Functional Nasal Surgery and Use of CPAP in OSAS Patients: Our Experience

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Abstract The surgical correction of nasal obstruction is definitely effective and recommended in patients with poor CPAP compliance, often secondary to the high pressures that need to be given in patients with nasal sub stenosis. For this reason, the objective of this study is the evaluation of the effectiveness and effects of the functional nose surgery on adherence to CPAP- therapy in patients (with moderate to severe OSAS with indication of ventilation therapy) poorly compliant with CPAP. The study was performed on a sample of 52 patients, 40 male and 12 female, aged between 29 and 72 years followed by the Otolaryngology Unit of the University Palermo in the period between January 2015 and January 2017. All patients were subjected to the following s iter: anamnesis with Epworth Sleepiness Scale, NOSE scale, evaluation of “CPAP usage data.” Upper airway optical fiber endoscopy with Müller’s maneuver. We performed various type of nasal surgery (septoplasty, decongestion of the lower turbinates and FESS) 6 months after the surgery, CPAP usage was evaluated and the NOSE scale has been reapplied. All patients had a subjective degree of obstruction classified in severe or extreme by the NOSE scale before surgery. Almost all patients reported a mild degree of obstruction after the surgery. About CPAP usage, the average usage has passed by 2, 3 h at night to 6, 8 h after the surgery. The result is significant because it shows how the nasal functional surgery can make selected patients suitable to

ventilation therapy. As our work shows, a better nasal function allows to reduce the CPAP pressure, Therefore, we believe that all patients with medium to severe obstructive apnea syndrome and for whom night-time ventilation therapy (CPAP) is advised should be evaluated with endoscopy and anamnesis oriented to evaluate nasal obstructive pathologies that may reduce effectiveness of CPAP.

Keywords OSAS · CPAP · Turbinates · Snoring

Introduction

Nose plays a very important role in OSAS subjects from the pathophysiology point of view because, even if it is less inclined to collapse due to the presence of an osteo-cartilagine skeleton, its impaired functionality causes effects on oropharynx and hypopharynx, the two most collapsible regions. Pathological alterations involving the nose, both from the anatomical and functional point of view, can often be considered as triggers and/or aggravating obstructive sleep disorder [1, 2]. In particular, nasal disorders seem to play a preponderant role in determining a negative effect on sleep quality and daytime sleepiness [3]. The greatest impact of nasal surgery on OSAS was observed in those studies introducing nasal surgery in a multilevel surgical such as concurrent palatal implants or those associated with ororopharynx and hypopharynx surgery [4, 5]. Functional nose surgery is definitely suggested in the treatment of simple-snoring and UARS [6] and must be associated with functional oropharyngeal and hypopharyngeal surgery [7–9] in some cases.

Subjects with mild or moderate OSAS who are not CPAP-compliant and with a high risk of anesthesiology,

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according to literature data, may benefit from a functional nose surgery approach in the field of multilevel surgery also including oropharyngeal (pharyngoplasty) and hypopharyngeal times (hyoid suspension) [10–12]. The temporal sequence of multilevel surgery involves the execution of nasal surgery after the oropharyngeal one in order to avoid the possible discharge of serum-haemorrhagic secretions from the nose during the latter.

In addition, the surgical correction of nasal obstruction is effective and suggestive in patients with poor CPAP compliance, often secondary to high pressures needing to be given in patients with nasal sub stenosis [13–15]. For this reason, the objective of this study is the evaluation of the effectiveness and effects of the functional nose surgery on adherence to CPAP- therapy in patients (with moderate to severe OSAS with indication of ventilation therapy) poorly compliant with CPAP, independently from apneic syndrome cause and obstruction site.

Materials and methods

The study was performed on a sample of 52 patients, 40 male and 12 female, aged 29–72 years followed by Palermo University Otolaryngology Unit. They were observed from January 2015 to January 2017; 38 patients were affected by severe OSAS instead 14 patients by moderate OSAS. Ventilation therapy with CPAP was proposed to all patients. Inclusion criteria were:

- Confirmed OSAS diagnosis by nocturnal cardiopulmonary monitoring and/or polysomnography.
- Respiratory nasal obstruction.
- Therapeutic indication for CPAP.
- Poor compliance with CPAP.

All patients were subjected to the following iter:

- (1) Anamnesis orientated with questionnaire administration called “Nasal Obstruction Symptom Evaluation” (NOSE scale) by Stewart (Table 1) and evaluation of “CPAP usage data” (quantity of CPAP hours) and change in pressure needed after nasal surgery.
- (2) Upper airway optical fiber endoscopy with Müller’s maneuver.
- (3) Administration of Epworth Sleepiness Scale (ESS) for assessment of daytime sleepiness (Fig. 1).
- (4) Cardiorespiratory night monitoring after nasal surgery.

