyonu sırasında fiberoptik farengoskopi yapıldı. İki uygulamanın sonuçları karşılaştırıldı.

Bulgular: Pozisyon değişikliği MM sonuçlarında anlamlı değişikliğe yol açmadı. İki yöntem arasında ileri derecede uyumsuzluk olduğu görüldü. Anestezi indüksiyonu sırasındaki fiberoptik farengoskopik incelemede, MM'ye göre özellikle yumuşak damak seviyesinde daha fazla obstrüksiyon saptandı.

Sonuç: Obstrüksiyonun MM ile olduğundan daha düşük derecede değerlendirilebileceği düşünüldü.

Anahtar Sözcükler: Endoskopi/yöntem; obstrüktif uyku apnesi; horlama; tanı.

◆ *Department of Otolaryngology, Medicine Faculty of Hacettepe University (Hacettepe Üniversitesi Tıp Fakültesi Kulak Burun Boğaz Hastalıkları Anabilim Dalı), Ankara, Turkey.*

◆ *Received - July 12, 2005 (Dergiye geliş tarihi - 12 Temmuz 2005). Request for revision - March 23, 2006 (Düzeltme isteği - 23 Mart 2006). Accepted for publication - April 14, 2006 (Yayın için kabul tarihi - 14 Nisan 2006).*

◆ *Correspondence (İletişim adresi): Dr. Ahmet Emre Süslü. Hacettepe Üniversitesi Tıp Fakültesi, Kulak Burun Boğaz Hastalıkları Anabilim Dalı, 06100 Sıhhıye, Ankara, Turkey. Tel: +90 312 - 310 41 11 Fax (Faks): +90 312 - 311 35 00 e-mail (e-posta): aesuslu@yahoo.com*

Obstructive sleep apnea-hypopnea syndrome (OSAHS) is a condition characterized by recurrent episodes of partial or complete obstruction of the upper airway, which results in oxygen desaturation and arousal from sleep by consecutive mechanisms. The prevalence of OSAHS is as high as 2-4% in middle-aged adults.[1] In addition to the symptoms that affect the quality of life negatively, OSAHS causes severe morbidity associated with cardiovascular and cerebrovascular systems, so the treatment of OSAHS is essential.

Uvulopalatopharyngoplasty (UPPP) which was first described by Ikematsu in 1952 is the most common surgical intervention for the treatment of OSAHS. After Fujita et al.[2] reported the improvement in obstructive sleep apnea patients undergoing UPPP, this procedure has became widely used for the treatment of apnea and snoring.

Surgical results of UPPP or uvulopalatal flap are considerably successful for simple snoring.[3] In contrast to simple snoring, OSAHS can not be treated as successfully as snoring by the operations involving the soft palate and pharynx. Obstruction at other sites not addressed by UPPP in the upper airway (especially base of the tongue) may be the cause of the poor response. Detecting collapsed or obstructed segments in the upper airway is necessary in order to predict the success of the surgical procedures for OSAHS.

The Muller maneuver (MM) is one of the easiest endoscopic examination procedures for observing upper airway obstruction in OSAHS patients. Another test, the sleep nasendoscopy allows visualization of the site of obstruction during sleep. Both of these endoscopic examination procedures have been used for predicting good UPPP responders.

In the present study, two endoscopic examination methods used to detect the obstructed segments of the upper airway, the Muller maneuver and fiberoptic pharyngoscopy during the induction of anesthesia (while the subjects were sleeping), were compared.

PATIENTS AND METHODS

Twenty-eight patients who were referred to our clinic with suspected OSAHS between January and July 2004 were included in the study. The study protocol was approved by the Ethics Committee of Hacettepe University and all patients gave written informed consent for participation.

The diagnosis of OSAHS or simple snoring was achieved by overnight polysomnographies in all of the patients. OSAHS was considered to be present if AHI was ≥5. MM was performed both in sitting and supine positions after topical anesthesia was achieved with 10% lidocaine spray. A flexible nasopharyngoscope was inserted through the nasal cavity to the lower oropharynx. Collapse at the retropalatal and retroglossal levels were observed during a maximal inspiratory effort against a closed mouth and nose. The observed collapses at the retropalatal and the retroglossal levels of all the patients were rated on a five-point scale by the same examiner. No collapse was rated as zero, while collapses between 0-25%, 25-50%, 50-75% and 75-100% were rated as 1+, 2+, 3+ and 4+ respectively.

All patients were examined with fiberoptic nasopharyngoscopy during sleep just after the induction of anesthesia. Until the examination procedure was completed, muscle relaxants were not given to any of the patients. Snoring was achieved in all patients and endoscopic examination was performed during this snoring period before the cessation of respiration. Anesthesia was induced in all patients by titrating Propofol (DiprivanR) 1 ml/10 mg. The same scoring system used in MM was used to classify collapse at the retropalatal and retroglossal levels.

