

A REVIEW ON DEVIATED NASAL SEPTUM: CLASSIFICATION, CLINICAL FEATURES AND MANAGEMENT

ABSTRACT:

The nasal septum separates the right and left part of the nasal cavity and columellar septum, membranous septum and septum proper are the parts of it. Deviation of nasal septum is a common case of nasal obstruction presented in a clinic. A lot of classifications have been developed to help ease the study of deviated nasal septum but none of them is used as a standard. Some of the classifications include the one given by Vidigal, Guyuron, Cerek, Mladina and Cottle's. Apart from nasal obstruction other common clinical features involving deviated nasal septum are sinusitis especially in horizontal deviation type V. Pressure on lateral wall by spurs can also cause pressure headache. Due to increased air flow in the nasal cavity, dryness occurs causing epistaxis. Obstruction of nasal cavity causes mouth breathing in return either exaggerating or leading to obstructive sleep apnoea. Septal deviation also effects the choroidal thickness and choroidal blood supply. Histopathologically, lymphocytic infiltration and squamous metaplasia occurs in septal mucosa. These changes occur mostly due to change in the aerodynamic flow. There is decreased cilia movement and inferior turbinate hypertrophy. Thickness of inferior turbinate gains importance while septoplasty as, if thickened a lot, the inferior turbinate demands excision. The deviated nasal septum is associated with sinusitis, chronic suppurative otitis media and Eustachian tube dysfunction. Management involves submucous resection or septoplasty. Out of the two, septoplasty is preferred as it is a conservative surgery. Only symptomatic and cosmetically grossly disfigured cases require a surgical treatment while the asymptomatic cases are generally not indicated for surgery.

KEYWORDS: Deviated nasal septum, nasal obstruction, pathological changes in DNS, Submucous resection, septoplasty, crooked nose

INTRODUCTION:

The nose, being the most prominent facial feature, is at a higher risk of severe damage. Nasal fractures are the most common bone injury in the adult face, and they are commonly caused by car accidents, sports injuries, and altercations. Nasal fractures can cause major aesthetic or functional problems, even if they are first thought to be small(1). Nasal septum

is most likely to be deformed in cases of nasal or facial trauma. The nasal septum separates the left and right side of the nasal cavity and thereby forms the two nostrils. It thus constitutes the medial wall of both nasal cavities and is coated with mucous membrane on both sides. It is made of three parts columellar septum, membranous septum and the septum proper. The bony portion is nearly entirely made up of vomer, ethmoid's perpendicular plate. The nasal spine of the frontal bone, the rostrum of the sphenoid, and the nasal crests of the nasal, palatine, and maxillary bones all contribute to its borders. The septal cartilage and the septal processes of the inferior nasal cartilages make up the cartilaginous portion. Cuticular tissue, or the bottom end, is made up of fibro fatty tissue that is covered by skin. The columella is the bottom border of the septum. In most cases, the nasal septum is not precisely middle. Its centre portion is frequently shifted to one side or the other. Overgrowth of one or more of the component elements causes the deviation. There are four boundaries to the septum: superior, inferior, anterior, and posterior. Two surfaces, one on the right and one on the left. According to Cottle, the septum is divided into five areas namely, Vestibular Areas, valvular area, Attic area, turbinate area and choanal area. The anterior and posterior Ethmoidal arteries supply the anterosuperior parts, the superior labial branch of the facial artery supplies the anterior-inferior portion, the sphenopalatine artery supplies the posteriosuperior portion. It's the main artery. Few branches of the larger palatine artery supply the posterior inferior portion. The septum's anterior-inferior portion, or vestibule, includes anastomoses between all branches, such as the septal ramus of the superior labial branch of the facial artery, the sphenopalatine artery, the larger palatine artery, and the anterior ethmoidal artery. The Kiesselbach's plexus is a vast capillary network formed by these. Little's area is a typical location for nasal bleeding or epistaxis. The veins create a plexus in the bottom portion of the septum, often known as Little's region. The plexus feeds anteriorly into the facial vein and posteriorly into the pterygoid venous plexus through the sphenopalatine vein. The trigeminal nerve gives rise to general sensory nerves that run the length of the septum. The internal nasal branches of the anterior ethmoidal nerve supply the anterosuperior portion of the septum. The anterosuperior alveolar nerve supplies the anteroinferior portion. The medial-posterior-superior nasal branches of the pterygo palatine ganglion supply the posteriosuperior portion. The nasopalatine branch of the pterygopalatine ganglion supplies the posteroinferior portion. It is the most important nerve. Special sensory nerves, also known as olfactory nerves, are only found in the upper region of the body, in the olfactory area.

