ISSN 2692-5877
DOI: 10.46998/IJCMCR.2026.61.001515

International Journal of
Clinical Studies & Medical Case Reports

Research Article

Preoperative Predictors of Functional Success After Septoplasty: Moving From Anatomical Deviation to Patient-Centered Selection

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Received: August 31, 2026 Published: November 04, 2026

Abstract

Background: Septoplasty is one of the most frequently performed functional procedures in otolaryngology, yet postoperative benefit remains heterogeneous. Anatomical correction of a deviated nasal septum does not invariably translate into subjective relief of nasal obstruction, emphasizing the need for better preoperative patient selection.

Objective: To evaluate functional outcomes after septoplasty and identify preoperative epidemiological and clinical factors associated with sustained symptomatic improvement.

Methods: We conducted a retrospective observational study of patients undergoing septoplasty over a 5-year period. [The source dataset reports 300 patients in the Methods but 350 observations in the original title; the definitive sample size must be verified before submission.] Functional outcome was evaluated using the validated Nasal Obstruction Symptom Evaluation (NOSE) scale together with a visual analogue satisfaction scale. Preoperative variables included demographic characteristics, allergic rhinitis, previous nasal trauma, baseline obstruction severity, anatomical severity of septal deviation, and location of deviation according to Cottle areas. Associations with short-, intermediate-, and long-term functional outcomes were examined.

Results: The mean age was 36.7 years, with a male predominance (sex ratio 1.4). Allergic rhinitis was present in 40% of patients and a history of nasal trauma in 40.2%. According to baseline NOSE scores, 60.2% of patients had severe nasal obstruction, 36.6% moderate obstruction, and 3.2% mild obstruction. Greater baseline global discomfort, moderate-to-severe nasal obstruction, quasi-obstructive septal deviation, and deviation involving Cottle areas I–III were associated with greater functional benefit after surgery. Patients with anterior septal deviation experienced particularly marked symptomatic improvement. Conversely, selection based exclusively on the surgeon's subjective assessment of the anatomical magnitude of septal deviation was associated with a substantial proportion of postoperative dissatisfaction.

Conclusion: Functional success after septoplasty appears to depend not simply on the presence of septal deviation but on the interaction between baseline symptom burden and the functional relevance and location of the deformity. Patients with moderate-to-severe symptoms and functionally significant anterior deviation appear to derive the greatest benefit. Incorporating validated patient-reported outcome measures into surgical decision-making may improve patient selection and reduce avoidable postoperative dissatisfaction.

Keywords: Septoplasty; Nasal obstruction; Septal deviation; NOSE scale; Patient-reported outcomes; Prognostic factors; Functional outcome; Patient selection

Introduction

Nasal obstruction is among the most frequent complaints encountered in rhinology and can substantially impair sleep, physical activity, productivity, and disease-specific quality of life. Septal deviation is a common structural contributor, and septoplasty remains one of the most frequently performed functional nasal operations worldwide [1–4].

Nevertheless, the relationship between anatomical septal deviation and perceived nasal obstruction is complex. Nasal resistance is determined not only by septal geometry but also by the nasal valve, inferior turbinates, mucosal inflammation, the nasal cycle, and individual perception of airflow. Consequently, correction of a visibly deviated septum does not guarantee symptomatic success [4–7].

This discrepancy has progressively shifted outcome assessment from purely anatomical or objective measurements toward patient-reported outcome measures. The Nasal Obstruction Symptom Evaluation (NOSE) scale, developed and validated by Stewart et al., provides a standardized disease-specific assessment of obstruction severity and has become one of the principal instruments for evaluating septoplasty outcomes [1,2].

Contemporary evidence strongly supports the efficacy of appropriately selected septoplasty. A recent meta-analysis involving 2,577 patients found a mean improvement of approximately 49 points in NOSE score six months after surgery [8]. More importantly, the multicenter randomized NAIROS trial demonstrated superior symptomatic improvement with septoplasty compared with defined medical management and showed that greater baseline symptom severity predicted a larger treatment effect [9,10]. These observations suggest that the fundamental clinical question is no longer simply whether septoplasty works, but which patients are most likely to benefit.

Several candidate predictors have been investigated, including baseline symptom severity, anterior versus posterior deviation, unilateral versus bilateral deformity, turbinate hypertrophy, allergic rhinitis, age, smoking, objective nasal airflow measurements, and radiological parameters [5–7,11–15]. However, no universally accepted preoperative prediction model currently exists.

