Al-Azhar International Medical Journal

Volume 4 | Issue 12 Article 18

2023
Section: ENT

Importance of a Septal Deformity Grading System in Evaluation of Nasal Obstruction (Pre and Post Septoplasty Operation): a prospective study

Mohamed Adel Abd-El Aty Hagras
Otorhinolaryngology Faculty of Medicine - Al Azhar University, Cairo , Egypt,
mohammadhagrass250@gmail.com

Ahmed Seleim
Professor of Otorhinolaryngology Faculty of Medicine - Al Azhar University, Cairo , Egypt

Marwan Ahmed Ibrahim
Lecturer of Otorhinolaryngology Faculty of Medicine - Al Azhar University, Cairo , Egypt.

How to Cite This Article

Hagras, Mohamed Adel Abd-El Aty; Seleim, Ahmed; and Ibrahim, Marwan Ahmed (2023) "Importance of a Septal Deformity Grading System in Evaluation of Nasal Obstruction (Pre and Post Septoplasty Operation): a prospective study," *Al-Azhar International Medical Journal*: Vol. 4: Iss. 12, Article 18.
DOI: https://doi.org/10.58675/2682-339X.2159

ORIGINAL ARTICLE

Importance of a Septal Deformity Grading System in Evaluation of Nasal Obstruction (Preseptoplasty and Postseptoplasty Operation): A Prospective Study

Mohamed Adel Abd-El Aty Hagras*, Ahmed Seleim, Marwan Ahmed Ibrahim

Department of Otorhinolaryngology, Faculty of Medicine, Al-Azhar University, Cairo, Egypt

Abstract

Background: **Nasal airway obstruction is a disturbing condition that impairs quality of life and could affect the condition of one's upper and lower airways. Therefore, it is one of the most frequent clinical reasons for a referral to the clinics of otolaryngology.**

Aim: **The aim of the work was to estimate the importance of nasal septal deformity grading (SDG) system in evaluation of nasal obstruction (preseptoplasty and postseptoplasty operation).**

Patients and methods: **In this prospective study, 50 patients with persistent nasal blockage were joined, 29 (58 %) males and 21 (42 %) females, between the period from May 2021 to May 2022, the work was conducted at the Otorhinolaryngology Departments of Al-Azhar University Hospitals and El-sahel Teaching Hospital. Diagnosis of nasal obstruction was established by clinical, endoscopic, and radiographic examination then application of SDG system was done preseptoplasty and postseptoplasty operation.**

Results: **This study showed a statistically significant decrease in postoperative SDG score (4.5 ± 1.7) when compared with preoperative SDG score (9.2 ± 2.5) in the studied patients ($P < 0.001$). SDG is an objective method to rely on it in evaluation of improvement of nasal obstruction after septoplasty operation.**

Conclusion: **According to our results, a higher score of SDG denotes a more severe degree of deformity and nasal obstruction and represents a more difficult correction. It offers accurate anatomic data on the degree of nasal septal abnormalities.**

Keywords: Nasal obstruction, Septal deformity grading system, Septoplasty

1. Introduction

Nasal airway obstruction is an upsetting complain that reduces quality of life and may have an impact on the health of the upper and lower respiratory tracts. Thus, it is one of the most frequent clinical grounds for referring a patient to a clinic for otolaryngology.[1]

Measures that are both objective and subjective are used to assess nasal blockage. Based on the physiology of nasal airflow or the morphology of the nasal cavity, nasal patency can be measured objectively. Numerous elements, including pressure receptors, heat receptors, pain receptors, secretions, and others, influence how people notice nasal obstruction.[2]

The completion of several investigations has enhanced the diagnosis of this ailment. Nasal airway obstruction diagnosis is still a challenging issue because there are gaps between subjective symptoms and objective findings.[3]

The septal deformity assessment system was developed using seven physical measures that have been shown to be significantly distinct from the presumed straight septum for individuals with septal anomalies. Along with the subjective data

Accepted 8 August 2023.
Available online 24 January 2024

* Corresponding author at: Faculty of Medicine, Al-Azhar University, Cairo, 11884, Egypt.
E-mail address: mohammadhagrass250@gmail.com (M.A.A.-E.A. Hagras).

https://doi.org/10.58675/2682-339X.2159

gathered from the NOSE survey, it gives objective anatomic data regarding the severity of nasal septal abnormalities.[4]

The aim of the work was to estimate the validity of nasal septal deformity grading (SDG) system in evaluation of nasal obstruction (preseptoplasty and postseptoplasty operation).