The submandibular nodes are located in the front part of the mandible. The retropharyngeal and deep cervical nodes are located in the posterior part of the neck.

Development of nasal septum -The mesenchymal frontonasal process develops downward from the roof of the stomodeum and unites with the maxillary processes, which emerge from the 1st branchial arch. Between the frontonasal process and the lateral nasal process, the ectodermal thickening of the olfactory placode invaginates as a pit. The median nasal process and upper lip philtrum are formed by the frontonasal process. The lower lateral cartilage and lobule of the lateral part of the nose are formed by the lateral nasal process. Internally, the olfactory placode invaginates to rest high in the nasal cavity, forming olfactory epithelium. Congenital cleft lip occurs when the medial frontonasal process and the maxillary process fail to unite. The nasal septum, in particular, serves as an important underlying support component for the nose. The septum is in charge of giving stability and support to the nasal tip, nasal dorsum and middle nasal third. (2). Deviated nasal septum is one of the main causes for nasal obstruction.(3)As the name suggests ,it occurs as a result of deviation of the septum towards one side of the nasal cavity. The nasal septum is made of both bone and cartilage. The cartilaginous part of the septum is made of hyaline cartilage which makes it flexible. If the septum is exposed to mechanical force(traumatic or surgical),especially during the growth period, this flexibility acts as a two-edged sword; providing cushioning effect and at the same time be vulnerable to malformation due to excessive growth or scar formation causing tension. These factors affect the development, vector and shape of the septum and explain the aetiology of DNS. (4)Most of the clinical features associated with DNS are due to obliteration of the nasal cavity of one side and over exposure of the nasal mucosa to air on the deviated part. As a result of air flow changes there is compensatory hypertrophy in the concave side, that is the side where the septum is deviated to.(5)The deviated septum is surgically managed by septoplasty or sub mucus resection. Only the symptomatic cases are managed surgically. With this background, a systematic review article is written to highlight the clinical features, surgical management and pathological changes in deviated nasal septum.

OBJECTIVES: In this review article, Deviated Nasal Septum is discussed under the headings of clinical features, management and histopathological changes.

METHODOLOGY: The data of the following review article was collected during the period from 25th July-17th August, 2021. The mentioned data were retrieved from

PubMed,EMBASE,Medline and Google Scholar data base. Most relevant articles with recent developments regarding the clinical features and histopathological changes, published in English worldwide were used. The keyword search headings included "Deviated nasal septum, pathological changes in DNS, nasal obstruction, classification of DNS, management", and a combination of these. Reference list of each included study will be searched for further supportive data.

MAIN TEXT:

CLASSIFIATION & CLINICAL FEATURES-

DNS involves males more than females by a ratio of about 2:1 (20).According to the clinical study conducted on deviated nasal septum and its associated pathology by Prayaga N. Srinivas Moorthy, about 74% of patients of DNS come to the clinic with a complaint of persistent nasal obstruction(5). The inferior turbinate mucosa, especially the medio inferior, with the most thickness and least glandular tissue, plays a major role in obstruction. The nasal cycle is usually not appreciable in a normal healthy person. But in a patient with deviated septum,the nasal cycle can end up in alternate obstruction.(4)The laterality of the obstruction depends upon the type of septal deformity. Deformity in nasal septum can occur in either of the two ways, independent or combined: anterior cartilage deformity of the quadrilateral septal cartilage which occurs as a result of physical trauma, which involves all the septal components, caused by compression of the maxilla due to pressure during pregnancy or parturition and leads to facial deformity. Vidigal et al.came up with a classification which used the relationship between the nasal septum and inferior turbinate. According to it, the deviation can b divided into three degrees. It ranges from the deviation not reaching the inferior turbinate to reaching the inferior turbinate to reaching the lateral wall and compressing the inferior turbinate. Guyuron et al. used six classes in their classification. For deviation in anteroposterior and cephalocaudal direction included C and S shaped deviation. Nasal spur and septal tilt are used to describe localized deviation. Cereke's used the same C and S types as by Guyuron and also included nasal septal deviations.(16)According to Mladina, septal deformities are of seven types. In the first type, a slight deviation occurs in the vertical or horizontal plane. Type two and three are vertical deviations anteriorly and posteriorly respectively. A septum is classified as the fourth type when it is S shaped. Fifth type is horizontal spurs with or without effect on the opposite side. The sixth type includes fifth type with a deep groove on the concave surface.

