



# A systematic review of the nasal septal turbinate: An overlooked surgical target

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## ABSTRACT

**Objective:** The nasal septal turbinate (NST) is a conspicuous structure located in the anterior nasal cavity that impacts the internal nasal valve. Its structure and function is often thought to be poorly characterized, and it is rarely addressed surgically. The authors perform a systematic review in an attempt to synthesize what has been learned of this structure and to evaluate its potential as a treatment target.

**Methods:** A query of the Medline, Embase, Web of Science and Cochrane databases was undertaken in search of studies evaluating the NST. This qualitative systematic review was performed in accordance with PRISMA guidelines. Study quality and risk of bias were assessed with established criteria.

**Results:** Of the initial 1069 hits from the four databases, 16 articles were ultimately included in the review, which varied in quality and risk of bias. The included articles consisted predominantly of radiographic and histopathologic studies. Four studies evaluated NST treatment outcomes. The NST represents a fusiform-shaped region of erectile tissue, similar in structure and function to that of the inferior turbinates. Preliminary treatment outcomes suggest the NST represents an important surgical target in nasal airway surgery.

**Conclusion:** When evaluating nasal obstruction patients, surgeons should assess the NST and consider addressing it surgically.

## 1. Introduction

The nasal septal turbinate (NST) is a widened, fusiform-shaped region of the septum located in the anterior nasal cavity [1]. The central portion of the NST contains septal cartilage and bone however the majority of its three-dimensional volume consists of soft tissue; mucosa, erectile tissue, vasculature and secretory glands (Fig. 1) [2]. A variety of nomenclature has been used to refer to this structure over the years including the nasal septal body, septal swell body and the intumescencia septi nasi anterior [3,4,5]. Despite being a conspicuous structure that impacts the internal nasal valve, the NST is rarely intervened on surgically. The authors perform a systematic review of studies evaluating the NST in an effort to summarize what has been learned about this structure and to evaluate its potential as a treatment target.

## 2. Methods

This systematic review was performed in accordance with the

guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), which are a standardized and widely utilized criterion for performing effective systematic reviews [6]. Using the search terms, “nasal/nose septal turbinate(s) OR nasal/nose septal body (ies) OR nasal/nose septal swelling(s) OR nasal/nose swell body(ies) OR intumescencia septi nasi anterior OR Kiesselbach's body/ridge OR septal cavernous body,” a query of the Medline, Embase, Web of Science and Cochrane databases was performed for articles evaluating the nasal septal turbinate. Two authors performed the review independently and corroborated the search results (WM, AJ). The date of the final search was August 20, 2018. Prospective and retrospective studies were considered, including anatomic, radiographic and histopathologic studies. Studies including five or fewer patients were excluded. Foreign language articles, animal studies and narrative reviews were excluded. Extracted data was compiled and manipulated using Microsoft Excel (Microsoft, Seattle, WA). The quality of articles was assessed by assigning a score using the methodological index for non-randomized studies (MINORS) [7]. The MINORS criteria represent a validated instrument for assessing non randomized studies. Non-

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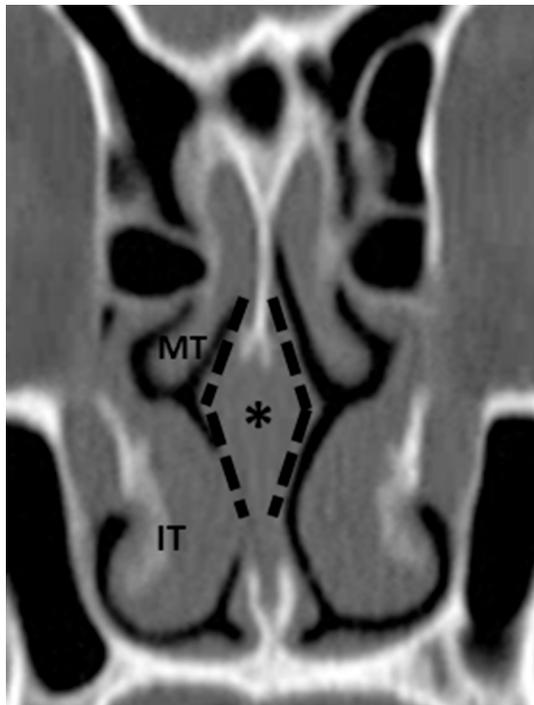


