Section: ENT

Original Research Article

CLINICAL UTILITY OF DELTA NEUTROPHIL INDEX AS A SEVERITY AND PREDICTION MARKER IN PATIENTS WITH ACUTE PANCREATITIS

Abbhishek Joshi[1], Girraj Singh[2]

[1]*Assistant Professor, Department of ENT, K M Medical College. Mathura, Uttar Pradesh, India.*
[2]*Associate Professor, Department of ENT, G S Medical College. Pilukhwa Hapur, Uttar Pradesh, India.*

Received *: 05/04/2025*
Received in revised form *: 24/05/2025*
Accepted *: 15/06/2025*

Corresponding Author:
Dr. Abbhishek Joshi,
Assistant Professor, Department of ENT, K M Medical College. Mathura, Uttar Pradesh, India.
Email: manujoshi1779@gmail.com

DOI: 10.70034/ijmedph.2025.3.188

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (3); 1020-1026

ABSTRACT

Background: Snoring in adults is one of most common cause of distress for general population, life partner and family member and requires for timely attending, counseling, diagnostic evaluation, and treatment. **Objective:** To find co-relation between nasal obstruction and snoring & evaluate the effect of relieving nasal obstruction on snoring by requisite nasal surgery.

Materials and Methods: The present study comprising of 100 cases was conducted according to inclusion/exclusion criteria written below. These cases were selected at random from the Outpatient Department of ENT, Ram Lal Eye and ENT Hospital attached to Government Medical College, Amritsar. Study included patients with Age 18 years or above & patients presenting with impaired nasal breathing due to nasal obstruction. A thorough history according to the proforma attached was taken in each case, followed by detailed nasal examination and investigation. All cases were operated in Ram Lal Eye and ENT Hospital, Amritsar.

Results: The present study was conducted on patients having chief complaint of snoring. Patients are found to be benefitted by requisite nasal surgery, which included septoplasty/ submucosal resection of septum, polypectomy or turbinectomy. The patients were followed up and assessed on 15th day, one month and three months after surgery.

Conclusion: Snoring is a common disorder usually presenting to otorhinolaryngologists. But this night time annoyance may indicate a more serious health condition and can disrupt their household and strain patient's relationship. As snoring or obstructive sleep apnoea/hypopnea syndrome is often caused by obstruction at multiple levels hence it is often treated by surgeries at different levels of respiratory tract. Nasopharyngeal, oropharyngeal and hypopharyngeal surgeries have been used in either one, two or three steps. Various oropharyngeal techniques are uvulopalatopharyngoplasty (UPPP) and Laser Assisted Uvulopalatopharyngoplasty (LAUP).

Keywords: Nasal Surgery, Snoring, Epworth sleepiness scale.

INTRODUCTION

Snoring is the cardinal symptom of nocturnal upper airway obstruction and may be associated with or cause significant social or physiological disturbance.[1]

It is the low frequency sound produced by vibration of the upper airway walls during partial upper airway obstruction. These vibrations usually take place in soft palate but may also be present at other sites including tonsils, epiglottis and base of tongue.[2]

Snoring is a common problem. 45% of normal adults snore at least occasionally, and 25% snore habitually.[3] Primary snoring without sleep disordered breathing is not harmful in itself but may lead to social impairment.[4] Loud snoring coupled with periods of silence is more dangerous because it could be a sign of obstructive sleep apnoea.

Sleep apnoea results due to intermittent cessation of airflow at both nose and mouth during sleep. Apnoeic episodes may last for 20-30 seconds up to as high as

2-3 minutes. Significant disturbances are noted if such episodes occur for 15 times or more per hour.

Obstructive sleep apnoea is characterized by recurrent episodes of partial or complete upper airway obstruction during sleep which are usually terminated by an arousal.

