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Research Article

SUBJECTIVE AND OBJECTIVE NASAL EVALUATION OF PATIENTS WITH OBSTRUCTIVE SLEEP APNEA SYNDROME

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ABSTRACT

Objective: The aim of the study was to evaluate the nasal cavities of patients with obstructive sleep apnea syndrome using subjective methods (VAS, NOSE scale) and objective methods (Nasal endoscopy, acoustic rhinometry, rhinomanometry). Methods: 55 OSAS patients from 2015-2017 in ENT department of Jingzhou Number 1 Hospital were included in this study. Two studies were carried out. The first study was between subjective, rhinometry and rhinomanometry measures including 55 OSAS patients. Second study was between subjective and endoscopic measures. This study included dividing 55 OSAS patients into two groups.

Group A: 23 OSAS patients with nasal complaints and Group B: 32 OSAS patients with no nasal complaints. Subjective evaluation was done using VAS and NOSE scale. Objective evaluation was done using nasal endoscopy, acoustic rhinometry and rhinomanometry.

Results: The patients with nasal complaints exhibited higher score on the VAS and NOSE scale. However, most patients showed the presence of anatomical nasal alteration (presence of hypertrophy of inferior turbinate, deviated nasal septum, narrow nasal cavity) during nasal endoscopy. Although the result of correlation was in the expected direction, subjective and objective measures were not highly significant.

Conclusion: There was poor correlation between the different evaluations methods used and there was a discrepancy between the subjective perception of the patients and the objective findings.

Keywords: OSAS, Nasal Obstruction, VAS, NOSE, Acoustic Rhinometery, Rhinomanometer, Nasal Endoscopy.

INTRODUCTION

Nasal obstruction is a very common complaint among people. There are various causes by which a nasal cavity can be obstructed. Anatomical nasal alteration like deviated nasal septum, hypertrophy of turbinates and narrowing of nasal cavity can cause nasal obstruction. Disorders like rhinosinusitis, acute nasopharyngitis, rhinitis, nasal polyps, papillomas, and hemangiomas are also some of the causes of nasal obstruction. Patients with obstructive sleep apnea syndrome have also shown to have obstruction of the nose.

There are different ways to evaluate nasal obstruction. Subjective evaluation using the Nasal Obstruction Symptom Evaluation (NOSE) scale and Visual Analogue Scale (VAS) are widely used. This subjective measures evaluates patient's perception of nasal obstruction. VAS evaluates patient's perception on the day of the examination whereas NOSE scale is used to evaluate the nasal obstruction for the past one month. Acoustic Rhinometry (AR) is an objective tool used to measure the cross-sectional area and nasal volume within a given distance in the nasal cavity. Rhinomanomtery measures the transnasal pressure and airflow and provides a nasal resistance value and a graph of the relationship between pressure and airflow. Nasal endoscopy involves evaluation of the nasal and sinus passages with direct vision using a magnified high- quality view. It serves as an objective diagnostic tool in the evaluation of sinonasal anatomy and nasal pathology. Discordance between objective measures of disease severity and subjective patient self-assessments has been established in other medical conditions including sleep apnea [15,62]. Although some studies have established a correlation between objective and subjective measures of nasal obstruction [83-105] others have not [116]. To investigate the relationship between subjective and objective measures of the nasal airway, this study compares two subjective measures (NOSE and VAS) and acoustic rhinometry, rhinomanometry and nasal endoscopy.

MATERIALS AND METHODS

55 OSAS patients from 2015-2017 in ENT department of Jingzhou Number 1 Hospital were included in this study. Two studies were carried out. The first study was between subjective measures and acoustic rhinometry and rhinomanometry measures including 55 OSAS patients. Second study was between subjective and endoscopic measures which included dividing 55 OSAS patients into two groups. Group A: 23 OSAS patients with nasal complaints and Group B: 32 OSAS patients with no nasal complaints. Subjective evaluation was done using VAS and NOSE scale. Objective evaluation was done using nasal endoscopy, acoustic rhinometry and rhinomanometry.

NOSE scale and Nasal Obstruction VAS All the OSAS patients were evaluated using the questionnaire the NOSE scale and nasal obstruction VAS to assess the subjective parameters of nasal obstruction.