Fig. 1. Coronal CT image of the anterior nasal cavity. \*The nasal septal turbinate (NST) is delineated by the dashed lines and consists of cartilage, bone and soft tissue. IT = inferior turbinate. MT = middle turbinate.

comparative studies are assessed in eight domains and comparative studies have an additional four domains. Each domain is scored from zero to two. The optimal score is therefore 16 for non-comparative studies and 24 for comparative studies. For the purposes of this review, a value below 11 was considered to represent a high risk of bias for non-comparative studies. A value below 16 was considered to represent a high risk of bias for comparative studies. For randomized trials, a risk of

bias of good, fair or poor was assigned as defined by the Cochrane Collaboration [8]. A level of evidence score of one through five was assigned to each article using the criterion from the Oxford Center of Evidence-Based Medicine [9]. This study was designed to be a descriptive systematic review and as such, meta-analysis statistics were not attempted.

### 3. Results

The systematic review schema used to identify eligible articles is shown in Fig. 2. Of the 1069 initial hits, 1045 were excluded based on the title, abstract or redundancy. Of the 24 unique full-length manuscripts that were reviewed, three were excluded for having an insufficient number of patients. Two foreign language articles were excluded. Two were found to describe histology of erectile tissues of the nasal cavity without a focus on the NST and were thus excluded. One narrative review was excluded. This resulted in 16 manuscripts that met inclusion criteria with a collective 1964 patients (Tables 1–3) [10–25].

#### 3.1. Radiographic studies

Nine studies evaluated the anatomy of the NST radiographically, which was the most common type of study (Table 1). Four of the studies were prospective and with a low risk of bias. All studies presented level II or III evidence. Typically described as fusiform in shape, the average maximal width of the NST was estimated at 10–12 mm [14,15,24]. Costa performed perhaps the most complete measurements of the NST dimensions and estimated an average height of 19.6 mm and length of 28.4 mm [14]. The maximal width of the NST was estimated at 24.8 mm from the nasal floor in a region directly anterior to the heads of the middle turbinates. Similar to compensatory inferior turbinate hypertrophy, the soft tissue of the NST was found to be more prominent when contralateral to a septal deviation [15,19,23]. The NST was found to decrease in size with age and was noted to correlate with inferior turbinate size [11,18,24,25]. Gelera found that the soft tissue components of the NST were larger in patients with a history of sinonasal