2. Patients and methods

In this prospective study, 50 patients with persistent nasal blockage were joined to this study, 29 (58 %) males and 21 (42 %) females, the study was conducted at Al-Hussein University Hospital and El-Sahel Teaching Hospital from the period between May 2021 and May 2022. Diagnosis of septal deformity was recognized by clinical, endoscopic examination, and CT computed tomographic (scan) of nose and paranasal sinuses. To our mind, this study is the first one to compare preoperative and postoperative SDG system.

2.1. Patients

2.1.1. Inclusion criteria

Patients with unilateral or bilateral nasal obstruction, patients in the age range of 18–60 years of both sexes.

2.1.2. Exclusion criteria

Participants who were either younger than 18 or older than 60 were excluded from the study. Patients having a history of nasal surgery were also excluded, as were those with nasal obstruction caused by sinonasal trauma, a tumor, or polyps.

2.2. Methods

History-taking procedures involving complaints (such as nasal blockage, nasal discharge, sneezing, postnasal drip, headache, snoring, sleep issues, nasal itching, epistaxis, and facial pain) were applied to all participants. Examination: general checkup, anterior rhinoscopy for nasal examination. Every patient had a thorough physical checkup. Complete physical examination was done, involving anterior rhinoscopy, diagnostic nasal endoscopy before and after decongestion, Cottle and modified Cottle maneuvre, and examination of the septum, turbinates, meati, internal, and external nasal valves. Using 0° and 30° angle 4-mm Hopkin rods, a diagnostic nasal endoscopy was performed, primarily focusing on the SDG system's seven items (both before and after septoplasty). This is done after nasal decongestion, assisted with cotton wool soaked in oxymetazoline and topical xylocaine spray anesthesia.

2.3. Investigations

Each patient underwent a CT scan of the nose and paranasal sinuses axial, coronal, and sagittal reconstructive bone window (1 mm cuts). In addition to the routine laboratory investigations.

2.3.1. Grading of septal deformities

Clinical, endoscopic nasal examinations, CT scan, and direct intraoperative finding allowed us to grade the septal deformities depending on the seven features of SDG system (Fig. 1).[5] Laterality is used to further categorize each of the seven locations, and the degree of the deformity is assessed on a four-point Likert scale from 0 to 3, with higher scores suggesting higher levels of deformity (left or right). The scale goes from 0 (no deformity) to 3 (the most severe deformity).

For these seven regions, the severity rating is as follows (Fig. 1). The 0 score indicates that there is no deformity at any of the seven places. (a) Nasal spur is scored based on its severity. A score of 1 denotes a little spur that would not require treatment, a score of 2 denotes a moderate spur, and a score of 3 denotes a severe spur that touches the turbinate. (b) Caudal deviation; if it greatly deviates from the columella, it receives a score of 2, and if it receives a score of 3, it is inside the nares. A score of 1 indicates that it is inside the columellar footprint. (c) Dorsal curvature, where 1 is 'nonsurgical,' 2 'need a spreader graft,' and 3 are 'adjacent/touch the upper lateral cartilages.' (d) Dorsal deviation off angle, where 1 and 2 are nonsurgical, where 3, 'adjacent/touches the upper lateral cartilages.' (e) The intersection of the quadrangular cartilage, vomer, and perpendicular plate, position 1 is 'nonsurgical,' wherein positions 2 and 3 are 'touching turbinate.' (f) The posterior septal angle, where positions 1 and 2 'slightly deviate the columella' and position 3 'resides in the nares,' respectively. (g) Anterior septal angle, where a value of 1 indicates 'slight tip deviation,' a value of 2 'moderate tip deviation,' and a value of 3 'severe tip deviation.'

The sums of the 1, 2, and 3 scores are all displayed in the sum row. The grades assigned for each side of each of the seven regions are added together to produce the total score, which ranges from 0 to 42.

According to our observations, we discovered septal spurs in 45 out of 50 patients during the preoperative assessment (Fig. 2). Also, we detected 20 patients with caudal deviation (Fig. 3), 35 patients with dorsal curvature, and 24 patients have a

Patient Name: Date: Surgeon:

Septal Deformity Grading Sheet		0	1	2	3
Spur		None	Mild, may not require treatment	Intermediate	Touches turbinate
	Right				
	Left				
Caudal Deviation		None	Within columellar footprint	Slightly deviates columella	Resides in nares
	To Right				
	To Left				
Dorsal Curvature (Mid Vault- C Shape)		None	Non-surgical	Requires Spreader Graft	Adjacent/ touches the ULC
	Concave Right				
	Concave Left				
Dorsal Deviation off Angle		None	Non-surgical	Requires Spreader Graft	Adjacent/ touches the ULC
	Straight to Right				
	Straight to Left				
PP-Vomer- QC Junction		None	Non-surgical	Obstructive	Touches turbinate
	Obstruction Right				
	Obstruction Left				
PSA		None	Within columellar footprint	Slightly deviates columella	Resides in nares
	To Right				
	To Left				
ASA		None	Slight deviation of tip	Moderate deviation of tip	Severe deviation of tip
	To Right				
	To Left				
			1	2	3
		Sum:			
		Grand Total:			