We therefore evaluated a large cohort of patients undergoing septoplasty to determine whether readily available preoperative clinical characteristics could identify patients most likely to experience sustained functional improvement. We hypothesized that baseline symptom burden and the functional location and severity of septal deviation would be more informative than anatomical assessment alone.

Materials and Methods

Study design and population:

This retrospective observational study included consecutive patients who underwent septoplasty during a 5-year period.

The original source document contains a discrepancy between the reported sample size in the title (350 observations) and that reported in the Methods (300 patients). This number must be checked against the original database before submission.

Preoperative assessment:

Patients underwent standard otorhinolaryngological evaluation with assessment of nasal obstruction and septal anatomy.

Variables of interest included:

- age and sex;
- allergic rhinitis;
- previous nasal trauma;
- subjective global discomfort;
- severity of nasal obstruction;
- anatomical severity of septal deviation;
- location of the deviation according to Cottle areas;
- anterior versus more posterior deviation.

Patient-reported outcomes:

Nasal obstruction was assessed using the NOSE scale. Patients were categorized according to baseline obstruction severity as having mild, moderate, or severe symptoms.

Patient satisfaction was additionally evaluated using a visual analogue scale.

Functional results were considered across short-, intermediate-, and long-term postoperative follow-up.

Statistical analysis:

The available source material reports an analytical comparison of epidemiological and clinical factors according to postoperative functional outcome. Exact statistical tests, effect estimates, confidence intervals, and individual P values were not available in the source abstract and therefore must be retrieved from the original statistical database before journal submission. No values have been reconstructed or invented for the present manuscript.

Results

Patient characteristics:

The mean age was 36.7 years, and there was a male predominance with a sex ratio of 1.4.

Allergic rhinitis was documented in 40% of patients, whereas 40.2% reported previous nasal trauma.

Baseline burden of nasal obstruction:

The majority of patients had substantial preoperative symptoms. According to the NOSE scale:

- 60.2% had severe nasal obstruction;
- 36.6% had moderate obstruction;
- only 3.2% had mild obstruction.

Thus, more than 96% of the cohort presented with at least moderate symptom burden.

Predictors of postoperative functional improvement:

Several preoperative features were associated with favorable functional outcome.

Patients reporting severe or moderate global discomfort experienced greater postoperative benefit.

Similarly, moderate or severe baseline nasal obstruction was associated with better functional improvement. Patients with a baseline NOSE score >50 and those with scores between 26 and 50 appeared to benefit more consistently than patients with mild symptoms.

Anatomical location was also relevant. Septal deviations involving Cottle areas I, II, and III were associated with favorable postoperative improvement.

Patients with a quasi-obstructive septal deviation experienced substantial symptomatic benefit.

Notably, patients with anterior septal deviation reported the greatest improvement following septoplasty.

Anatomical correction versus patient-perceived success:
A central observation was that anatomical assessment alone did not adequately predict postoperative satisfaction.
When the indication for septoplasty relied predominantly on the surgeon's subjective evaluation of the magnitude of septal deviation, a substantial proportion of patients remained dissatisfied.

These findings support a multidimensional approach combining anatomy with preoperative symptom severity.

Discussion

The principal finding of this study is that functional benefit after septoplasty is not uniformly distributed among patients with septal deviation. Instead, the magnitude of improvement appears strongly related to baseline symptom burden, functional severity, and anatomical location of the deviation.

This finding is particularly relevant because septoplasty has historically been indicated largely on anatomical grounds. Yet nasal septal morphology and subjective obstruction correlate imperfectly. Objective measures such as rhinomanometry, acoustic rhinometry, CT-derived measurements, and peak nasal inspiratory flow may characterize airway geometry or resistance but have shown inconsistent ability to predict patient-perceived surgical benefit [5,11,12].

Our observation that patients with greater baseline symptoms experienced greater benefit is strongly concordant with contemporary evidence. Stewart et al. established the NOSE scale specifically to quantify disease-specific obstruction [1], and subsequent studies demonstrated marked postoperative reductions in NOSE scores [2,3,13].

More recently, the NAIROS randomized controlled trial provided high-level evidence supporting septoplasty over medical management for appropriately selected adults with at least moderate nasal obstruction [9,10]. Importantly, treatment effect increased with baseline symptom severity. Our findings independently support this concept: moderate and severe obstruction predicted greater improvement, whereas patients with minimal symptoms had less potential for meaningful benefit.