The upper airway obstruction causes hypoventilation, which in turn causes hypercapnia and hypoxaemia. Both hypercapnia and hypoxaemia along with increased respiratory effort and negative airway pressure lead to arousal stimulus. At the time of the arousal upper airway muscle activity increases, which results in relief of the upper airway obstruction. This is associated with a loud snort and a short period of compensatory hyperventilation.[5]

To evaluate the site of snoring various techniques used are:

- Sleep nasendoscopy – levels of obstruction can be graded by this technique.[6]

Grade	Obstruction
1	Simple palatal level snoring/palatal flutter
2	Single level palatal obstruction
3	Palatal level obstruction with intermittent oropharyngeal involvement.
4	Sustained multisegmental obstruction
5	Tongue base level obstruction
6	Isolated epiglottic involvement

- Oesophageal manometry to find relationship between reflux and obstructive sleep apnoea.[7]
- Nasal spray test involves using a topical nasal decongestant on alternate nights and comparing the severity of snoring and apnoa. If the decongestant results in improvement of symptoms it may be worth treating nasal abnormalities to help in snoring.[8]
- MRI and histological studies have demonstrated that patients with obstructive sleep apnoea develop upper airway oedema secondary to the mechanical trauma associated with snoring and recurrent upper airway obstruction.[9]

First line of treatment for snoring is always to improve general health. Regular exercises, good sleeping habits combined with avoidance of alcohol and sleeping pills and loss of weight help majority of snorers. Others may require medical management which includes:

- Decongestants – If snoring is due to allergies or nasal infection then using a decongestant before bedtime helps to reduce the oedema of nasal tissue and may help in improvement of snoring.
- Continuous Positive Airway Pressure (CPAP) is regarded as the mainstay of obstructive sleep apnoea treatment.[10]
- Progesterone can be used, as it increases upper airway dilating muscle activities.[11]
- Snoring often stops by use of a mandibular advancement device. This is a tooth guard like device that juts the low jaw and the base of tongue forward.

A number of surgical modalities have been tried for snoring. These includes:

- Uvulopalatopharyngoplasty
- Laser assisted uvulopalatoplasty.
- Radiofrequency assisted uvulopalatoplasty.
- Sclerosing agents can be injected into soft palate tissue.
- Nasal surgery – If snoring stems from the nose, nasal surgery to correct causes of nasal obstruction may also help in curing or improving the symptoms of snoring.
- When snoring and nasal obstruction co-exist, nasal surgery may be considered as the first line of surgical treatment.[12]

Various surgeries performed to relieve nasal obstruction are:

- Septoplasty/submucosal resection of septum
- Inferior Turbinectomy
- Intranasal Polypectomy

The present study has been undertaken to examine the dictum that nasal surgery which relieves nasal airway impairment may also relieve or decrease the severity of snoring.

MATERIALS AND METHODS

The present study comprising of 100 cases was conducted according to inclusion/exclusion criteria written below. These cases were selected at random from the Outpatient Department of ENT, Ram Lal Eye and ENT Hospital attached to Government Medical College, Amritsar.

Inclusion

1. Age 18 years or above
2. Patients presenting with impaired nasal breathing due to nasal obstruction.

Exclusion

1. Patients complaining of snoring due to any reason other than nasal obstruction.
2. Drug abuse
3. Acute infection of respiratory tract.

A thorough history according to the proforma attached was taken in each case, followed by detailed nasal examination and investigation.

All cases were operated in Ram Lal Eye and ENT Hospital, Amritsar. Nasal obstruction was relieved by surgery as required e.g for deviated nasal septum - septoplasty, for nasal polyp - polypectomy and for turbinate hypertrophy - turbinectomy.

Evaluation of degree of nasal obstruction was done by using Gertner's plate. Gertner's plate is a metallic plate, on which semicircles of radius 1 cm, 2 cm, 3 cm, 4 cm, 5 cm and 6 cm are marked. Area occupied by nasal air during expiration on that plate was calculated by using formula:

$$\frac{\pi \times \text{Horizontal Distance}}{2} \times \frac{\text{Vertical distance.}}{2}$$

- Snoring was assessed by using VAS (Visual analogue scale) for snoring, based on patient's bed partner's subjective assessment i.e.

0 - No snoring at all

1-3 - Soft snoring not interrupting the bed partner's sleep.
4-6 - Loud snoring, enough to be bothersome to the partner
7-9 - Very intense snoring annoying to anyone nearby
10 -Bed partner leaves room.
Snoring scale as described by patient's bed partner.
Scoring:
0 = No snoring
1-3 = Mild, not disturbing
4-6 = Moderate, often disturbing
7-9 = Moderately severe, always disturbing
10-12= Severe, patient loosing concentration
13-15= Grave, patient becoming irritable
Effect of snoring on day time activities of patient was evaluated by Epworth sleepiness scale (ESS)13.
Rate on a scale of 0-3, that how likely patient is to doze off in each of the following situations.
0 = Would never doze
1 = Slight chance of dozing
2 = Moderate chance of dozing
3 = High chance of dozing
Scoring
1-6 = Patient has enough sleep
7-8 = Average score, but with sleep deficit.
10+ = Patient needs doctor's consultation.
Follow up of each case was done after 15 days, 1 month and 3 months of nasal surgery.
Results of all four i.e. nasal patency, visual analogue scale score by patient and bed partner and Epworth sleepiness scale score were compared before and after surgery.