Nasal Endoscopy Patients then underwent nasal endoscopy using a flexible fiberoptic endoscope to evaluate the anatomy of the nasal cavity.

Acoustic Rhinometry Acoustic rhinometry was performed in each patients using Acoustic Rhinometer A1 developed by GM Instruments Ltd. A1 Clinical software version 3.0.0.969 was used which was delivered by the manufacturer. The normal value of the minimal cross sectional area was 0.45 to 0.78 cm2 and the normal value of nasal cavity volume was 6.45 to 12.65 cm3.

Rhinomanometry was done in all patients using Rhinomanometer NR6 developed by GM Instruments Ltd. Clinical sotware version 3.0.0.969 was used which was delivered by the manufacturer. The normal value for airflow resistance is 0.131 to 0.441 Pa/cm3/s.

STATISTICAL ANALYSIS AND RESULTS

In the case of comparisons between the two subjective parameters or between any two objective parameters, one would expect a positive correlation (i.e., improvement in both variables or worsening in both variables). However, in a comparison between both subjective measurement and any objective parameter, one would expect a negative correlation (e.g., an increase in NOSE scale indicating worse subjective nasal obstruction and a decrease in MCA indicating a smaller airway). Spearman correlation was used to establish the negative or positive correlation between NOSE, VAS and acoustic rhinometry. P value was also determined between all the categories. The correlations between different measurement categories were all small and not statistically significant.

There was a poor negative correlation between subjective measures and rhinometry (Table 1). There was positive correlation between the NOSE and VAS (Figure 1) and also positive correlation between MCA and Nasal volume (Figure 2).

SPEARMAN CORRELATION ANALYSIS				
Acoustic Rhinometry	Acoustic Rhinometry		Subjective	
	MCA	Nasal Volume	NOSE	VAS
MCA	1.00			
Nasal Volume	0.274 (p=0.0429)	1.00		
Subjective				
NOSE	-0.099(p=0.4721)	-0.048(p=0.7278)	1.00	
VAS	-0.091(p=0.5088)	-0.031 (p=0.8222)	0.887(p=0.0001)	1.00

Table 1

MCA= minimal cross-sectional area, NOSE= nasal obstruction symptom evaluation scale, VAS= visual analogue scale.

There exists a negative correlation between subjective measures and acoustic rhinometry. The relationship between the variables is weak (the nearer the value is to zero, the weaker the relationship).The p value here is >0.05. Therefore, by conventional criteria, this difference is considered to be not statically significant. For NOSE and VAS, there exist a strong positive correlation and as the p value is <0.0001, it is statistically significant.

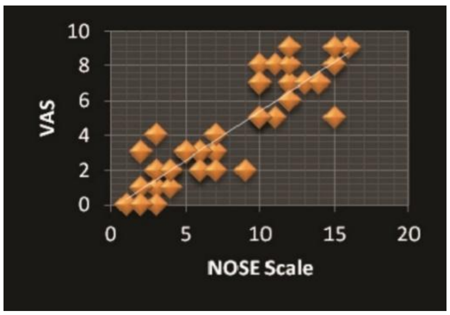


Figure 1: Scatterplot of VAS and NOSE scale.

It shows strong positive correlation.

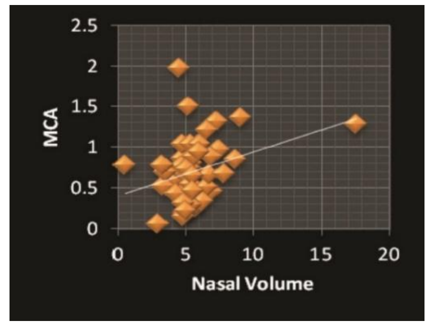


Figure 2: Scatterplot of MCA and Nasal volume.

It shows weak positive correlation.