A 2023 systematic review and meta-analysis involving 2,577 patients similarly reported a pooled baseline NOSE score of approximately 68 and an improvement approaching 49 points six months after septoplasty [8]. More recent meta-analyses of randomized trials have confirmed superior patient-reported outcomes for surgery compared with non-surgical treatment [16,17].

The second major observation concerns the location of septal deviation. Patients with anterior deviation experienced particularly marked improvement. This is physiologically plausible because the anterior nasal cavity and internal nasal valve represent high-resistance segments of the nasal airway, such that relatively small structural changes can substantially influence perceived airflow.

Long-term observations by Dinis and Haider similarly suggested that patients with anterior septal deformities may obtain substantial symptomatic benefit, while simultaneously emphasizing the limitations of selecting patients solely on clinical anatomical assessment [5].

The literature is nevertheless complex. In a prospective cohort of 494 patients, Cantone et al. identified anterior septal deviation as an important determinant of outcome but also observed a greater risk of postoperative redisplacement in anterior deformities [6]. Thus, anterior deviation may represent both a strong functional target and a technically demanding anatomical phenotype.

The importance of morphology is further supported by classification studies demonstrating considerable heterogeneity among septal deformities [14,15]. Treating all deviations with an identical surgical strategy is therefore unlikely to produce uniform outcomes.

Our findings concerning Cottle areas I–III further reinforce this concept. Deformities located within functionally critical anterior segments may produce disproportionately severe symptoms relative to their apparent anatomical size. Consequently, describing only the degree of septal deviation without documenting its location may underestimate functional significance.

Conversely, structural deviation is not the sole determinant of obstruction. Allergic rhinitis, inferior turbinate hypertrophy, nasal valve dysfunction, mucosal disease, and sensory perception can contribute to persistent symptoms. Studies evaluating septoplasty with concomitant turbinate surgery have generated heterogeneous results, although recent randomized evidence suggests that selected patients with compensatory inferior turbinate hypertrophy may obtain additional subjective benefit from turbinate reduction at the cost of increased adverse events [18].

Our cohort contained a substantial prevalence of allergic rhinitis (40%). The available source dataset, however, does not provide sufficient inferential statistics to establish allergic rhinitis as an independent predictor of outcome. It should therefore not be interpreted as either protective or detrimental in this population.

The finding with the greatest clinical implications may be the persistence of dissatisfaction when surgical indication was based predominantly on the surgeon's subjective anatomical assessment. Patient and surgeon perspectives do not necessarily measure the same construct: the surgeon evaluates anatomy, whereas the patient experiences airflow limitation and its consequences.

This argues for a patient-centered selection paradigm. Septoplasty should not be viewed simply as correction of a crooked septum. The therapeutic target is clinically meaningful nasal obstruction attributable to that deviation.

A practical preoperative framework emerging from our results would therefore integrate: (1) validated symptom severity, preferably with NOSE; (2) anatomical localization of the deviation; (3) assessment of the nasal valve and turbinates; (4) identification and treatment of inflammatory disease; and (5) explicit discussion of patient expectations.

Strengths and limitations:
The principal strength of this study is the relatively large clinical cohort and the simultaneous evaluation of subjective obstruction, anatomical characteristics, and postoperative satisfaction across different follow-up periods.

Several limitations require acknowledgment. The retrospective design introduces selection and information biases. Objective airflow measurements were not available in the source dataset. Detailed multivariable effect estimates were unavailable for preparation of this manuscript. The exact sample size must also be reconciled with the original database before submission. Finally, contemporary prospective studies should combine standardized anatomical phenotyping with validated patient-reported outcomes and multivariable prediction modeling.

Conclusion

Septoplasty provides substantial functional benefit in appropriately selected patients, but anatomical septal deviation alone is an insufficient indication for surgery.

Patients with moderate-to-severe baseline nasal obstruction, quasi-obstructive deformity, and functionally important anterior septal deviation appear particularly likely to benefit. Incorporating validated patient-reported symptom severity alongside precise anatomical localization may improve surgical selection, expectation management, and postoperative satisfaction.

The clinically relevant question should therefore shift from “Is the septum deviated?” to “Is this deviation responsible for this patient's functional burden, and is correction likely to provide meaningful benefit?”

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