The concordance between the two endoscopic examination methods was analyzed by the Kappa coefficient.

RESULTS

Twenty-eight patients (23 males, 5 females; mean age 44.6 years; range 28 to 59 years) were studied. Surgery was recommended to 22 of them because of OSAHS. Seventeen patients were classified as mild OSAHS (5≤AHI<15), 3 as moderate OSAHS (15≤AHI<30) and 2 patients as severe OSAHS (AHI≥30). Six of the patients agreed for surgery because of simple snoring (AHI: <5). MM both in sitting and supine positions and the fiberoptic pharyngoscopy during drug induced sleep for the induction of anesthesia, were performed to all patients and the results were compared.

A high level of concordance expressed as the Kappa co-efficient (0.706), was found between MM

in sitting position and MM in supine position for the retropalatal level. The concordance between these two tests was statistically significant ($p<0.01$). For the retropalatal level, MM in the sitting position revealed less than 50% obstruction (1+, 2+) in 12 patients and only one of these (8%) had more than 50% obstruction (3+, 4+) when MM was performed in the supine position. Out of 16 patients who had more than 50% obstruction (3+, 4+) with MM in the sitting position, 2 patients (12.5%) had less than 50% obstruction (1+, 2+) when the test was performed in the supine position.

The results of MM in the sitting position and MM in the supine position for retroglossal level were similar. Statistical significance ($p<0.01$) was reached by a 100% concordance (Kappa co-efficient: 1.00).

The scores of nasopharyngoscopy during the induction of anesthesia and MM were compared for the retropalatal level. Out of 12 patients whose obstructions were less than 50% (1+, 2+) with MM in the sitting position, 11 patients (92%) had more than 50% obstruction (3+, 4+) with pharyngoscopy during anesthesia induction. Out of 16 patients with obstructions over 50% (3+, 4+) with MM in the sitting position, 15 (93.75%) patients also had more than 50% obstruction (3+, 4+) with pharyngoscopy during anesthesia induction. Kappa co-efficient of the concordance was only 0.134 for these two examination methods and this represented statistical discordance ($p=0.88$). Similarly the scores of MM in the supine position and pharyngoscopy during the induction of anesthesia were also found to be discordant (Kappa co-efficient= 0.109, $p=0.151$).

The scores were compared for the retroglossal level. Six patients (24%) who were scored as 1+ or 2+ with MM in the sitting position and MM in the supine position had scores of 3+ or 4+ with pharyngoscopy during the induction of anesthesia. There was no concordance between these procedures (Kappa co-efficient=0.059, $p=0.724$). The scores of the endoscopic examinations (MM in the sitting position, MM in the supine position, and pharyngoscopy during the induction of anesthesia) are shown in Table I.

DISCUSSION

Surgeries regarding the soft palate and oropharynx, including UPPP, are the most common operations performed in patients with OSAHS and simple snoring. However, the basic principle of UPPP and its modifications is to enlarge the oropharynx and to prevent collapse during sleep UPPP is beneficial in approximately 50% of unselected patients with obstructive sleep apnea.[4,5] It was emphasized that the patients who do not respond to UPPP probably have obstructions in regions of the upper airway, which are not altered by UPPP.[6,7] There are various

TABLE I

THE SCORES OF THE MM IN SITTING POSITION, THE MM IN SUPINE POSITION, AND THE PHARYNGOSCOPY DURING THE INDUCTION OF ANESTHESIA

	MMsit		MMsup		sp	
	rp	rg	rp	rg	rp	rg
1	4+	0	4+	0	4+	0
2	3+	0	3+	1+	4+	4+
3	3+	2+	3+	2+	4+	0
4	3+	1+	3+	2+	3+	2+
5	2+	3+	3+	3+	4+	4+
6	2+	0	3+	1+	3+	0
7	3+	1+	2+	1+	4+	4+
8	4+	1+	4+	1+	4+	0
9	2+	3+	2+	3+	4+	1+
10	3+	2+	2+	1+	1+	0
11	1+	0	1+	0	4+	3+
12	1+	2+	1+	2+	4+	2+
13	2+	0	2+	0	4+	1+
14	2+	1+	2+	1+	4+	2+
15	1+	2+	1+	2+	4+	3+
16	3+	1+	3+	1+	4+	1+
17	3+	1+	3+	1+	4+	1+
18	3+	0	3+	0	4+	0
19	4+	1+	3+	1+	4+	1+
20	3+	1+	3+	0	4+	0
21	4+	3+	4+	3+	4+	1+
22	4+	2+	4+	2+	4+	1+
23	2+	2+	2+	2+	4+	2+
24	1+	0	1+	0	3+	3+
25	4+	1+	4+	1+	4+	3+
26	4+	1+	4+	1+	4+	2+
27	2+	1+	2+	1+	2+	1+
28	2+	0	2+	0	4+	1+

MMsit: MM in sitting position; MMsup: MM in supine position; sp: Pharyngoscopy during the induction of anesthesia; rp: Retropalatal level; rg: Retroglossal level.

methods to predict good UPPP candidates by detecting the obstructed or collapsed segments of the upper airway.