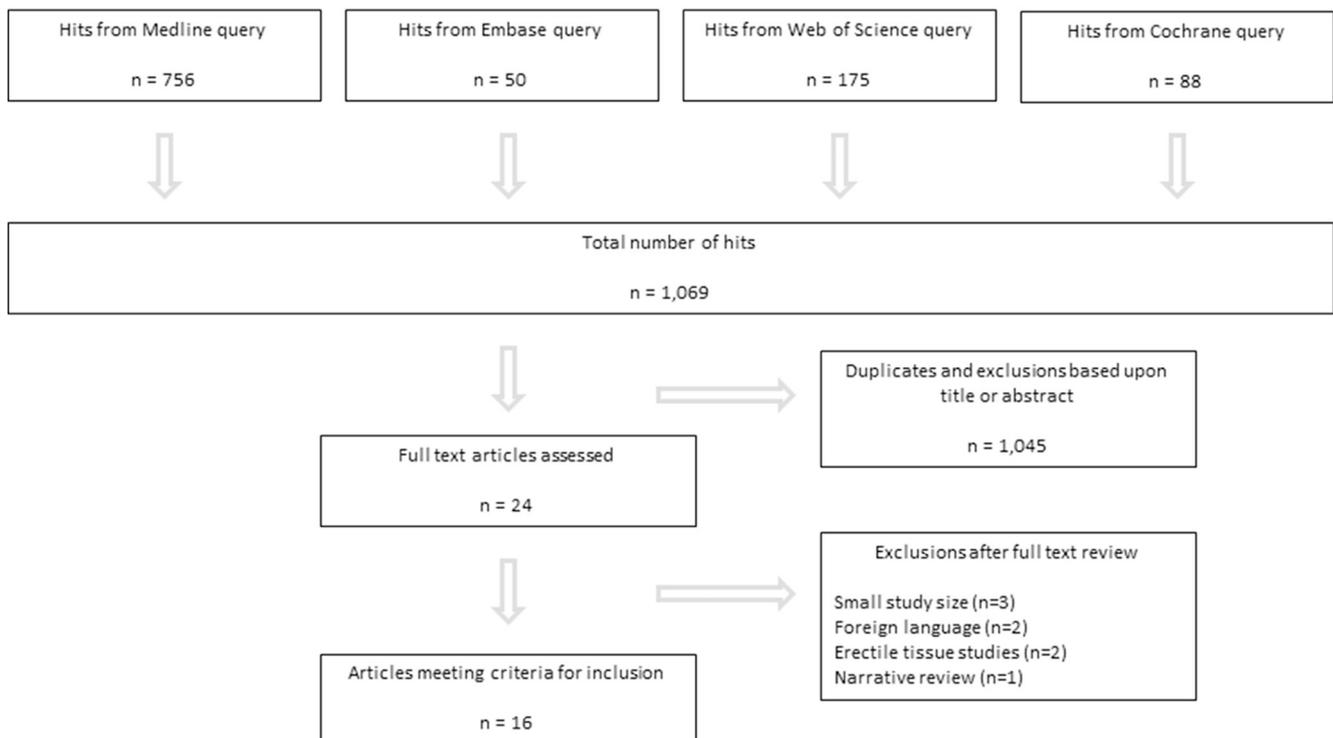


Fig. 2. Systematic review flowchart.

**Table 1**  
Summary of radiographic studies.

Author	Year	Location	N <sup>a</sup>	Design	Findings	Bias <sup>b</sup>	Evidence <sup>c</sup>
Arsilan [11]	2004	Middle East	595	Prospective CT	NST is larger in males and decrease with age	12/16 (L)	II
Costa [14]	2010	North America	54	Prospective MRI	NST dimensions	12/16 (L)	II
Setlur [15]	2011	North America	100	Retrospective CT	NST is larger when contralateral to a deviation	10/16 (H)	III
San [17]	2014	Middle East	70	Retrospective CT	NST dimensions are comparable between patients with and without allergies	10/16 (H)	III
San [18]	2014	Middle East	150	Retrospective CT	NST is larger in males and shrinks with age	10/16 (H)	III
Demirci [19]	2015	Europe	199	Retrospective CT	NST is larger when contralateral to a deviation and inversely correlates with inferior and middle turbinate size	10/16 (H)	III
Akil [23]	2017	Asia	70	Prospective CT	NST is larger when contralateral to a deviation	12/16 (L)	II
Geleera [24]	2017	Asia	405	Retrospective CT	NST is larger in patients with allergies and shrinks with age	10/16 (H)	III
Yu [25]	2018	Asia	50	Prospective CT	NST correlates with inferior turbinate size	12/16 (L)	II

<sup>a</sup> Number of study subjects.

<sup>b</sup> Score per MINORS criteria. “H” and “L” denote high and low risk of bias respectively [7].

<sup>c</sup> Level of evidence per OCEBM criteria [9].

allergies [24].