After endoscopy results, 37 patients were subjected to septoplasty and decongestion of lower turbinates by radio frequency, because affected by deviation of nasal septum and hypertrophy of lower turbinates (13 patients in this

group had already undergone palatal surgery, passing from a severe to moderate osas form, and continued cpap therapy); 10 patients were subjected to decongestion of lower turbinates by radio frequency because affected by lower turbinates’ hypertrophy but they weren’t affected by nasal septum deviation; 5 patients were subjected to functional endoscopic sinuses surgery (FESS) because affected by bilateral nasal polyposis. Three weeks after surgery, these patients continued to use CPAP with pressure regulation by the reference pulmonologist after cardiorespiratory night monitoring. Six months after surgery, CPAP usage was evaluated and NOSE scale reapplied.

Results

No patients had haemorrhagic complications in the post surgery, therefore all patients were resigned the day after surgery. Patients subjected to septoplasty surgery and FESS were packed with nasal swabs (merocel) at the end of surgery which were removed on the third day. In Table 2 NOSE scale and ESS scale results, about the first and the after of the surgery were reported.

All patients had a subjective degree of obstruction, classified severe or extreme by NOSE scale before surgery. Almost all patients reported a mild degree of obstruction after surgery. The work is therefore in agreement with articles in literature analyzing the impact of nose functional surgery for nasal obstruction. Among publications, the most recent study referring to NOSE score in a cohort of 61 patients is by Stapleton and his colleagues [5]. About ESS, because the single most criterion of reduction in Epworth scale is fixed at or below 12 as successful, we calculated the average of pre and post operative ESS values, and it is declined from 16 to 8.

In Table 3 apnea values and hypopnea index, before and after the surgery, are reported.

Apnea–hypopnea index variation, made by surgery, is minimal, despite being statistically significant. Also in this case the work is in accordance with literature [14].

In Table 4 pressure values, delivered by CPAP, before and after surgery, are reported.

About CPAP, average usage passed from 2, 3 h at night to 6, 8 h after surgery.

Average CPAP pressure in pre-operative was 12.7 cmH₂O after surgery, Average pressure of CPAP was 9.1 cmH₂O

The result is significant because it shows how the nasal functional surgery can make selected patients suitable to ventilation therapy.

American thoracic society established 4 h at night as the minimum usage threshold for CPAP. This is the threshold

Table 1 NOSE questionnaire: what do you think you've had the following issues in the last month?

	No problem	Very slight problem	Moderate problem	Quite important problem	Severe problem
Nasal congestion or feeling of lack of air	0	1	2	3	4
Nasal obstruction or feeling of nasal clogging	0	1	2	3	4
Difficulty breathing from the nose	0	1	2	3	4
Difficulty sleeping	0	1	2	3	4
Inability to breath enough air during physical exercise	0	1	2	3	4
Severity of nasal obstruction	Range of score				
Slight	0–5				
Moderate	6–10				
Severe	11–15				
Extreme	16–20				

to define patients adhering to ventilation therapy compared to those [16].

Discussion

CPAP positive pressure ventilation therapy is the gold standard in the treatment of moderate-to-severe obstructive sleep apnea, which is not always suitable for surgical treatment.

Alterations of the nasal structure related to a collapse of the upper airway is one of the main causes of OSAS in many patients and, conversely, many patients with OSAS were shown to suffer, with greater probability, nasal obstruction. In many studies, however, nasal surgery effectiveness in improving OSAS was debated (and according to what emerges from literature,) but it still remains a controversial topic.

Nasal obstructive pathologies increase nasal resistance and consequently can increase upper respiratory tract resistance, generating a negative pharyngeal pressure; this may be due to sleep apnea and OSAS. However, as it emerges from J Wu's study, nasal obstruction assumes a physiopathological importance in mild apnea and not in severe forms of OSAS [9]. Severe nasal blockage symptoms such as snoring, daytime sleepiness, sleep apnea/hypopnea were shown to improve the quality of life of the patients themselves.

In fact nasal surgery might actually improve subjective sleep-related symptoms in patients with OSAS as well as simple snoring.

Wu et al. conducted a study to evaluate patients undergoing nasal surgery and observed pre- and post-operatively to verify AHI index decrease but conclusion was

that a long-term randomized observation would be necessary and controlled to evaluate the real benefit of nasal surgery on OSAS [6]. According to the study of Wu, Li et al., published from 1999 to 2009, there is only an improvement in subjective symptomatology and on ESS scale but not in AHI (or at least slightly improvement) [6–17].

Recently, an improvement of AHI in selected patients after nasal surgery, has been reported in literature [18–20].