Fig. 1. Scoring guide for septal deformities. QC stands for quadrangular cartilage, ASA for anterior septal angle, PP for perpendicular plate, PSA for posterior septal angle, and ULC for upper lateral cartilages.

nonsurgical dorsal deviation of angle. Concerning PPVQC junction, 21 patients were found to have obstructive junction, only one case had a junction that did not require surgery, and 28 patients had a junction that touches turbinate. In 31 out of the 50 patients examined, the posterior septal angle was found to be within the columellar footprint while the columella deviated slightly in 14 cases. When examining the anterior septal angle, we found that 30 patients had a very minor tip deviation, 16 patients had no tip deviation at all and four cases with moderate tip deviation. Data from the history, examination (before and after decongestion), intraoperative findings, and postoperative findings were all analyzed.

Septoplasty operation was done for all included patients UGA. Injection of lidocaine (20 mg/ml) and epinephrine HCl (1 : 200 000 saline) subperichondrium plane. The septal deviation was reached by dissecting the subperichondral plane after performing a hemitransfixion incision. The deviated part and spur (Fig. 2) were removed (Figs. 4 and 5) to straighten the septum. At the end of the procedure a nasal packing was used and removed after 48 h.

2.3.2. Ethical considerations and participant consent

Prior to the study, patients were asked to provide written informed consent, with the option to withdraw at any time. The Al-Azhar University Faculty of Medicine Research Ethics Committee approved the study.

2.4. Statistical analysis

Was carried out utilizing SPSS Inc., version 28.0 (Chicago, Illinois, USA). While qualitative data are reported as frequency and percentage, the results for quantitative data are presented as mean values ± SD. A P value of less than 0.05 was regarded as statistically significant, and we used relevant statistical tests such χ^2 or Mann–Whitney U tests as necessary.

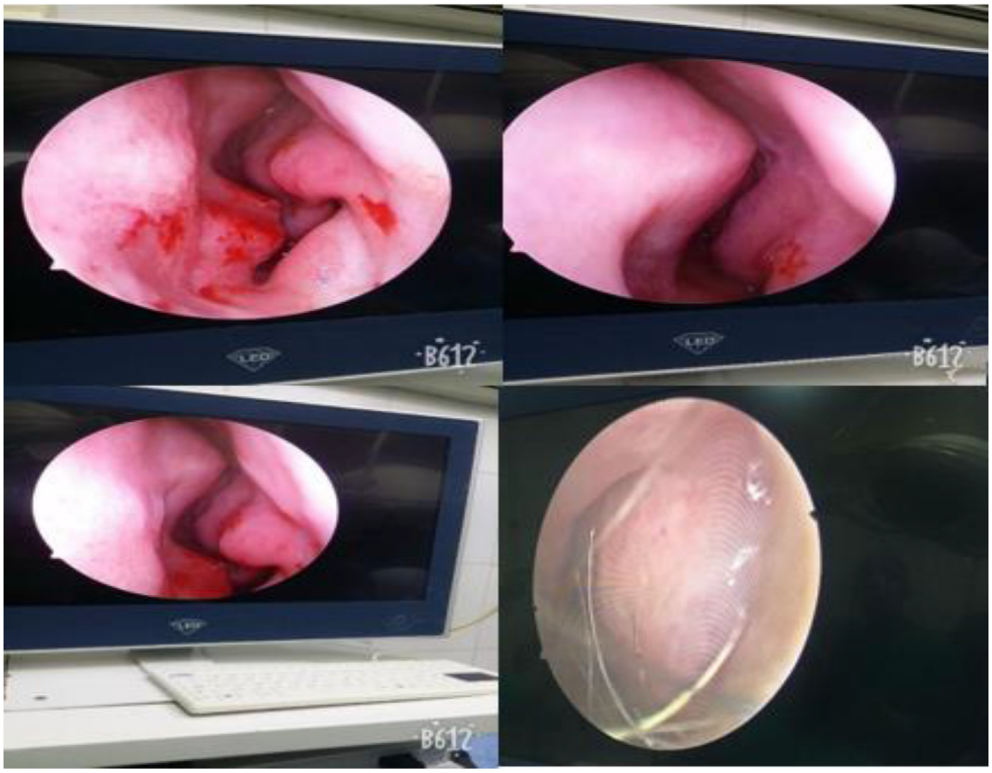

Fig. 2. Preoperative spur (endoscopic view).