RESULTS

The youngest patients were 18 years of age and the oldest patient was 62 years of age. The maximum number of patients in our study were in second and third decades of life. The oldest case presented with complaints of bilateral nasal obstruction and mouth breathing.
Males were found to be affected more than females in our study, approximately in the ratio of 3:1. No specific reason could be ascertained for this finding.
In our study, 62 cases belonged to urban area while 38 cases belonged to rural area. This could possibly be due to easy access of urban population to health care as compared to people living in rural area.
All 100 patients presented with chief complaints of snoring and nasal obstruction. Out of them 60 patients reported bilateral nasal obstruction while the remaining 40 patients had unilateral obstruction. Associated mouth breathing was present in all cases of bilateral nasal obstruction except in one case. Some patients of unilateral nasal obstruction also presented with mouth breathing.
Out of 100 patients, 77 patients complained of nasal discharge which was either unilateral or bilateral. The nasal discharge was perineal in some cases while in some patients it was episodic or seasonal in character. Mild to severe posterior nasal discharge was also present in 49 cases.
In the present study of the 100 patients, 65 had normal BMI, 27 patients had BMI between 25 and 28 thus were labelled overweight. 8 patients were obese as their BMI exceeded 28.

Table 1: Distribution of patients with normal weight (BMI <25) and overweight (BMI>25) among various grades of visual analogue scale by patient

Grade	Normal weight	Over weight	Significance
No snoring	2	0	$X^2 = 18.69$ df = 5 p = 0.002 significant
Mild snoring (1-3)	35	9	
Moderate snoring (4-6)	15	11	
Moderately severe snoring (7-9)	11	5	
Severe snoring (10-12)	2	7	
Grave snoring (13-15)	0	3	
	65	35	

Majority of normal weight patients (61) presented with mild to moderately severe snoring. The patient view scale grade in these patients ranged between 1 to 9. Only 2 patients who otherwise had normal weight reported severe snoring. Another 2 normal weight patients were not aware of their snoring, it were their bed partners who reported snoring in these patients. On the other hand majority of over weight patients (26) presented with moderate to grave snoring. The patient view scale grade in this group ranged from 4 to 15. Differences in the grades of snoring amongst normal and over weight group as determined by patient view scale were found to be statistically significant when Chi-square test was applied (p value : 0.002).

Table 2: Distribution of patients with normal weight (BMI <25) and overweight (BMI >25) among various grades of visual analogue scale by bed partner

Grade	Normal weight	Over weight	Significance
No snoring	0	0	Significance X2 = 7.24 df = 3 p = 0.065 not significant
Soft snoring	31	8	
Loud snoring	13	7	
Very intense snoring	16	14	
Bed partner leaves room	5	6	
	65	35	

The snoring grades were also determined on the basis of bed partners view scale. Of the 65 normal weight patients of the majority of these patients forty four reported soft (31) to loud (13) snoring. Only bed partners of 21 patients reported very intense snoring or a loud snoring forcing him/her to leave the room.

As per grading by bed partners of the 35 over weight patients, nearly half of these patients twenty had very intense (14) snoring or loud (7) snoring forcing the bed partner to leave the rooms. The results were not found to be statistically significant (p = 0.065).

Table 3: Distribution of patients with normal weight (BMI <25) and overweight (BMI>25) among various grades of epworth sleepiness scale

Grade	Normal weight	Over weight	Significance
0-6 (normal sleep)	64	29	Significance
7-9 (sleep deficit)	1	4	$X^2 = 8.8$
>10 (patient need doctor's consult)		2	df = 2
Total	65	35	p = 0.013 Significant

All sixty five normal weight subjects, except one had normal sleep when graded on Epworth Sleepiness Scale. Where as six overweight subjects out of a total of thirty five, suffered from sleep deficit. Two subjects (case no. 31, 70) out of these six subjects needed doctor consultation due to disturbed sleep. This difference was found to be statistically significant (p value 0.013).