Subjective improvement in the quality of sleep and daytime somnolence is the main benefit reported by patients undergoing nasal surgery, depending on the severity of pre-operative nasal obstruction and the degree of improvement with surgery [4, 5].

Since nasal surgery qualitatively improves the life of people with respiratory difficulties and disorders related to the latter, the effectiveness of such surgery should be assessed in patients with severe—moderate OSAS.

In his study, Leitzen found no great correlation between severe OSAS, evaluated at PSG, and nasal anatomical abnormalities [2]. Although constituting an important structure of the upper respiratory tract, nasal anomalies have little known role in the severity of OSAS and standardized nasal exams would be necessary to quantitatively evaluate anatomical problems so to see if there is a correlation between subjective and objective nasal dysfunction and osas severity.

Authors such as Friedman and Poirier instead, advocate the importance of correcting nasal obstruction as a way to improve OSAS severity [1–11]. In particular, Porier introduced patients with OSAS not compliant to CPAP and with documented nasal obstruction in his study [11].

CPAP today turns out to be the treatment of election for various forms of OSAS but its effectiveness is limited by

Epworth Sleepiness Scale

Name: _____ Today's date: _____

Your age (Yrs): _____ Your sex (Male = M, Female = F): _____

How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired?

This refers to your usual way of life in recent times.

Even if you haven't done some of these things recently try to work out how they would have affected you.

Use the following scale to choose the **most appropriate number** for each situation:

- 0 = would never doze
- 1 = slight chance of dozing
- 2 = moderate chance of dozing
- 3 = high chance of dozing

It is important that you answer each question as best you can.

Situation	Chance of Dozing (0-3)
Sitting and reading _____	_____
Watching TV _____	_____
Sitting, inactive in a public place (e.g. a theatre or a meeting) _____	_____
As a passenger in a car for an hour without a break _____	_____
Lying down to rest in the afternoon when circumstances permit _____	_____
Sitting and talking to someone _____	_____
Sitting quietly after a lunch without alcohol _____	_____
In a car, while stopped for a few minutes in the traffic _____	_____

Fig. 1 The Epworth Sleepiness Scale Questionnaire

the poor compliance of patients who prefer to undergo multilevel surgery. However surgery is not always conclusive, so (if we add the poor tolerability) many patients remain untreated because of poor tolerability.

Pharyngoplasty combined with other surgical procedures, such as reduction of turbinates, suspension of the

hyoid bone, has shown a certain validity in relieving snoring and mild apnoic events [7].

Some authors have assessed CPAP pressure also before and after septoplasty in 323 patients with an increase of 1.4 cmH₂O of pressure and of 0.62 more hours on average [12]. According to literature, an increase in airway patency

Table 2 Results of the NOSE scale

Number of patient	NOSE scale preoperative	NOSE scale postoperative
1	14	4
2	16	4
3	15	6
4	18	3
5	16	2
6	15	2
7	13	0
8	17	2
9	19	3
10	14	4
11	17	6
12	16	3
13	18	5
14	18	4
15	14	2
16	16	1
17	17	0
18	17	3
19	18	5
20	17	4
21	16	2
22	15	1
23	16	1
24	17	2
25	17	3
26	17	3
27	16	4
28	18	2
29	15	3
30	18	4
31	19	5
32	15	3
33	20	6
34	17	4
35	14	3
36	16	2
37	17	2
38	19	5
39	17	4
40	16	2
41	15	3
42	16	2
43	16	3
44	18	4
45	15	2
46	18	2

Table 2 continued

Number of patient	NOSE scale preoperative	NOSE scale postoperative
47	17	1
48	16	4
49	17	2
50	17	1
51	15	2
52	14	3

and oxygen saturation of hemoglobin postoperatively to nasal intervention in subjects with severe OSAS has been found; the saturation has gone from 51% pre-operatively to a value not inferior to 90% after the intervention, reaching 93% with the CPAP [15].

In our study, a sample of 52 patients with severe or moderate OSAS was considered; 37 of them were submitted to septoplasty with reduction of inferior turbinates. The same patients underwent a pre-and post-operative work-up (after removal of nasal swabs) which showed a considerable increase in the hours of use of CPAP, from 2, 3 per night to 6, 8 per night, about twice the pre-operative one. Average CPAP pressure in pre-operative was 12.7 cmH₂O, after surgery (the average pressure of CPAP) it was 9.1 cmH₂O. With our study we can state that subjecting these patients to an isolated nasal intervention does not completely resolve OSAS and the related symptoms, but it surely improves the compliance of these patients towards CPAP, by offering them the greatest benefit obtainable from this treatment which, despite being the gold standard, does not have a wide range of suitable and tolerant patients. Therefore, although in many cases nasal surgery itself does not quite resolve OSAS, it certainly improves CPAP use in many patients, making them more tolerant of this therapy, both in terms of use time and pressure. Surgical success in the treatment of OSAS specifically includes a reduction of 50% of AHI (with an overall AHI of 20) leading to complete suspension of CPAP. Despite this the finding of a decrease of AHI does not completely exclude CPAP use. Therefore our study focuses not so much on the improvement of nocturnal apneas, given by nasal surgery, but on how such a surgery can increase the number of patients adhering to CPAP in order to use it as much as possible to obtain the greatest benefit. It must be remembered that the non-adherence to this treatment can be determined by conditions such as nasal congestion, sinus/nasal pressure, loss of air, claustrophobia. Therefore nasal surgery may have an additional role in the management of patients with nocturnal obstructive apneas.

