

## Original Research Article

# Sleep disturbances in patient with chronic nasal obstruction due to nasal polyp: a prospective study

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## ABSTRACT

**Background:** Nasal obstruction is thought to be a major cause of sleep impairment. Typical sleep-related problems seen with nasal polyp include snoring, sleep-disordered breathing and sleep apnoea. The impact of nasal polyposis on quality of life is well studied however its effects on sleep have been less well studied. In the current study, we aim to investigate sleep disturbances in Filipino patients with nasal polyposis using different sleep questionnaires VAS score for snoring, Epworth sleepiness scale (ESS) for daytime sleepiness and Pittsburgh sleep quality index (PSQI) for sleep quality and the effect of endoscopic sinus surgery on sleep quality.

**Methods:** A prospective, non-randomized study was done in the Department of Otorhinolaryngology Head and Neck Surgery of Southern Philippines Medical Center from February 2014 to July 2014. Number of 18 patients with chronic nasal obstruction for more than 6months due to nasal polyps at least grade II on endoscopic examination were included in the study. Visual analogue scale (VAS) score for snoring, ESS for daytime somnolence and PSQI for quality of sleep was compared preoperatively and 1month postoperatively.

**Results:** Mean value of VAS score for snoring, mean value of excessive daytime sleepiness measured by ESS and mean PSQI score for sleep quality improved significantly with  $p < 0.001$  after endoscopic sinus surgery.

**Conclusions:** Nasal polyp patients mostly present with nasal obstruction, snoring and excessive daytime sleepiness. Correction of nasal obstruction significantly improves snoring and sleep quality. After endoscopic sinus surgery, patients may experience improvement in snoring and have better sleep quality with decreased daytime sleepiness.

**Keywords:** Nasal polyps, Nasal obstruction, Sleep disorder breathing, Endoscopic sinus surgery

## INTRODUCTION

Nasal obstruction is thought to be a major cause of sleep impairment. Sleep disturbance can be caused by symptoms of inflammatory disorders of the upper respiratory tract, such as allergic rhinitis, rhinosinusitis, and nasal polyposis.<sup>1</sup> Typical sleep-related problems seen with nasal polyp include snoring, sleep-disordered breathing and sleep apnea, all of which are associated with nasal obstruction.<sup>2</sup>

Nasal polyposis has been associated with a poorer quality of life for patients than for healthy subjects or patients with allergic rhinitis possibly owing to the worse nasal congestion/obstruction experienced by patients with nasal polyposis.<sup>3</sup> Surgical correction of nasal airway obstruction improves quality of life in patients with nasal polyps, as well as in patients with deviated nasal septum and sleep apnea.

The impact of nasal polyposis on quality of life is well studied however, sleep impairment has been less well

studied. This study aims to focus on evaluating associations between nasal obstruction and its impact on sleep quality in patients with nasal polyposis using different sleep questionnaires visual analogue scale (VAS) score for snoring, Epworth sleepiness scale (ESS) for daytime sleepiness and Pittsburgh sleep quality index (PSQI) for sleep quality and the effect of endoscopic sinus surgery on sleep quality.

## METHODS

This prospective, non-randomized study was done in the Department of Otorhinolaryngology Head and Neck Surgery of Southern Philippines Medical Center from February 2014 to July 2014. Number of 18 patients with chronic nasal obstruction for more than 6 months due to nasal polyps at least grade II on endoscopic examination were included in the study.

### Inclusion criteria

Patients aged 20-60 years old who had chronic nasal obstruction for more than 6 months with no prior medications taken and had at least grade II nasal polyps on endoscopic examination were included in the study.

### Exclusion criteria

Minors and patients with severe medical problems, patients with maxillofacial deformity, central sleep apnea, and other primary sleep disorders (insomnia, periodic limb movement, restless legs, parasomnias, and narcolepsy), systemic diseases associated with sleep apnea, and those who were put into Mallampati classifications 3 and 4 will be excluded from the study.

### Sampling procedures

All the patients who met with the included criteria are included in this study. The sample size was 18.

### Sample size computation

Sample size for this study was computed using the software SampSize. Estimations were based on the assumption of the study done by Tosun et al that the mean ESS score among preoperative patients with chronic nasal obstruction is  $9.4 \pm 4.1$ . The sample size was computed to detect a 4-point difference between preoperative ESS score and postoperative ESS score as statistically significant. In a test for comparison of paired means carried out with 5% level of significance, a sample size of 18 patients will have 80% power of rejecting the null hypothesis (of no significant difference between preoperative mean ESS score and postoperative mean ESS score) if the alternative holds.