Narrowing of nasal cavities was present in all cases. 62 patients had unilateral narrowing and 38 patients had bilateral narrowing. Bilateral narrowing of nasal cavities was detected in patients having bilateral nasal polyposis, s-shaped deviated nasal septum, bilateral inferior turbinate hypertrophy and in some patients where compensatory inferior turbinate hypertrophy was present along with unilateral DNS (case No. 4,5,14,20, 58, 68, 70, 77, 92) and unilateral polyposis (case No. 39, 52, 85). In two case (62, 93) polyps were present along with DNS causing bilateral nasal obstruction.

Deviated nasal septum was present in 63 cases. Right sided deviation was seen in 24 cases and left sided deviation in 34 cases. Whereas S-shaped deviation causing bilateral obstruction was present in 5 cases. Nasal polypi were present in 31 cases. Right sided polyposis was seen in 10 cases and left sided polyposis in 8 cases. Bilateral polyps were present in 13 cases. Bilateral inferior turbinate hypertrophy was seen in 6 cases.

Septoplasty or submucosal resection of nasal septum was performed in all patients who presented with DNS i.e. 63 cases. Intranasal Polypectomy was performed in 31 patients and bilateral inferior turbinectomy was performed in 6 cases. At same time in some cases of septoplasty, unilateral turbinectomy was also performed.

Table 4: Showing comparison of preoperative visual analogue scale by patient with post operative visual analogue scale by patient

Time period	Mean score	SD	t-value	Significance
Preoperative	4.76	3.59		
First followup	2.73	3.48	18.842	<0.0001 HS
Second followup	1.86	2.79	19.771	<0.0001 HS
Third followup	1.69	2.62	18.641	<0.0001 HS

The pre-operative mean visual analogue scale was 4.76 (SD 3.59) indicating moderate snoring, often disturbing to the patient. Following surgery patients experienced an improvement in the symptoms and the mean visual analogue scale by patient dropped to 2.73 (SD 3.48) at first followup, 1.86 (SD 2.79) at second followup and to 1.69 (SD 2.62) at third followup. This drop in mean score was found to be statistically highly significant (p value <0.0001).

Table 5: Showing comparison of distribution of patients among various grades of visual analogue scale by patient preoperatively and post operatively

Grade	Preoperative	1st followup	2nd followup	3rd followup
0 (No snoring)	2	47	54	54
1-3 (Mild snoring)	44	17	23	26
4-6 (Moderate snoring)	26	19	15	13
7-10 (Modrately severe snoring)	16	12	5	4
10-12 (Severe snoring)	9	5	3	3
13-15 (Grave snoring)	3	0	0	0
Total	**100**	**100**	**100**	**100**

This table shows that at first follow up 47 patients were completely relieved from snoring and at second and third follow up this number increased to 54 Wilcoxon signed ranks test shows that at first followup. 21 patients remained in same grade although some improvement did occur. Not even a single patient reported any worsening of his/her symptoms. 79 patients showed improvement in grade i.e. they shifted to lower grades. This result was found to be statistically significant (z=8.64).

At the time of second follow up, 4 patients remained in same grade while 96 showed improvement in grade when compared with their pre operative grading. This result was also statistically significant (n=9.11).

Similarly at third follow up, 3 remained in same grades and 97 showed improvement of their symptoms. This result was also significant (z=9.09).

Mean visual analogue scale by bed partner preoperative was 5.67±3.00 which fell to 3.41±3.24 at first follow up showing a highly significant improvement statistically (t<0.0001). Again at 2nd and 3rd follow ups this score further fell to 2.35±2.52 and 2.27±2.49 respectively. These results were also found to be statistically significant (t>0.0001).

Table 6: Showing comparison of distribution of patients among various grades of visual analogue scale by bed partner preoperatively and post operatively

Grade	Preoperative	1st followup	2nd followup	3rd followup
No snoring	0	33	40	40
Soft snoring	39	17	24	27
Loud snoring	20	30	30	27
Very intense snoring	30	19	5	5
Bed partner leaves rooms	11	1	1	1
Total	**100**	**100**	**100**	**100**

This table shows that at first followup 33 patient's bed partners reported that now the patient had completely recovered from snoring. He/she did not snore now and their number further increased to 40 on 2nd and 3rd follow ups Wilcoxon Signed Ranks test shows that at first follow up 29 patients remained in same grade inspite of minor improvements noticed by bed partner on visual analogue scale. No patient showed any worsening of symptoms and 71 patients showed visible obvious improvement. So that they shifted to lower grades. This results was statistically significant (z=8.22). At second follow up 8 patients continued to remain in same grade. 92 patients improved their grades. This result was also statistically significant (z=8.92). At third followup results remained same as that of 2nd follow up.