For second objective test that is for nasal endoscopy, the patients were divided into 2 groups. Group A had patient with NOSE and VAS score of 10 or more and 5 or more respectively. They were considered as positive group. Likewise, patient with DNS, hypertrophy of turbinates and narrow nasal cavity were also placed in the positive group. Group B had patients with NOSE and VAS score of 9 or less and 4 or less respectively. They were considered as negative group. Patients with no DNS, no hypertrophy of the turbinates and no narrowing of the nasal cavity were also placed in the negative group. Nasal endoscopy was done for both the groups checking for DNS, Hypertrophy and Narrow nasal cavity. Spearman correlation was used to establish the correlation between subjective (NOSE and VAS) and nasal endoscopy. Spearman correlation was also established between subjective and nasal endoscopy data in the 2 groups. In group A, perfect positive correlation was seen between subjective and objective evaluation of the patients (Table 2). In contrast group B had a perfect negative correlation between subjective and objective evaluation of the patients (Table 3).

SPEARMAN CORRELATION ANALYSIS						
	VAS+NOSE	DNS	VAS+NOSE	HT	VAS+NOSE	NNT
Negative	0	4	0	4	0	2
Positive	28	19	23	19	23	19
Coefficient	R=1		R=1		R=1	

Table 2

HT= Hypertrophy turbinate, NNT= narrow nasal cavity VAS= visual analogue scale, NOSE= nasal obstruction symptom evaluation scale, DNS= deviated nasal septum. As R= 1, there exist a perfect positive correlation between subjective measures (NOSE, VAS) and objective measure (DNS, hypertrophy, narrow nasal cavity=Nasal endoscopy).

SPEARMAN CORRELATION ANALYSIS						
	VAS+NOSE	DNS	VAS+NOSE	HT	VAS+NOSE	NNT
Negative	32	4	32	11	32	11
Positive	0	28	0	21	0	21
Coefficient	R= -1		R= -1		R= -1	

Table 3

HT= Hypertrophy turbinate, NNT= narrow nasal cavityVAS= visual analogue scale, NOSE= nasal obstruction symptom evaluation scale, DNS= deviated nasal septum. As R= -1, there exist a perfect negative correlation between subjective measures (NOSE, VAS) and objective measure (DNS, hypertrophy, narrow nasal cavity=Nasal endoscopy).

Third statistical analysis was done to establish the correlation between subjective measures and rhinomanometry using Spearman correlation analysis. Poor positive correlation was seen between the variables (Table 4).

SPEARMAN CORRELATION ANALYSIS			
Rhinomanometry	Rhinomanometry Nasal Airway Resistance	Subjective NOSE	 VAS
Nasal Airway Resistance	1.00		
Subjective			
NOSE	0.083 (P=0.5469)	1.00	
VAS	0.107 (P=0.4368)	0.887(p=0.0001)	1.00

Table 4

NOSE= nasal obstruction symptom evaluation scale, VAS= visual analogue scale. Although technically a positive correlation, the relationship between the variables is weak (the nearer the value is to zero, the weaker the relationship).The p value here is >0.05. Therefore, by conventional criteria, this difference is considered to be not statically significant.

The fourth statistical analysis was done to evaluate the correlation between two objective measures (Acoustic rhinometry and Rhinomanometry). There was a very weak negative correlation between MCA and nasal airway resistance whereas there was poor positive correlation between nasal volume and nasal airway resistance (Table 5).

SPEARMAN CORRELATION ANALYSIS			
Rhinomanometry	Rhinomanometry Nasal Airway Resistance	Acoustic Rhinometry MCA	 Nasal Volume
Nasal Airway Resistance	1.00		
Acoustic Rhinometry			
MCA	-0.073 (P=0.5964)	1.00	
Nasal Volume	0.073 (P=0.5964)	0.274(p=0.0429)	1.00

Table 5

MCA= minimal cross sectional area. There is negative correlation between MCA and airway resistance. The relationship between the variables is very weak. However, there is a weak positive correlation between nasal volume and airway resistance (the nearer the value is to zero, the weaker the relationship).The p value here is >0.05. Therefore, by conventional criteria, this difference is considered to be not statically significant.

DISCUSSION

Obstructive Sleep Apnea Syndrome (OSAS) Obstructive sleep apnea syndrome (OSAS) or obstructive sleep apnea/hypopnoea syndrome (OSAHS) is a most common respiratory sleep disorder in which major pauses in breath occurs while sleeping. It is caused by the collapse of the upper airway and characterized by difficulty in breathing during sleep, leading to repetitive pauses in inspiration despite the effort to inspire causing partial awakening.