### Interventions and comparisons

All the patients participating in the study were endoscopically examined for nasal patency at Outpatient

Department of Otorhinolaryngology Head and Neck Surgery. All the participants were given the appendix containing the VAS scale, questionnaire for ESS and PSQI translated in Visayan (local language). The severity of snoring was determined by VAS, graded 0 to 10. Snoring volume was evaluated subjectively by the female partner using a VAS from 0 (no snoring) to 10 (snoring heard from another room). Excessive daytime sleepiness was measured using the ESS (Johns).<sup>4</sup> The sleep quality and sleep disturbances using PSQI (Buysse et al).<sup>5</sup> The data was collected by the researcher. All patients included in the study underwent endoscopic sinus surgery under general anesthesia for the removal of nasal polyps. All of the preoperative examinations and the measurements including VAS scoring for snoring, ESS scoring, PSQI and nasal endoscopy was repeated 1 month after the surgery.

### Statistical analysis

Analysis of data for this research was done using PSPPIre 0.8.3. Continuous data were summarized using mean  $\pm$  SD and compared using paired t-test. Categorical data were summarized using frequencies and percentages and compared using chi-square. A p value of  $<0.05$  was considered statistically significant.

## RESULTS

There were 18 patients with grade III nasal polyps, of which 14 (77.8%) were male and 4 (22.2%) female in this study. Ages ranged from 16 to 67 years, with a mean age of  $38.72 \pm 15.02$  years as shown in Table 1.

**Table 1: Baseline (pre-operative) demographic characteristics of patients with bilateral nasal polyposis grade III (n=18).**

Characteristics	Values
<b>Age (mean<math>\pm</math>SD)</b>	38.72 $\pm$ 15.02
<b>Sex</b>	<b>N (%)</b>
Male	14 (77.8)
Female	4 (22.2)
<b>Grade of nasal polyp</b>	
Grade II	0
Grade III	18 (100)

Before surgery, 17 patients (94.45%) were snorers, of which 10 (55.56%) had mild snoring, 5 (27.78%) had moderate snoring and 2 (11.11%) had severe snoring. After surgery, 3 patients (16.67%) had mild snoring whereas in 15 (83.33%) snoring completely disappeared. Mean VAS score for snoring improved significantly after the surgery (preoperatively,  $3.50 \pm 1.95$  and postoperatively,  $0.17 \pm 0.38$  ( $p < 0.001$ )) as shown in Table 2. Mean value of excessive daytime sleepiness, measured by ESS, decreased significantly ( $p < 0.001$ ) in the postoperative period (preoperatively,  $6.17 \pm 3.11$  and postoperatively,  $1.28 \pm 0.83$ ). Similarly mean PSQI score for sleep quality measure preoperatively was  $4.61 \pm 1.69$

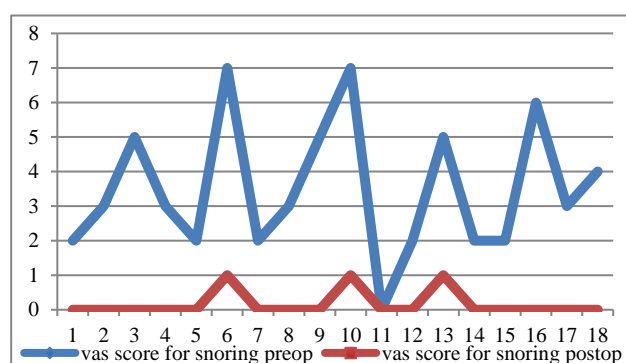
and postoperatively  $0.89 \pm 0.58$  which was statistically significantly with  $p < 0.001$ .

Before surgery the average duration of sleep in 13 patients was 6-8 hrs. Only 5 patients had 5-6 hours of sleep. Number of 13 patients described their overall sleep quality fairly good and 5 patients had fairly bad sleep quality. Snoring and nasal obstruction were the common cause of troublesome sleeping in almost all patients. Number of 17 patients had trouble sleeping due to

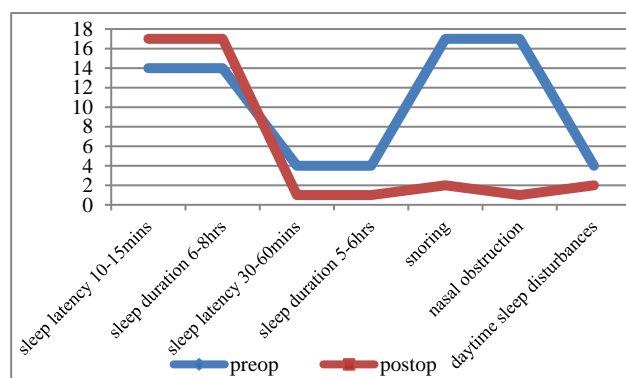
snoring and nasal obstruction. Only 4 patients had disturbed sleep because of bad dreams. None of the patient took medicines (prescribed or over the counter) to help them sleep. Number of 4 out of 18 patients had trouble engaging in social activity due to excessive sleepiness. After endoscopic sinus surgery the overall sleep quality was very good. Snoring and nasal obstruction was relieved resulting in good sleep as shown in Figure 2.