Mean pre-operative Epworth sleepiness scale score was 2.78±-2.55 which fell to 1.10±1.85 at 1st follow up showing significant decrease (<0.0001). These results remained same at the time of second and third follow ups.

Table 7: Comparison of distribution of patients among various grades of epworth sleepiness scale score preoperatively and post operatively

Grade	Preoperative	1st followup	2nd followup	3rd followup
Enough sleep	93	97	97	97
Average score	5	2	2	2
Patient need doctor's consult	2	1	1	1
Total	**100**	**100**	**100**	**100**

This table shows that 93 patients had enough sleep pre-operatively. 5 had average score but 2 needed doctor's consult. At first follow up number of patients with enough sleep rose to 97. Two patients still had average sleep score but 1 patient (case No. 31) remained in 3rd grade i.e. needed doctor's consult. This patients initial score was 15 that fell to 10 but there was no further improvement. Results remained same at the time of 2nd and 3rd follow ups. Wilcoxon signed ranks test shows that during all follow ups 95 patients remained in same group, only 5 patients showed improvement in their score.

Mean pre-operative area of right nasal cavity was 16.28±11.41 which increased to 26.07±8.48 at first follow up, showing a significant improvement (t<0.0001). This increase was maintained at the time of second and third followups as well.

Mean preoperative left nasal cavity area was 15.57±11.03 which increased to 26.09±8.34 at first followup showing statistically significant improvement in area after nasal surgery. This increase was maintained at the time of second and third follow-ups too.

DISCUSSION

Our study included patients in aged 18 years and above. We excluded patients less than 18 years of age because in this age group an important cause for snoring is adenoid hypertrophy. In a study authors examined 18 children with the complain of snoring.[14]

In our study majority of patients were in the age group of 18-50 years and few were 50 or above. The mean age of our patient is 31. Although studies say that snoring increases as age increases but at the same time it is so because the normal ageing process leads to loosening of the throat muscles, thus resulting in snoring. However age has no effect on nasal causes.[15]

A study was conducted to describe the characteristic of snoring patients and to assess the value of various treatment programmes for the complaint. He reported that average age of adult snorer was 46 years. Majority of the adult snorers included in the study were in age group of 30-60 years.[14]

In our study 77% of the patients were male while the rest 23% were females. A study also reported that

82% patients included were male and compared to 18% females.[14]

In our study 60% patients complained of bilateral nasal obstruction while 40% patients reported unilateral nasal obstruction only. 95% of these patients also had associated mouth breathing, while all patients (except one) who complained of bilateral nasal obstruction also had associated mouth breathing, some patients with unilateral nasal obstruction also complained of mouth breathing.

In a study it was reported that 73% snorers included in his study too had a stuffy nose. He found that stuffy nose was even more highly correlated with the more serious snores. 82% of every night snorers had stuffy noses. 82% of the every position snorers too had stuffy noses.[14]

In the present study 65% patients had BMI <25 and 35% had BMI >25. If we further divide overweight into obese and grossly obese (BMI >28) then 8% patients were grossly obese.

According to a study among adult snorers 13% were grossly obese. Obesity results in a lot of fatty tissue around the neck thus increases episodes of snoring.[14]

In the present study, 52% patients showed total improvement from snoring at the completion of three month followup. Similar results have been reported by this study showing 50% relief from snoring after septal surgery. The severity of nasal obstruction and intensity of snoring pre-operatively, the magnitude of nasal obstruction relief post-operatively and the degree of collapsibility of the soft palate were found not to influence the outcome of septal surgery on snoring.[16]

In our study 97% patients reported either elimination (52%) or improvement (45%) of snoring after nasal surgery. Similar results have been reported by other studies as well.