Numerous methods including physical examination, cephalometric analysis, computed tomography (CT) scanning of the upper airway, and various endoscopic examination procedures, such as MM, have been used to predict the location of upper airway obstruction. Additionally there are other methods including polysomnography synchronized somnofluoroscopy, cine-computed tomography, dynamic magnetic resonance imaging during sleep and fiberoptic nasopharyngoscopy which can be performed during sleep. Theoretically, patients who do not have collapse in their upper airway, other than the oropharynx, are expected to be good UPPP responders.

As patients with an elongated uvula and hypertrophic tonsils could be estimated as good UPPP candidates, upper airway examination alone is not enough to make the decision for operation.[8] Individuals with abnormalities that narrow the posterior airway such as retrognathia and macroglossia are obviously poor UPPP candidates. With the help of cephalometric analysis, Petri et al.[9] reported that the lowered position of the hyoid bone, increased cranio-cervical angle, and shortening of the length of the maxilla were significantly associated with poor results of UPPP.

MM described by Borowiecki and Sassin,[10] is the most feasible and inexpensive method to detect possible collapse in OSAHS patients. Previous reports about the predictive efficacy of MM for UPPP are contradictory. According to Sher et al.,[11] the predictive value of MM is high. They achieved surgical success in 87% of patients who were selected by MM. In contrast to this, Katsantonis et al.[12] indicated a low predictive value; only 33% in their selected cases who responded to UPPP. Similarly, Petri et al.[9] reported that MM was inadequate for identifying good UPPP responders. Although MM is the most practical test for examining the upper airway in patients with snoring and OSAHS, the low predictive value of this endoscopic examination method makes it less reliable.

Examination methods performed in the awake state are preferred for their simplicity, but they do not provide as much information as those performed during sleep. Fiberoptic examination of the upper airway during sleep in patients with OSAHS has been a valuable tool in assessing the dynamics of the airway and determining the site and mechanism of obstruction. Muscular tone differences of the upper airway during wakefulness and sleep might be responsible for the low predictive efficacy of MM.

Although polysomnography synchronized somnofluoroscopy or dynamic magnetic resonance imaging during sleep seem to be ideal tests for selecting patients who respond to procedures involving the soft palate and oropharynx,[13] they are impractical for sleep laboratories. Fiberoptic nasopharyngoscopy during sleep was believed to be the most beneficial test to determine the level of obstruction in OSAHS patients.[14-16] The reliability of sleep endoscopy was doubtful because induction and maintenance of sleep with the help of various medications may affect sleep pattern and muscle tone. Increased success rates for UPPP were reported after diagnostic workup by sleep endoscopy.[17] Croft and Pringle[16] reported that fiberoptic nasopharyngoscopy was a more efficient method than MM to select UPPP candidates. To our knowledge, based on our review of the relevant literature, there is only one report that compares MM and nasopharyngoscopy during sleep. Pringle and Croft[18] compared MM and pharyngoscopy during sleep and found MM to be less accurate than pharyngoscopy during sleep.

The aim of the present study was to compare the results of the two endoscopic examination methods for the retropalatal and retroglossal levels, rather than comparing their predictive efficacies. We modified the sleep endoscopy to an easier test by performing endoscopic examination during the induction of anesthesia. In this way, we attempted to avoid some disadvantages such as hospitalization of the patient, intolerance, and time loss. In our study MM, both in sitting and supine positions and fiberoptic nasopharyngoscopy during induction of anesthesia were compared. The effect of body position to the extent and severity of the obstruction was addressed by comparing MM in the sitting position with MM in the supine position. The results of the tests, both for the retropalatal and the retroglossal levels were not much different. At the level of the tongue base, a 100% concordance was achieved between the results of MM in both examination positions.

In the present study, the scores of nasopharyngoscopy during the induction of anesthesia and MM in the sitting and supine positions were found to be discordant. Out of 12 patients whose obstructions were less than 50% (1+, 2+) at the retropalatal level with MM in the sitting position, 11 patients (92%) had more than 50% obstruction (3+, 4+) with pharyngoscopy during anesthesia induction. Similar incompatibilities between the scores of MM and pharyngoscopy during the induction of anesthesia were present for the retroglossal level.