3. Results

This is a prospective study that included 50 patients complaining from persistent nasal obstruction. Diagnosis of the disease was established by clinical, endoscopic, and radiographic examination (Table 1).

The previous table provides a description of the patient population's demographic information: 29 (58 %) male patients and 21 (42 %) female patients, respectively, made up the study's patient population. With a minimum age of 18 and a maximum age of 58, the average age of all participants in the study was 29.6 ± 8.8 years (Table 2).

The previous table displays: there is no distinction between preoperative and postoperative chest discomfort that is of statistical significance ($P > 0.05$).

Fig. 3. Caudal dislocation (CT PNS).

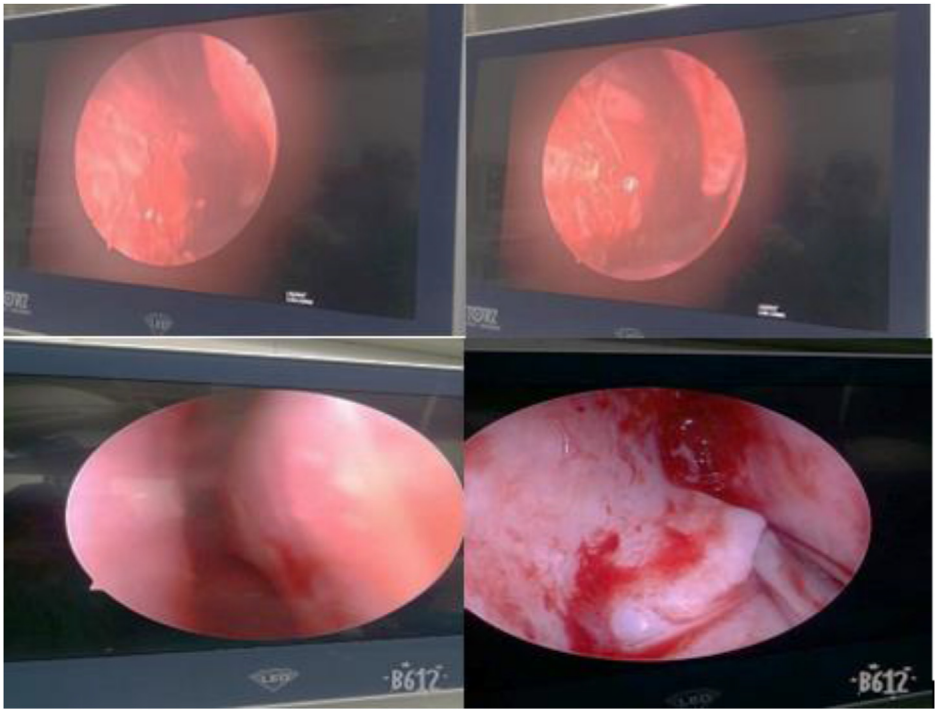

Fig. 4. Intraoperative view showing spur removal.

When contrasted with preoperative epistaxis (14 individuals, 28 %), postoperative epistaxis (four individuals, 8 %) showed a statistically significant ($P = 0.009$) reduction. When opposed to preoperative nasal obstruction (50 patients, 100 %), postoperative nasal obstruction (39 individuals, 78 %) was significantly less common ($P < 0.001$). Highly significant statistically ($P = 0.001$) compared to preoperative postnasal discharge (34 patients, 68 %), postoperative postnasal discharge was lower in 13 (26 %) instances.

As opposed to preoperative face pain and headache (37 participants, 74 %), postoperative facial pain and headache (14 participants, 28 %) showed a