Table 3 Values of apnea and hypopnea index, before and after the surgery

Number of patient	AHI pre-operative	AHI post-operative
1	52.3	49.1
2	58.4	50.4
3	69.2	57.1
4	45.3	40.2
5	39.2	37.7
6	40.2	38.2
7	21.7	17.4
8	47.3	42.5
9	58.2	50.1
10	22.8	21.7
11	59.2	53.2
12	44.9	38.6
13	42.3	35.4
14	39.1	36.1
15	23.9	22.1
16	30.1	27.4
17	19.6	15.6
18	55.6	39.7
19	56.7	41.5
20	27.8	23.8
21	21.7	22
22	22.9	20.7
23	27.8	25.4
24	30.1	28.1
25	44.8	39.2
26	38.3	33.7
27	37.8	36.9
28	41.2	39.8
29	26.5	23.4
30	48.7	45.6
31	52.6	50.2
32	27.2	22.3
33	53.7	50.1
34	41.2	39.1
35	20.6	17.9
36	32.2	29.1
37	26.8	22.3
38	39.7	34.1
39	39.9	38.1
40	17.9	15.7
41	17.6	16.6
42	34.8	30.8
43	36.7	31.7
44	34.1	30.6
45	37.1	29.8
46	40.3	38.1
47	41.7	30.8

Table 3 continued

Number of patient	AHI pre-operative	AHI post-operative
48	31.4	28.9
49	37.8	32.5
50	41.7	40.7
51	48.5	43.6
52	50.7	48.1

Table 4 Values of pressure delivered by CPAP before and after the surgery

Number of patient	Pressure CPAP preoperative	Pressure CPAP postoperative
1	13.2	8.8
2	14	10
3	11.9	9.6
4	11.7	9.1
5	12.4	9
6	14	8.9
7	13.8	8.3
8	13.7	9.3
9	12.5	9.2
10	12.3	9.3
11	11.9	9.4
12	11.4	9.6
13	13.6	8.8
14	12.1	8.7
15	13.1	9
16	13.1	9
17	12.2	8.7
18	12.3	8.5
19	12.7	8.6
20	11.8	9.3
21	11.9	9.5
22	11.9	9.4
23	11.4	9.2
24	13.2	9.6
25	13.7	9.3
26	13.4	8.1
27	13.3	9
28	12.3	9
29	12.2	9.2
30	14.1	9.2
31	12.6	9.5
32	11.9	9
33	11.7	8.4
34	12.4	8.4
35	13.2	9.2
36	12.1	9.2
37	12.2	8.8

Table 4 continued

Number of patient	Pressure CPAP preoperative	Pressure CPAP postoperative
38	11.7	9.1
39	14	10
40	12.9	9.2
41	11.8	8.6
42	13.6	9.4
43	12.6	9.4
44	11.8	9.1
45	13	8.7
46	14.2	9.8
47	12.9	8.7
48	14.2	9.9
49	14	9.2
50	12.9	9.3
51	11.8	8.7
52	13.9	9.6

Conclusions

The effectiveness of functional nose surgery in OSAS treatment has been a reason for discussion among authors for many years. Today it can be considered as the only approach only in simple snoring, instead in the obstructive sleep apnea it is considered as a support therapy in a multilevel approach. However, in view of the results and according to literature, this surgery plays a primary role in the improvement of the compliance to CPAP in patients with severe- moderate forms, even if it changes AHI modestly.

As our work shows, a better nasal function allows to reduce CPAP pressure values considerably, allowing patients to the use of this essential therapy for the treatment of the pathology steadily, for all hours of the night. Therefore, we believe that all patients with medium to severe obstructive apnea syndrome and for whom night-time ventilation therapy (CPAP) is advised, should be evaluated with endoscopy and anamnesis oriented to evaluate nasal obstructive pathologies that may reduce CPAP effectiveness.

Compliance with ethical standards

Conflict of interest The authors have no conflicts of interest to disclose.

Ethical approval This study was approved by Ethics Committee of University Hospital of Palermo.

Informed consent Our research involved human participants who had obtained informed consent.

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