**Table 2: Pre-operative and post-operative (endoscopic sinus surgery) clinical characteristics of patients with bilateral nasal polyposis grade III (n=18).**

Parameter	Pre operative	Post-operative	Change	P value
<b>Mean VAS score for snoring<math>\pm</math>SD</b>	$3.50 \pm 1.95$	$0.17 \pm 0.38$	$-3.33 \pm 1.71$	$<0.001$
<b>Classification by VAS</b>	<b>N (%)</b>	<b>N (%)</b>		$<0.001$
No snoring (VAS=0)	1 (5.5)	16 (88.9)		
Mild snoring (VAS=1-3)	10 (55.6)	2 (11.1)		
Moderate snoring (VAS=4-6)	5 (27.8)	0		
Severe snoring (VAS=7-10)	2 (11.1)	0		
<b>Mean ESS score<math>\pm</math>SD</b>	$6.17 \pm 3.11$	$1.28 \pm 0.83$	$-4.89 \pm 2.63$	$<0.001$
<b>Classification by ESS</b>				0.055
Unlikely to be abnormally sleepy (ESS=0-7)	13 (72.2)	18 (100)		
Average amount of daytime sleepiness (ESS=8-9)	2 (11.1)	0		
Excessively sleepy depending on situation (ESS=10-15)	3 (16.7)	0		
Excessively sleepy (ESS=16-24)	0	0		
<b>Mean PSQI score<math>\pm</math>SD</b>	$4.61 \pm 1.69$	$0.89 \pm 0.58$	$3.72 \pm 1.53$	$<0.001$



**Figure 1. Preoperative and postoperative VAS score for snoring.**



**Figure 2. Comparing preoperative and postoperative common PSQI components.**

## DISCUSSION

Sleep is essential for a person's health and wellbeing. Nasal congestion/obstruction is thought to be a major cause of sleep impairment. Sleep-related problems seen with nasal polyp include sleep-disordered breathing, sleep apnea, and snoring, all of which are associated with nasal congestion/obstruction. The socioeconomic burden of these is significant. The socioeconomic costs include the costs of treatment and the secondary cost of poor productivity, which results from the impact of symptoms on patients' lives and the use of inappropriate therapies. Patients' quality of life is significantly affected which has been shown using generic health-related quality-of-life questionnaires.

The nose is the primary route of breathing during sleep. Studies in normal subjects demonstrate that nasal breathing increases ventilation by stimulating certain receptors in the nasal airway, and occlusion of the nasal airway may produce decreased oropharyngeal patency.<sup>6,7</sup> Therefore, the nasal congestion associated with nasal polyp can limit maximal upper airway airflow and contribute to sleep disturbances.

In a population-based, case-control study, patients with nasal polyposis had a 2-fold higher risk of sleep disturbances than controls.<sup>8</sup> This is further supported by a study that approached it from the other way around; in a study of general medical outpatients, an increased

prevalence of CRS symptoms in patients with unexplained chronic fatigue was observed.<sup>9</sup> Thus, sleep impairment is a significant issue for nasal polyp patients and questions regarding quality of the sleep have been incorporated in many disease-specific quality of life questionnaires.

In our study, 17 patients had nasal obstruction, which was worse at night and the main cause for sleep disturbance. After endoscopic sinus surgery the nasal obstruction was significantly improved and only 1 patient had nasal congestion due to rhino sinusitis. Studies have shown that there is a clear relationship between sleep impairment and daily fatigue. Poorly sleeping patients would be expected to experience fatigue and improved sleep should have positive influence on fatigue. Daytime sleepiness is one of the common complaints of patient with sleep disturbances. The ESS, created by Johns is the most widely used scale in assessing daytime sleepiness, particularly in response to treatment.<sup>4</sup> In our study 13 subjects has ESS score of less than 7, which showed normal daytime sleepiness ( $p < 0.005$ ). Only 3 patients had score more than 10 indicating excessively sleepy. However, mean value of excessive daytime sleepiness, measured by ESS, decreased significantly ( $P < 0.001$ ) in the postoperative period (preoperatively,  $6.17 \pm 3.11$  and postoperatively,  $1.28 \pm 0.83$ ). These findings are different from the study done by Verse et al reported a significant improvement of the mean ESS score from 12 to 8 after nasal surgery in 26 adult patients with sleep-disordered breathing.<sup>10</sup> Patients included in the study did not have OSAS so they were not found to be excessively sleepy at daytime. It has been suggested that snoring alone, without conventional sleep apnea or hypopnea, may disrupt sleep and produce substantial daytime hyper somnolence. A study done by Stradling et al showed that snoring (without classical sleep apnea) might sometimes reduce sleep quality sufficiently to produce substantial daytime drowsiness.<sup>11</sup> In our study also 3 patients who were moderate to severe snorer were found to be excessively sleep at daytime, which suggests that snoring alone without apnea, might reduce sleep quality. Most of the patients were found likely to fall asleep while watching TV and lying down to rest in afternoon. 13 out of 18 patients have moderate chances of dozing while watching TV and lying down to rest in the afternoon. While only 3 of the patients had high chances of dozing.