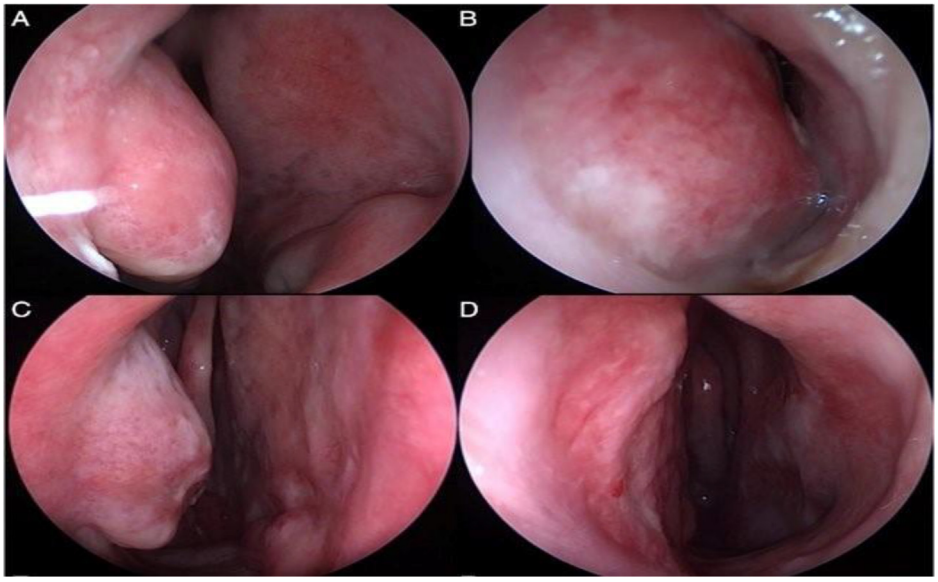

Fig. 5. Endoscopic caudal dislocation findings preoperative and postoperative. (a, b) Preoperative endoscopy reveals a significantly leftward deviated septum. (c, d) Endoscopic views taken after surgery reveal a straightened caudal septum.

Table 1. Description of demographic data in the studied patients.

	Studied patients ($N = 50$)
Sex [*n* (%)]	
Male	29 (58)
Female	21 (42)
Age (years)	
Mean ± SD	29.6 ± 8.8
Minimum–maximum	18–58

very statistically significant ($P = 0.001$) reduction. As contrasted to preoperative snoring and sleep disorders (37 participants, 74 %), postoperative snoring and sleep disorders (six participants, 12 %) showed a very statistically significant ($P = 0.001$) reduction (Table 3).

This table shows highly statistically significant ($P < 0.001$) decreased postoperative SDG score

Table 2. Comparison between preoperative and postoperative symptoms.

	Preoperative ($N = 50$) [*n* (%)]	Postoperative ($N = 50$) [*n* (%)]	χ^2	*P* value
Nasal obstruction	50 (100)	11 (22)	63.9	<0.001 HS
Postnasal discharge	34 (68)	13 (26)	17.7	<0.001 HS
Epistaxis	14 (28)	4 (8)	6.7	0.009 S
Chest symptoms	13 (26)	7 (14)	2.25	0.134 NS
Allergic symptoms	28 (56)	28 (56)	0.0	1.0 NS
Facial pain and headache	37 (74)	14 (28)	21.2	<0.001 HS
Snoring and sleep disorders	37 (74)	6 (12)	39.2	<0.001 HS
Other system affection	0	0	–	–

S: *P* values under 0.05 are regarded as significant.
P values below 0.001 are regarded as highly significant (HS).
P values over 0.05 are regarded as non-significant, or NS.

Table 3. Comparison between preoperative and postoperative septal deformity grading scoring.

	Preoperative ($N = 50$)	Postoperative ($N = 50$)	Statistical test	*P* value
SDG scoring (mean ± SD)	9.4 ± 2.2	4.7 ± 1.7	MW = 107.5	<0.001 HS

MW, Mann–Whitney *U* test; SDG, septal deformity grading.
HS: *P* value less than 0.001 is considered highly significant.

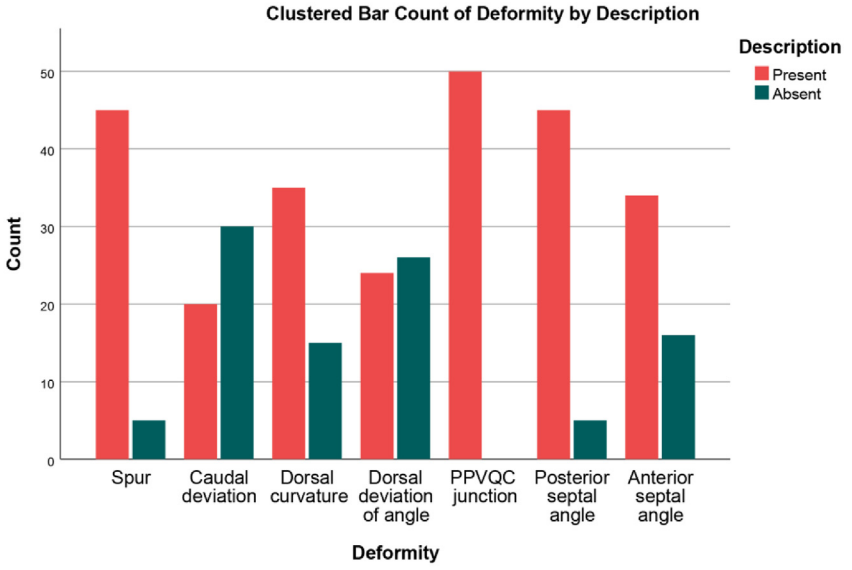

Fig. 6. Description of deformity in all studied patients.