In a study 126 patients were reviewed who complained of both nasal obstruction and snoring and who underwent nasal surgery. They reported that snoring was completely relieved in 39 (31%), was less loud in further 72 (57%) patients. Their study suggested that when snoring and nasal obstruction coexist nasal surgery should be considered as first line of surgical treatment.[17]

Studies have been conducted with the aim of assessing whether any preoperative factors would predict success or failure of the nasal surgery for snoring. In this study it was found that symptoms of excessively loud snoring, witnessed apnoeic episodes, hypersomnolence, or obstructive sleep apnoea diagnosed by overnight oxygen saturation measurements to be statistically associated with failure of nasal surgery to improve snoring.[18]

This study also aimed to find out if there are reliable predictors for the success or failure of septal surgery in relieving snoring in patients with symptomatic nasal obstruction secondary to a deviated nasal septum and who have associated snoring. The study concluded that severity of nasal obstruction and intensity of snoring preoperatively, the magnitude of nasal obstruction relief postoperatively and the degree of collapsibility of soft palate (as determined by degree of velopharyngeal closure on the Muller maneuver) were found not to influence the outcome of septal surgery on snoring.[16]

In our study the patients included had snoring associated with nasal obstruction due to a deviated nasal septum, nasal polyposis and/or enlarged inferior turbinates. All other contributory causes were excluded. 97% of our patients had total or partial relief from snoring. Thus it is safe to conclude that targeted nasal surgery plays a definite role in relief of snoring secondary to nasal obstruction. In our study mean VAS by patient fell from preoperative level of 4.76±3.59 to 1.69±2.62, which was statistically highly significant.

VAS BY BED PARTNER

The subjective improvement in snoring reported by the patients in our study was echoed by their bed partners also. The mean VAS score fell from preoperative level of 5.67+3.00 to 2.27+2.49, which was statistically highly significant. It was also observed that 40% patient's bed partners noticed complete elimination and 59% noticed improvement in snoring.

The author assessed subjective and objective improvement after single stage multilevel minimally invasive treatment for obstructive sleep aponea/hypopnea syndrome (OSAHS). They reviewed all those patients who had three level treatment including nose, palate and base of tongue. The patients and bed partners subjective assessment of disease severity (bed partners snoring VAS and ESS) were collected before and on completion of follow up. The mean snoring VAS decreased from 9.4+0.9 preoperatively to 3.2+2.4 post multi-level treatment. This was accompanied by 77.9% subjective improvement in snoring.[19] The result of our study is comparable with that of the above study.

EPWORTH SLEEPINESS SCALE

In this study ESS decrease from 9.7+3.9 to 6.9+3.3 (P<0.001)19. Similar results are seen in our study showing ESS decreases from 2.78+2.55 to 1.10+1.85 (P<0.0001).

A prospective controlled study was conducted with 26 adult patients who underwent nasal surgery as single treatment of their sleep related disorders. They concluded that although nasal surgery has a limited efficacy in treatment of adult patients with sleep-aponea, nevertheless, it significantly improves sleep quality and day time sleepiness independent of the severity of obstructive sleep related breathing disorders.[20]

COMPARISON OF NASAL PATENCY BY GERTNER PLATE

In our study highly significant improvement was seen in nasal cavity area postoperatively. Another author found significant improvement.[21]

But this study says that although total nasal resistance decreases significantly in overall patient group i.e. after nasal surgery, nasal measurements showed improvement in nasal patency, but snoring time did

not decrease after nasal surgery in the overall patient group.[22]

The annotation of the present study revealed that nasal surgery is relatively a safe and effective procedure to relieve snoring.

CONCLUSION

Snoring in a common complaint for which a patient seeks treatment, either medical or surgical. Patients with bilateral nasal obstruction had moderate to grave snoring. 52% patients reported complete relief and 45% experienced partial improvement after nasal surgery. The improvement in snoring reported by patients was seconded by 92% partners. No patient had worsening of his/her snoring post operatively.

When snoring and nasal obstruction coexist, nasal surgery should be the first line of treatment. Nasal surgery is an effective surgical modality performed on carefully selected patients. Morbidity associated with procedures like septoplasty, polypectomy and turbinectomy is also minimal thus making nasal surgery a useful tool.