### 3.2. Histopathologic studies

Four studies evaluated the histopathology of the NST via cadaver or living patient specimens (Table 2). All of the studies were prospective, with a low risk of bias, and presented level II evidence. The NST tissue was found to have thicker mucosa and more abundant mucous glands and vascular sinusoids relative to other nasal mucosa [12,13,14,16]. Although the exact proportions of these structures varied between studies, the NST was universally concluded to be an erectile tissue that regulates humidification and airflow, similar to the turbinates.

### 3.3. Treatment studies

Four studies evaluated NST treatment outcomes in patients undergoing surgery for nasal obstruction (Table 3). Three of the studies were prospective, two of which were with a low risk of bias. Collectively, level I,II and IV evidence was presented. Haight performed a prospective non-randomized study where 28 patients underwent inferior turbinate reduction alone and 28 underwent inferior turbinate reduction in conjunction with NST reduction [10]. Cryosurgery and cautery were both utilized and at 10–16 weeks post operatively, they found no difference in patient symptoms or rhinometry between the two patient groups. Catalano performed a prospective trial of in-office radio-frequency ablation of the NST in 60 patients who had failed a prior septoplasty and turbinate reduction [20]. Statistically significant reductions in NOSE scores from 41.6 pre-treatment to 17 and 21 at three and six months respectively were calculated. The authors also found statistically significant improvements in endoscopic findings based on middle turbinate visualization. They reported three minor infections, one small, asymptomatic septal perforation and five patients required multiple treatments. Kim retrospectively reviewed nasal obstruction scores in eight patients who underwent in-office NST coblation [21]. On a visual analog scale, an average pre-treatment obstruction score of 7.63 was reduced to 3.88, 4.16 and 4.63 at three, six and twelve months respectively. No complications were reported. Yu performed a prospective randomized controlled trial of 51 patients in which 25 underwent a microdebrider submucous turbinate reduction alone and 26 underwent a concurrent NST reduction [22]. All surgeries were performed under a general anesthetic. At three months post-operative, there were multiple statistically significant advantages in the NST group. Specifically, the authors found a larger nasal obstruction score improvement (2.02 vs. 1.43, p < 0.05). They also found a more pronounced improvement in total nasal volume on rhinometry (0.83 mL vs. 0.36 mL, p < 0.05). Other metrics such as olfaction, rhinorrhea and sneezing were similar between both treatment groups. The authors evaluated for hematoma, synechiae, perforation, and infection and there were no complications found related to NST reduction.

## 4. Discussion

Collectively, the NST studies included in this review provide a considerable amount of prospective data with a relatively low risk of bias. A wealth of evidence from radiographic and histopathologic studies has shown that the NST is a dynamic, fusiform-shaped structure located in the anterior nasal cavity that encroaches the internal nasal valve. Centrally, it contains septal cartilage and bone. Laterally, it consists of erectile, mucous-producing soft tissue similar to that of the turbinates. As such, its role in the nasal cavity appears to be that of air flow regulation and humidification.

The preliminary evidence evaluating the NST as a treatment target is encouraging. Three of the four treatment studies found significant benefits in favor of NST interventions [20,21,22]. All of these studies used objective nasal symptom scores in their analysis and collectively, they supported NST reduction as both an adjunct and isolated

**Table 2**  
Summary of histopathologic studies.

Author	Year	Location	N <sup>a</sup>	Design	Findings	Bias <sup>b</sup>	Evidence <sup>c</sup>
Wexler [12]	2006	Middle East	14	Prospective living patient	NST is glandular, erectile tissue	12/16 (L)	II
Elwany [13]	2008	Africa	30	Prospective cadaver	NST dimensions, the NST is glandular, erectile tissue	12/16 (L)	II
Costa [14]	2010	North America	10	Prospective cadaver	NST is glandular, erectile tissue	12/16 (L)	II
Sisman [16]	2014	Europe	50	Prospective cadaver	NST is glandular, erectile tissue	14/16 (L)	II

<sup>a</sup> Number of study subjects.