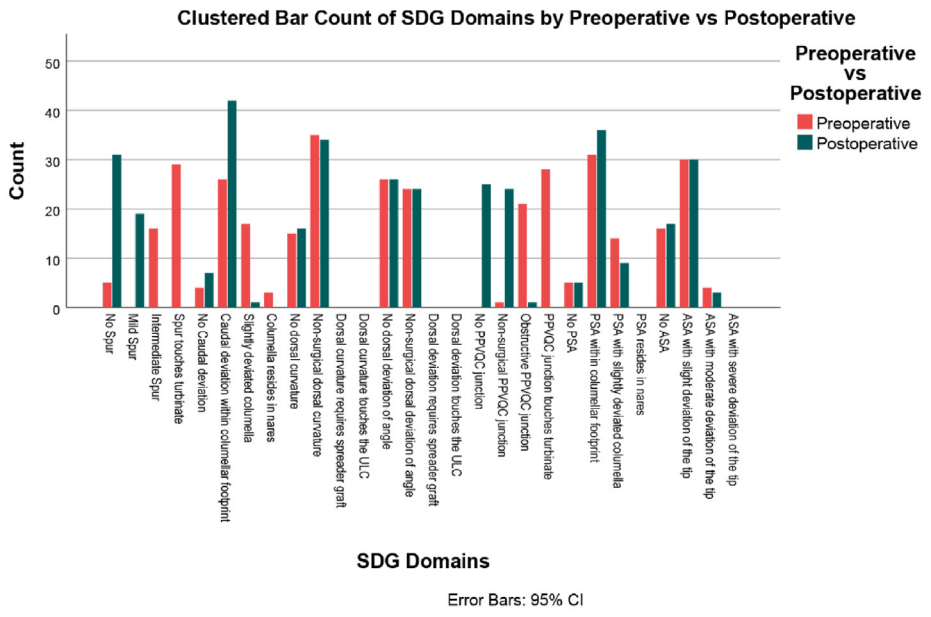

Fig. 7. Preoperative versus postoperative deformity.

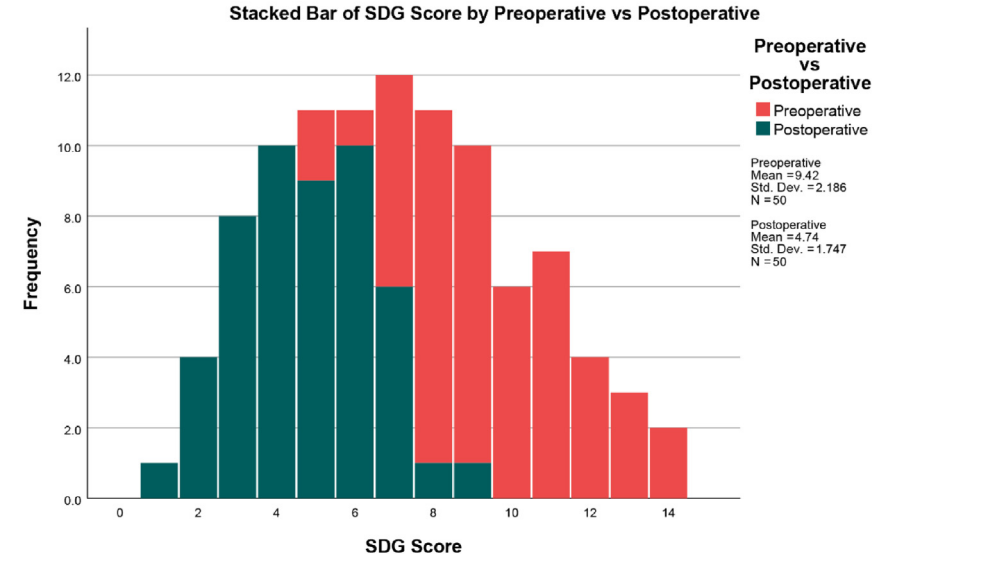

Fig. 8. Preoperative versus postoperative SDG score. SDG, septal deformity grading.

Table 4. Description of deformity in all studied patients.

	Presence of deformity	Absent deformity
Spur	45	5
Caudal deviation	20	30
Dorsal curvature	35	15
Dorsal deviation of angle	24	26
PPVQC junction	50	0
PSA	45	5
ASA	34	16

ASA, anterior septal angle; PSA, posterior septal angle.

(4.7 ± 1.7) when compared with preoperative SDG score (9.4 ± 2.2) in the studied patients (Figs. 6–8, Table 4).