Snoring is associated with changes in caliber of the upper airway, which reduce flow and increase airway resistance, and is a manifestation of increased turbulence in nasal flow. In this study, severity of snoring was measured using VAS for snoring along with participation of bed partner or room partner for two-way assessment. Before surgery, 17 patients (94.45%) were snorers, of which 10 (55.56%) had mild snoring, 5 (27.78%) had moderate snoring and 2 (11.11%) had severe snoring. Post endoscopic sinus surgery, 3 patients (16.67%) had mild snoring whereas in 15 (83.33%) snoring completely disappeared. Mean VAS score for snoring improved

significantly after the surgery (preoperatively,  $3.50 \pm 1.95$  and postoperatively,  $0.17 \pm 0.38$  ( $p < 0.001$ )). The study shows that endoscopic sinus surgery significantly improves nasal obstruction and snoring and benefits both the snorer and his or her bed partner. Snoring is common in patients with obstruction of the nasal passage, leading to disturbed sleep architecture and sleep fragmentation and causing associated daytime sleepiness and impaired quality of life. Our findings are similar to the study done by Tosun et al where VAS Snoring scores were significantly improved postoperatively ( $p < 0.01$ ) and completely disappeared in 9 of 27 patient and similarly a significant improvement occurred in mean daytime sleepiness scores in the postoperative period (4.14) as compared with the preoperative values (9.44;  $p < 0.01$ ).<sup>12</sup> Several Studies have also shown that nasal surgery may reduce the sound intensity of snoring by 5-10 dB. So, the study emphasizes on the role of endoscopic sinus surgery in improving nasal obstruction and snoring thereby helping both the snorer and his or her bed partner.

Polysomnography is the gold standard test to diagnose different sleep disorders. However considering the cost of the test, PSQI has been used in many studies as a tool for subjective measure of sleep quality and patterns.<sup>5</sup> The PSQI provides a subjective measure of sleep quality and patterns. The tool focuses on sleep quality. Patients with nasal polyposis have higher ratios of sleep disturbances. Improvement of sleep-related breathing disorders after nasal surgeries has been reported in several studies.<sup>13-16</sup> In this study also PSQI is used as one of the questionnaires for measuring sleep quality. The global PSQI score can range from 0 to 21. A global score of 5 or more indicates poor sleep quality; the higher the score, the worse the quality. In this study the mean PSQI score for sleep quality measure preoperatively was  $4.61 \pm 1.69$  and it was reduced to  $0.89 \pm 0.58$ , which was statistically significantly with  $p < 0.001$ . Preoperatively 8 patients had global PSQI score 5 or more indicating poor sleep quality, which got improved to 2 or less after endoscopic sinus surgery signifying the role of surgery in improvement of quality of sleep. Similarly, the average duration of sleep was 6-8 hrs. 13 out of 18 patients had overall sleep rate fairly good. Only 5 patients had fairly bad sleep quality. Snoring and nasal obstruction were the common cause of troublesome sleeping. 17 patients had trouble sleeping due to snoring and nasal obstruction. Only 4 patients couldn't sleep well because of bad dreams. None of the patient took medicines (prescribed or over the counter) to help them sleep. 4 out of 18 patients had trouble engaging in social activity due to excessive sleepiness. After endoscopic sinus surgery the overall sleep quality was very good. Snoring and nasal obstruction was relieved resulting in good sleep. None of the patient had trouble participating in social activity because of excessive sleepiness.

The findings of the study were similar to the study done by Li et al showed correction of an obstructed nasal airway significantly improves disease-specific and

generic QOL in adult patients with obstructive sleep apnea who also have nasal obstruction symptoms.<sup>17</sup> Although patients included in our study didn't have OSAS but significant improvement in nasal obstruction, snoring and daytime sleepiness emphasizes on the role of endoscopic sinus surgery in improving overall sleep quality in patients with nasal polyps.

## CONCLUSION

Nasal congestion/obstruction is a major cause of sleep impairment. Nasal polyp patients mostly present with nasal obstruction, snoring and excessive daytime sleepiness. So, correction of nasal obstruction significantly improves snoring and sleep quality. After Endoscopic sinus surgery, patients may experience improvement in snoring and have better sleep quality with decreased daytime sleepiness. The study highlights the importance of endoscopic sinus surgery in relieving nasal obstruction and thus improving sleep quality in patients with nasal polyposis.

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