We can not suggest which test was better for the selection of patients as UPPP candidates because post-UPPP polysomnographies could not be performed for evaluating surgical success. In other studies concerning nasopharyngoscopy during sleep, the test was performed after inducing sleep with benzodiazepine or other sedating drugs, and the examination procedure to detect the collapsed or obstructed localizations was completed in longer time intervals than in the present study. This difference in the test procedures must be taken into account when comparing the results of other studies with ours. In spite of the shorter duration of endoscopic examination, we were able to score both levels in all of the tests. Based on the results of the present study, the following conclusions could be drawn: (*i)* the degree of obstruction might be underestimated with MM, especially at the level of the soft palate and, (*ii)* this method may not properly reflect the actual obstruction during normal sleep, and (*iii)* if MM is the chosen endoscopic examination method, there is no need to repeat the test in different body positions.

Finally the authors call for additional studies with preoperative and postoperative polysomnography to determine the most practical and accurate test method for selecting the responders to UPPP or other interventions of the soft palate.

REFERENCES

1. Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurrence of sleep-disordered breathing among middle-aged adults. N Engl J Med 1993; 328:1230-5.
2. Fujita S, Conway W, Zorick F, Roth T. Surgical correction of anatomic azbnormalities in obstructive sleep apnea syndrome: uvulopalatopharyngoplasty. Otolaryngol Head Neck Surg 1981;89:923-34.
3. Powell N, Riley R, Guilleminault C, Troell R. A reversible uvulopalatal flap for snoring and sleep apnea syndrome. Sleep 1996;19:593-9.
4. Fujita S, Conway WA, Zorick FJ, Sicklesteel JM, Roehrs TA, Wittig RM, et al. Evaluation of the effectiveness of uvulopalatopharyngoplasty. Laryngoscope 1985;95:70-4.
5. Sher AE, Schechtman KB, Piccirillo JF. The efficacy of surgical modifications of the upper airway in adults with obstructive sleep apnea syndrome. Sleep 1996; 19:156-77.
6. Katsantonis GP, Walsh JK, Schweitzer PK, Friedman WH. Further evaluation of uvulopalatopharyngoplasty in the treatment of obstructive sleep apnea syndrome. Otolaryngol Head Neck Surg 1985;93:244-50.
7. Simmons FB, Guilleminault C, Miles LE. The palatopharyngoplasty operation for snoring and sleep apnea: an interim report. Otolaryngol Head Neck Surg 1984;92:375-80.
8. Rivlin J, Hoffstein V, Kalbfleisch J, McNicholas W, Zamel N, Bryan AC. Upper airway morphology in patients with idiopathic obstructive sleep apnea. Am Rev Respir Dis 1984;129:355-60.
9. Petri N, Suadicani P, Wildschiodtz G, Bjorn-Jorgensen J. Predictive value of Muller maneuver, cephalometry and clinical features for the outcome of uvulopalatopharyngoplasty. Evaluation of predictive factors using discriminant analysis in 30 sleep apnea patients. Acta Otolaryngol 1994;114:565-71.
10. Borowiecki BD, Sassin JF. Surgical treatment of sleep apnea. Arch Otolaryngol 1983;109:508-12.
11. Sher AE, Thorpy MJ, Shprintzen RJ, Spielman AJ, Burack B, McGregor PA. Predictive value of Muller maneuver in selection of patients for uvulopalatopharyngoplasty. Laryngoscope 1985;95:1483-7.
12. Katsantonis GP, Maas CS, Walsh JK. The predictive efficacy of the Muller maneuver in uvulopalatopharyngoplasty. Laryngoscope 1989;99(7 Pt 1):677-80.
13. Katsantonis GP, Walsh JK. Somnofluoroscopy: its role in the selection of candidates for uvulopalatopharyngoplasty. Otolaryngol Head Neck Surg 1986;94:56-60.
14. Camilleri AE, Ramamurthy L, Jones PH. Sleep nasendoscopy: what benefit to the management of snorers? J Laryngol Otol 1995;109:1163-5.
15. Quinn SJ, Daly N, Ellis PD. Observation of the mechanism of snoring using sleep nasendoscopy. Clin Otolaryngol Allied Sci 1995;20:360-4.
16. Croft CB, Pringle M. Sleep nasendoscopy: a technique of assessment in snoring and obstructive sleep apnoea. Clin Otolaryngol Allied Sci 1991;16:504-9.
17. Hessel NS, de Vries N. Results of uvulopalatopharyngoplasty after diagnostic workup with polysomnography and sleep endoscopy: a report of 136 snoring patients. Eur Arch Otorhinolaryngol 2003;260:91-5.
18. Pringle MB, Croft CB. A comparison of sleep nasendoscopy and the Muller manoeuvre. Clin Otolaryngol Allied Sci 1991;16:559-62.