OSAS is also associated with low oxygen saturation level, hypercapnia, snoring and excessive daytime sleepiness which is the hallmark of OSAS caused by sleep fragmentation. Different studies show that untreated OSAS also predisposes the life-shortening adverse clinical consequences like hypertension, neurocognitive dysfunction, cardiovascular disease, metabolic dysfunction, and corpulmonale.

The specialist should evaluate the patients if the condition of his/her sleeplessness is affecting their quality of life and if the history and physical examination is not complimenting the OSAS then the physician should consider making other diagnosis for the patients.such as 1）Sleep, medical and family history：Different question regarding sleep can be asked like, is the patient having restfull sleep, does he/she have morning headache, what is his/her normal position during sleep, does the bed partner complain about snoring etc.2）Physical examination: This includes the thorough examination of any abnormalities like enlarged tonsils and other craniofacial abnormalities like microganthia, overbite and retrognathia.3)Polysmnography:Overnight polysmnography is a most common sleep study. Polysomnography records brain activity, eye movement, heart rate and blood pressure, muscle tone along with snoring, chest movement, amount of oxygen in the blood and air movement through the mouth and nose while breathing.4) Home sleep test: Patient can self monitorself-monitor themselves using a device includes a breathing sensor, sensors to monitor heart rate, oxygen sensors that are put around finger and bands around the chest.

Visual Analogue Scale (VAS) is a measurement scale used to measure psychometric characters which cannot be directly measured. In the field of medicine it is used in measuring pain obstruction, nausea, fatigue, anxiety, dyspnea, depression etc. VAS in nasal obstruction is used by many clinician and researchers. It is used to obtain the severity of obstruction. Vas is usually seen as a horizontal line which is 10 cm long, with 0 being no obstruction and 10 being total obstruction (Figure 3). Visual analogue obstruction can be correlated with other diagnostic procedure (with rhinometry in OSAS) to make the diagnosis even more evidential.

Please make the line how troublesome is your breathing.

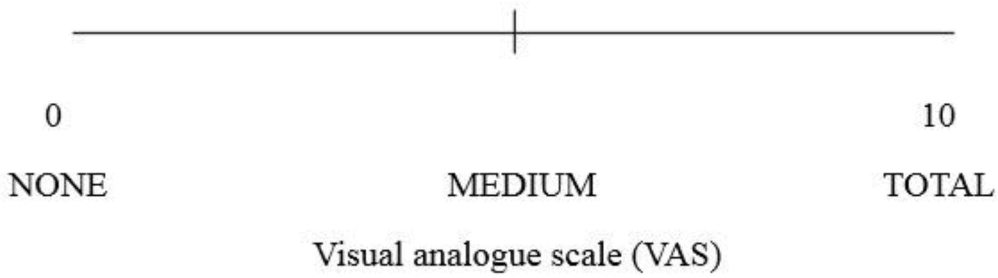
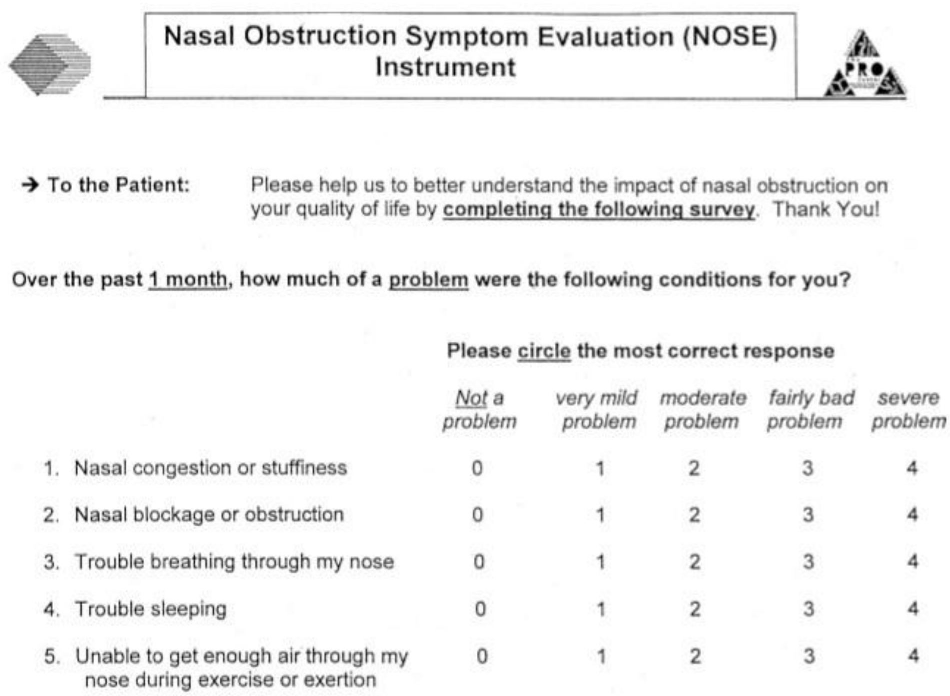