4. Discussion

The nasal septum, which separates the nasal cavity into two parts, is a crucial anatomical component. It is a bony and cartilaginous structure that is made up of the vomer bone, the perpendicular plate of the ethmoid bone, and the septal

cartilage that is situated in the middle of the nose. The nasal septum is essential for the proper functioning of the respiratory system and plays a vital role in the exchange of air and the sense of smell. Any structural abnormalities or deviations in the nasal septum can lead to various respiratory and olfactory disorders, including nasal obstruction, sinusitis, and reduced sense of smell.[6]

The diagnosis of nasal septum deviations and abnormalities is decisive in the management of these conditions, as it can help in the development of targeted treatment strategies.[7]

Nasal obstruction is a common condition characterized by difficulty in breathing through the nose. It can result from various causes, including structural abnormalities in the nasal cavity, inflammation of the nasal mucosa, and allergic reactions. Nasal obstruction can significantly impact the quality of life of affected individuals, leading to symptoms such as snoring, mouth breathing, and difficulty sleeping. The diagnosis of nasal obstruction requires a thorough evaluation of the patient's medical history and physical examination. Additional tests, such as imaging studies and nasal endoscopy, may also be required to identify the underlying cause of the condition.[8]

Septoplasty is a surgical procedure performed to correct a deviated or crooked nasal septum, which can cause nasal obstruction and breathing difficulties. While septoplasty can be performed on patients of all ages, there are certain considerations to keep in mind, particularly in pediatric and elderly patients.[9]

As regard sex, in this study there were 29 (58 %) males and 21 (42 %) females in the studied patients that denotes a higher incidence in males which is supported by study published by a study where they found that male patients were more likely to have severe septal deviations compared to female patients.[10] Another study found that male patients had a higher prevalence of nasal obstruction due to septal deviation.[11] Also, another study found 83 males and 17 females.[12]

As regards age, the mean age of all studied patients was 29.6 ± 8.8 years with minimum age of 18 years and maximum age of 58 years which is more or less matched with another study in which the mean age was 36 years.[12]

In this study there is a highly statistically significant decreased postoperative nasal obstruction (39 patients, 78 %) when compared with preoperative nasal obstruction (50 patients, 100 %). In a different study, 25 participants provided information regarding changes in nasal obstruction, and 72 % of them indicated that septoplasty had improved their nasal obstruction.[13] Sixteen percent of the participants claimed no improvement in nasal obstruction, whereas 12 % indicated worsened.

In this study there is a highly statistically significant decreased postoperative facial pain and headache (14 patients, 28 %) when compared with preoperative facial pain and headache (37 patients, 74 %). In another study 45 patients were found to have headache before septoplasty. headache improved after surgery in 33 (73.3 %) patients while six (26.7 %) patients reported no improvement.[14]

As regard this study there is a highly statistically significant decreased postoperative snoring and sleep disorders (six patients, 12 %) when compared with preoperative snoring and sleep disorders (37 patients, 74 %). Another study detected 22 patients were found to have complaints of snoring before septoplasty and the snoring complaints improved after the septoplasty in 16 (72.7 %) patients while six (27.3 %) patients reported no improvement.[15]

The SDG system is a recent advance in the field of otolaryngology that provides a systematic, reliable, and consistent method for evaluating septal deformities. The SDG system was introduced to overcome the limitations of previously available classification systems, such as Mladina's et al.[16] system, Guyuron et al.'s[17] modifications, and Baumann's[18] system, which do not provide accurate information on the location and degree of deformity at each anatomical site.

The SDG system has several advantages over previous classification systems. First, it provides a more detailed assessment of septal deformities by grading deviations at seven specific anatomic locations, which allows for a more precise diagnosis and surgical planning. Second, it provides a standardized method for grading septal deformities, which enables more accurate and consistent communication among healthcare professionals. Finally, the SDG system is easy to use and can be applied in both clinical and research settings.

In this study there was highly statistically significant ($P < 0.001$) decrease in postoperative SDG score (4.7 ± 1.7) when compared with preoperative SDG score (9.4 ± 2.2). Another study compared the objective SDG system and subjective NOSE questionnaire found that the SDG score decreased significantly following septoplasty, indicating a reduction in septal deviation and improvement in nasal airflow.[19]

4.1. Conclusion

The SDG system is a helpful tool to enhance surgical management and diagnosis of nasal

blockage caused by septal abnormality. Anatomical information on the severity of nasal septal deformity is provided by the SDG score. Our research led us to the conclusion that a higher score indicates a more severe degree of deformity.

Author's contributions

M.A.A.-E.A.H. enrolled patients and evaluated them before and after septoplasty. M.A.I. participated in the design of the study and performed the statistical analysis. A.S. conceived of the study and participated in its design and coordination and helped to draft the manuscript. All authors read and approved the final manuscript.

Conflicts of interest

There are no conflicts of interest.