REFERENCES

1. Guilleminault C and Dement WC. Sleep Apnea Syndrome Kroc Foundation Series:11, Alan R. Loss Inc., New York, NY, p.3., 1978.
2. Quinn SJ, Daley N, Ellis PDM. Observation of the mechanism of snoring using sleep nasendoscopy. Clin Otolaryngol, 1995; 20: 360-4.
3. Zwillich CM. The clinical significance of snoring. Arch Intern Med 1979; 139: 24.
4. Joachim T. Maurer MD, Thomas Verse MD, Boris A. Stuck MD et al. Palatal implants for primary snoring: Short term results of a new minimally invasing surgical technique. Otolaryngol Head Neck Surg 2005; 132: 125-31
5. John Fleetham. Physiology of sleep and sleep disorders. Scott brown's Otorhnolaryngology Head Neck Surgery, 7th edition 2008; 2: 2309.
6. Pringle MB, Croft CB. A grading System for patients with obstructive sleep apnoea-based on sleep nasendoscopy. Clinical Otolaryngol and Allied Sciences 1993; 18: 480-4. Quoated by scott Brown's Otorhinolaryngology, Head and Neck Surgery, 7th edition, 2008; 3: 2336.
7. Berg S, Hoffstein V, Gislason T. Acidifiation of distal esophagus and sleep related breathing disturbances. Chest 2004; 125: 2101-6. Quoated by scott Brown's Otorhinolaryngology, Head and Neck Surgery, 7th edition, 2008; 3: 2336.
8. Fairbanks DN. Predicting the effect of nasal surgery on snoring: a simple test. Ear, nose and throat J 1991; 70: 50-2. Quoated by scott Brown's Otorhinolaryngology, Head and Neck Surgery, 7th edition, 2008; 3: 2337.
9. Anastassov GE, Trieger N. Edema in the upper airway in patients with obstructive sleep apnea syndrome. Oral Surg, Oral Med, Oral Pathol, Oral Radiol, and Endodontics 1998; 86: 644-7. Quoated by scott Brown's Otorhinolaryngology, Head and Neck Surgery, 7th edition, 2008; 3: 2312.
10. Patel SR, White DP, Malhora A, Ayas NT et al. Continuous Positive Airway Pressure therapy for treating sleepiness in a diverse population with obstructive sleep apnea: results of a metaanalysis. Arch of Intern Med. 2003; 163: 565-71. Quoated by scott Brown's Otorhinolaryngology, Head and Neck Surgery, 7th edition, 2008; 3: 2324.
11. Popovic RM, White DW. Upper airway muscle activity in normal women: influence of hormonal status. J of Applied Physiol 1998; 84: 1055-62 Quoated by scott Brown's Otorhinolaryngology, Head and Neck Surgery, 7th edition, 2008; 3: 2312.
12. Fairbanks, David NF MD. Effect of nasal surgery on snoring. Southern Med J 1985; 78(3): 268-270.
13. Johns MW. A new method for measuring day time sleepiness: the Epworth sleepiness scale. Sleep 1991; 14: 540-45.
14. David NF, Fairbanks MD. Snoring - Surgical v/s non-surgical management. Laryngoscope 1984; 94: 1188-1192.
15. Khoo SM, Tan WC, Ng TP, Ho CH. Risk factors associated with habitual snoring and sleep disordered breating in a multi-ethnic Asian population: a population based study. Respir Med 2004; 98: 557-66. Quoated by scott Brown's Otorhinolaryngology, Head and Neck Surgery, 7th edition, 2008; 3: 2336.
16. WF Low. Can snoring relief after nasal septal surgery be predicted? Clin otolaryngol 1994; 19(2): 142-144.
17. Ellis PDM, Harries MLL, Ffowcs JE, Williams et al. The relief of snoring by nasal surgery. Clin Otolaryngol 1992; 17(6): 525-527.
18. CJ Woodhead, MB Allen. Nasal Surgery for Snoring. Clin Otolaryngol 1994; 9(1): 41-44.
19. Michael Friedman, Hsinching Lin, Berk Gurpinar et al. Minimally invasive single-stage multilevel treatment for obstructive sleep apnoea/hypopnea syndrome. Laryngoscope 2007; 117: 1859-1863.
20. Verse, Thomas MD, Maurer et al. Effect of nasal surgery on sleep related breathing disorders. Laryngoscope 2002; 112(1): 64-68.
21. Bertrand B, Eloy P, Collet S et al. Effect of nasal value surgery by open septorhinoplasty and lateral cartilage graft (spreader graft) on snoring among a population of single snorers. Acta otorhinolaryngol Belg 2002; 56(2): 149-55.
22. Paula Virkkula, Adel Bachour, Maija Hytonen et al. Snoring is not relieved by nasal surgery despite improvement in nasal resistance. Chest 2006; 129: 81-87.