Figure: Visual analogue scale

The Nasal Obstruction Symptom Evaluation Scale is a valid, reliable, and responsive instrument. theThe patient with obstruction is given this scale and asked how much problematic condition they have had over a period of one month and the patient has to circle the options in the given scale below.



Nasal Obstruction Symptom Evaluation (NOSE) Instrument

→ **To the Patient:** Please help us to better understand the impact of nasal obstruction on your quality of life by **completing the following survey**. Thank You!

Over the past 1 month, how much of a problem were the following conditions for you?

Please circle the most correct response

	Not a problem	*very mild problem*	*moderate problem*	*fairly bad problem*	*severe problem*
1. Nasal congestion or stuffiness	0	1	2	3	4
2. Nasal blockage or obstruction	0	1	2	3	4
3. Trouble breathing through my nose	0	1	2	3	4
4. Trouble sleeping	0	1	2	3	4
5. Unable to get enough air through my nose during exercise or exertion	0	1	2	3	4

Figure: A sample of NOSE instrument

This study suggests that there is a discrepancy between patient's perception of nasal obstruction and anatomical measures of the nasal airway. There have various studies in the past with regardsto the degree of correlation between subjective and objective measures with mixed results [327]. This study does not differentiate the two sides of the nasal airway. The side with the lowest value was taken as reference. Since patients typically seek overall improvement of nasal breathing, we believe the overall nasal airway is most clinically relevant to patients.

It may seem surprising to see that there is a poor correlation between subjective and rhinometric measures but as expected, the correlations between subjective and rhinometric measures in this analysis were in the negative direction. Although none of these negative correlations was statistically significant, this finding supports the validity of the methods used (Table 1). This lack of significant correlations suggests that different nasal measures may capture different aspects of the nasal airway.

Two groups of study were carried out to established correlation between subjective measures and nasal endoscopy. Group A showed perfect positive correlation while Group B showed perfect negative correlation. Although patients in Group B had no nasal complaints, there were anatomical alterations in the nasal cavity. This result suggests that there is a discrepancy between the subjective perception of the patients and the endoscopic findings (Table 2) (Table 3).

There was a relative lack of correlation between subjective measures and nasal airway resistance (rhinomanometry). Although not significant, the result was consistently in the positive direction. This suggested that nasal airflow resistance increased with increasing severity of nasal obstruction (table 4). There was a weak positive correlation between nasal volume and nasal airway resistance. Although not significant, the result was in the negative (unexpected) direction. One would argue that increase in the nasal volume would decrease the airway resistance which was not the case in our study. This may be due to the fact that acoustic rhinometry measures cross-sectional area along the length of the nasal passage whereas rhinomanometry is limited to measuring the narrowest point of the nasal airway (Table 5). The study also showed a negative correlation between minimal cross-sectional area (MCA) and airway resistance which was as expected. This suggests that increase in the minimal cross-sectional area decreases the resistance in the airflow. One difference for the lack of association is that a patient's perception of nasal obstruction may depend on factors beyond the physical caliber of the nose. Patients with longstanding nasal obstruction due to deviated nasal septum or hypertrophy of turbinates may have become desensitized to the severity of the obstruction over time and rate themselves as not having any nasal obstruction. This finding suggests that objective findings may be more useful clinically.

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