Acknowledgements

The authors wish to express their deepest gratitude and thanks to Prof. Dr Ahmed Mohamed Ahmed Seleim, Professor of Otorhinolaryngology, Faculty of Medicine, Al-Azhar University, for his generosity, cooperation, continuous guidance, valuable instructions, suggestions, and encouragement through this work. For him, the authors express heartfelt and profound respect. The authors deeply indebted to Dr Marwan Ahmed Ibrahim, Lecturer of Otorhinolaryngology Faculty of Medicine, Al-Azhar University, for his expert direction, guidance, continuous help throughout this work. Lastly, the authors are grateful to all the professors and staff members of the Otorhinolaryngology Department, Faculty of Medicine, Al-Azhar University for their kind help in conducting this study.

References

1. Teti VP, Akdagli S, Most SP. Cost-effectiveness of corticosteroid nasal spray vs surgical therapy in patients with severe to extreme anatomical nasal obstruction. *JAMA Facial Plast Surg*. 2016;18:165–170.
2. Kjærgaard T, Cvancarova M, Sverre K. Does nasal obstruction mean that the nose is obstructed? *Laryngoscope*. 2008;118: 1476–1481.
3. Lindsay RW, George R, Herberg ME, Jackson P, Brietzke S. Reliability of a standardized nasal anatomic worksheet and correlation with subjective nasal airway obstruction. *JAMA Facial Plast Surg*. 2017;2114:449–454.
4. Gu JT, Kaplan S, Greenfield S, Calloway H, Wong BJF. Validation of a septoplasty deformity grading system for the evaluation of nasal obstruction. *Laryngoscope*. 2019;129:586–593.
5. Lin JK, Wheatley FC, Handwerker J, Harris NJ, Wong BJF. Analyzing nasal septal deviations to develop a new classification system: a computed tomography study using MATLAB and OsiriX. *JAMA Facial Plast Surg*. 2014;16:183–187.
6. Oneal RM, Beil Jr RJ, Schlesinger J. Surgical anatomy of the nose. *Otolaryngol Clin North Am*. 1999;32:145–181.
7. Simon PE, Lam K, Sidle D, Tan BK. The nasal keystone region: an anatomical study. *JAMA Facial Plast Surg*. 2013;15: 235–237.
8. K Maru Y, Gupta Y. Nasal endoscopy versus other diagnostic tools in sinonasal diseases. *Indian J Otolaryngol Head Neck Surg*. 2016;68:202–206.
9. Lighthead AP, Murrant NJ. Pediatric septoplasty: a review of the literature. *Int J Pediatr Otorhinolaryngol*. 2012;118:46–52.
10. Szczygielski K, Topol M, Morshed K. Gender differences in nasal septal deviation severity: a retrospective analysis of 3360 patients. *Plast Reconstruct Surg*. 2017;139:926e–930e.
11. Hashemi SM, Dadgarnia MH, Alborzi G. Evaluation of nasal septal deviation in patients with chronic rhinosinusitis: a computed tomography study. *J Otolaryngol Head Neck Surg*. 2016;45:25.
12. Philip P, Pratap D, Rajeshwari A, Bhat V. Subjective assessment of outcomes of septoplasty. *Otorhinolaryngol Clin*. 2018;9:42–46.
13. Dąbrowska-Bień J, Skarżyński H, Górski SF, Skarżyński PH. Quality of life in patients with nasal obstruction after septoplasty: a single institution prospective observational study. *Int Arch Otorhinolaryngol*. 2021;25:e575–e579.
14. Ghazipour A, Abshirini H, Hekmat Shoar M. Pursalehan S Sinonasal headaches and post-operative outcomes after septoplasty in patients with nasal septal deviation. *Iran J Otorhinolaryngol*. 2011;23:133–139.
15. Yariktaş M, Döner F, Doğru H, Tüz M. The beneficial effect of septoplasty on snoring. *Kulak Burun Bogaz Ihtis Derg*. 2003;10: 58–60.
16. Mladina R, Cujic E, Subaric M, Vukovic K. Nasal septal deformities in ear, nose, and throat patients. An internati. study. *Am J Otolaryngol Head Neck Med Surg*. 2008;29:75–82.
17. Guyuron B, Uzzo CD, Scull H. A practical classification of septonasal deviation and an effective guide to septal surgery. *Plast Reconstr Surg*. 1998;104:2202–2209.
18. Baumann I. Quality of life before and after septoplasty and rhinoplasty. *GMS Curr Top Otorhinolaryngol, Head Neck Surg*. 2010;9:Doc06.
19. Liang MT, Chen YF, Huang TW, Yang TH, Chang TC, Lee LA. Comparison of the effectiveness of the SDG system and the NOSE questionnaire in evaluating the severity of nasal obstruction and the therapeutic effect of septoplasty. *Eur Arch Oto-Rhino-Laryngol*. 2019;276:3049–3305.