Combination of any of the above type is classified as type seven.(6)(7)According to a study conducted by Sumit Prasad, horizontal deviations type V are more prone to sinusitis while Vertical deviations type I and type II predispose to sinusitis due to involvement of nasal valve area.(7)DNS predisposes to sinusitis due to decreased airflow circulation or obstruction of sinus ostia. Along with nasal obstruction, DNS is also associated with pressure headache. Specifically, spurs can present with headaches due to pressure on the lateral wall of the nose.(2).A study by B J O'Reilly supports the hypothesis that epistaxis can be cause by deviated nasal septum.(9).As mentioned by Dr.PL Dhingra, in his book of diseases of ear nose and throat, the mucous layer on the deviated side is exposed to more air than normal which causes drying. The dried-up mucous crusts and leads to epistaxis.(20). M Damar found out in their study regarding relation between ear nasal pathologies that significantly higher incidence of DNS was found in patients of CSOM.(10)Even moderate septal deviations are also associated with Eustachian tube dysfunctions .In children it was found that septal deviations caused negative middle ear pressure.(17)An evaluative study was done by Dr. Ansu Sam relating NSD and external deviation. In the study it was found that more than half of the patient had external deformation. Amongst the patients having external nasal deformity, a slight deviation in horizontal or vertical plane occurs which was classified by Mladina as type one.(11)A decreased olfactory function is also seen owing to the anatomical and physiological changes in the nasal cavity.(12)As a result of nasal obstruction, mouth breathing is seen, especially in paediatric groups.(12)As a result of mouth breathing, the upper respiratory tract destabilizes causing or worsening obstructive sleep apnoea (OSA).(13)Nasal septum defect can have an effect on choroidal thickness and choroidal blood flow due to chronic hypoxia and hypercapnia(14).

EFFECTS-

The septal mucosa is made of three layers. The first layer is pseudo stratified columnar epithelial layer, then comes the basement membrane followed by the lamina propria. Apart from clinical features due to nasal obstruction a bunch of histopathological changes also occur in the nasal cavity due to deviated nasal septum. The changed aerodynamic flow and ill ventilation is responsible for these pathological findings.(15)Lakshit Kumar conducted a study to know the effect of deviation on the nasal epithelium. It was found in the study that, specifically on the concave side, there occurs squamous metaplasia and lymphocytic infiltrate on septal mucosa. The presence of lymphocytic infiltrate was justified by the

chronic inflammation occurring due to the septal defect. The lymphocytic infiltration can be graded using a 40X microscope. The grading is done from 0 to 3. The grading starts from no lymphocytic infiltration. When 1-2 lymphocytes are seen in the microscopic field, it is graded as one. Grade two and three are lymphocytes in all areas, sparse and intense respectively.(3) The chronic inflammation and squamous metaplasia make the patient susceptible to chronic rhino sinusitis.(16)The saccharin clearance time is also increased. There is also loss of cilia, more on the convex side than the concave side.(4) Serous and mucinous glands is reduced, especially on the concave side.(16) There is a twofold increase in the thickness of the inferior turbinate. Thickness of inferior turbinate gains importance while septoplasty as, if thickened a lot, the inferior turbinate demands excision.(17)Association of nasal and paranasal sinus pathologies with DNS is well established. Anterior and Posterior Ethmoidal sinuses are relatively more affected by DNS than the rest of the sinuses.(18)

SURGICAL MANAGEMENT-

A Deviated nasal septum can present in two ways, it can either have no symptoms and therefore no ramifications in the patient's life or it can produce mechanical nasal obstruction giving rise to symptoms or cause significant cosmetic disfigurement. The asymptomatic deviated nasal septum is usually minor and requires no treatment, while symptomatic conditions have to be managed surgically. The symptoms initiating surgical management are ill ventilation of the paranasal sinuses and middle ear causing recurrent sinusitis, recurrent headaches and epistaxis. Correction necessitates a targeted, anatomically based therapy. The "four R's" of nasal septal repair (resection, repositioning, reconstruction, and replacement) can be performed to straighten the septum and improve nasal look and function(2). The first step in giving appropriate support to the nasal architecture is to restore the location of the septum at the midline. Extracorporeal septoplasty and anterior septal transplantation are frequently required methods for septum correction and dorsal rectification. Asymmetric procedures to the bone dorsum and midvault are then done to restore symmetry (19).There are two approaches available for an otolaryngologist to use while managing a case of deviated nasal septum. They can either opt for SMR (sub mucus resection of nasal septum) or they can go for septoplasty. The more widely performed surgery is the latter one. Sub mucus resection of nasal septum is generally performed under local anaesthesia except for in children. The patient is reclined and the head end of the table is raised. The first obvious step in the procedure is providing