<sup>b</sup> Score per MINORS criteria, “H” and “L” denote high and low risk of bias respectively [7].

<sup>c</sup> Level of evidence per OCEBM criteria [9].

**Table 3**  
Summary of treatment studies.

Author	Year	Location	N <sup>a</sup>	Design	Findings	Bias <sup>b</sup>	Evidence <sup>c</sup>
Haight [10]	1989	North America	48	Prospective trial	No benefit with NST cautery or cryosurgery	13/24 (H)	II
Catalano [20]	2015	North America	60	Prospective case series	NST radiofrequency ablation is safe and effective	14/16 (L)	II
Kim [21]	2015	Asia	8	Retrospective case series	NST coblation is safe and effective	10/16 (H)	IV
Yu [22]	2015	Asia	51	Prospective randomized controlled trial	NST submucous reduction is safe and effective	Fair	I

<sup>a</sup> Number of study subjects.

<sup>b</sup> Score per MINORS criteria, “H” and “L” denote high and low risk of bias respectively [7], Cochrane Risk of Bias tool used for the randomized, controlled Yu study [8].

<sup>c</sup> Level of evidence per OCEBM criteria [9].

procedure. The Yu study is noted for being the only prospective randomized controlled trial, which showed considerable symptom improvement with NST treatment [22]. Of note, the one study that did not conclude NST treatment to be effective was the most outdated study included in the review and carried the highest risk of bias relatively [10]. This study was non-randomized and has been critiqued for using multiple treatment modalities. Complications were collectively minimal amongst the four treatment studies.

The results of this review encourage a re-evaluation of our assessment of nasal obstruction to include an evaluation of the NST. A traditional septoplasty corrects only underlying cartilage and bone, which fails to address the abundant soft tissue of the NST. Due to its encroachment of the internal nasal valve, the site of rate-limiting nasal air flow, this may be one of the higher yield regions of the septum in nasal obstruction patients [1,2]. In patients being treated for turbinate hypertrophy, addressing the NST may greatly improve results. As an easily accessible structure, treatment of the NST should minimally affect the overall procedure time and would impose minimal risk to the patient. Given what has been learned from turbinate surgery, controlled submucous reductions are advised so as to preserve NST function and avoid potential complications such as empty nose syndrome or other injuries. For patients with refractory rhinitis, the NST, given its abundance of erectile and mucous glands, may be a high yield target for injection therapies [26,27]. From a billing perspective, as this structure is both turbinate tissue and a part of the nasal septum, the Current Procedural Terminology (CPT) codes for either “septoplasty” (30520) or “inferior turbinate reduction” (30802) could be implemented if this structure is addressed procedurally. A specific CPT code for “nasal septal turbinate reduction” currently does not exist.

This review is limited in a variety of ways. Firstly, many of the included studies are retrospective and thus carry the inherent risks of data inaccuracies and selection bias. Of note, a majority of the included studies are from outside of North America and the exclusion of foreign language articles may have resulted in the exclusion of relevant data. Amongst the articles evaluating treatment outcomes, although all implemented objective tests, there was great variability in which metrics were used, which may serve as a confounder. The Kim study is limited by its small sample size of eight patients [20]. The studies evaluating NST treatments rarely had follow up longer than three to six months, which limits the ability to make conclusions about long-term results. Future prospective trials evaluating NST treatments as an isolated and

adjunct procedure are indicated.

## 5. Conclusions

The NST is a fusiform-shaped region of the septum located in the anterior nasal cavity that encroaches the internal nasal valve. The NST is similar in structure and function to the inferior turbinates. Preliminary data has shown that surgical treatment of the NST as both an isolated and adjunct procedure is very promising. Surgeons should assess the NST when evaluating nasal obstruction patients and consider addressing this site surgically.

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## Disclosures

Adam S. DeConde is a consultant for Intersect ENT, Olympus and Stryker Endoscopy.

## Conflict of interest

None.

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