local anaesthesia using 2% Xylocaine and 1:50,000 Adrenalin. Adrenalin is used because it is a vasoconstrictor which not only provides a bloodless field to the surgeon but also increases the duration of action of the local anaesthetic agent (21). The site for infiltration is the subperichondrial plane. After this, an incision, while should be curvilinear, is made to the left mucocutaneous junction of the deviated nasal septum. The mucoperichondrial and mucoperiosteal flaps are then elevated. After elevation of these two of these two, the cartilage is also incised. The mucoperichondrial and periosteal flaps of the opposite sides are also elevated. The deviated cartilage and bone are finally removed by Ballenger swivel knife and Luc's forceps respectively. Next, the initial mucoperichondrial incision is stitched back by silk stitches. Finally, the wound is packed with antibiotic and after that nasal dressing is applied. A major disadvantage of sub mucus resection surgery is that it is not a conservative approach. A huge chunk of septal bone and cartilage is removed. This removal is acceptable only when the septal bone or cartilage is required for the purpose of grafting. Another drawback of sub mucus resection is that it cannot be performed on patient below 17 years of age as it can affect the nasal growth of the child. It has more chances of complications like supratip depression, columellar recession or flapping of septum. In case of complication, re-operation is also difficulty. (20) It is due to these disadvantages that nowadays septoplasty is preferred over sub mucus resection. Septoplasty being a conservative technique involves removal of only the most deviated part, the rest of the septum corrected and repositioned artificially. (20-26) Flaps are raised only on one side while those of the opposite side are partially elevated. There are different types of incision used in septoplasty, namely Killian's, transfixion, hemitransfixion and horizontal. The complications of both the nasal septal defect correction surgeries are almost same. They include bleeding, septal haematoma, toxic shock syndrome, depression of bridge, saddle nose deformity and perforation.

CONCLUSION:

Deviated nasal septum is one of the most common nasal defects that an otolaryngologist encounters in their clinic. It presents most commonly with obstructive manifestations and sometimes in association with sinusitis. There occurs hypertrophy of the inferior turbinate with loss of cilia on the convex side. There is squamous metaplasia and lymphocytic infiltration with increased saccharin clearance time. Symptomatic nasal septal defect is

corrected by either sub mucus resection or septoplasty. Septoplasty being a conservative procedure is generally preferred as cartilage and bone are preserved. Both the surgeries share complications.

References:

1. Higuera S, Lee EI, Cole P, Hollier LH, Stal S. Nasal trauma and the deviated nose. *Plast Reconstr Surg*. 2007 Dec;120(7 Suppl 2):64S-75S.
2. Sykes JM, Kim J-E, Shaye D, Bocchieri A. The importance of the nasal septum in the deviated nose. *Facial Plast Surg FPS*. 2011 Oct;27(5):413-21.
3. Kumar L, Belaldavar BP, Bannur H. Influence of Deviated Nasal Septum on Nasal Epithelium: An Analysis. *Head Neck Pathol*. 2017 Dec;11(4):501-5.
4. Kim TK, Jeong JY. Deviated nose: Physiological and pathological changes of the nasal cavity. *Arch Plast Surg*. 2020 Nov;47(6):505-15.
5. Moorthy P, Kolloju S, Madhira S, Jowkar A. Clinical Study on Deviated Nasal Septum and Its Associated Pathology. *Int J Otolaryngol Head Neck Surg*. 2014 Jan 1;03:75-81.
6. Taghiloo H, Halimi Z. The frequencies of different types of nasal septum deviation and their effect on increasing the thickness of maxillary sinus mucosa. *J Dent Res Dent Clin Dent Prospects*. 2019;13(3):208-14.
7. Mladina R, Cujic E, Subarić M, Vuković K. Nasal septal deformities in ear, nose, and throat patients: an international study. *Am J Otolaryngol*. 2008 Apr;29(2):75-82.
8. Prasad S, Varshney S, Bist SS, Mishra S, Kabdwal N. Correlation Study Between Nasal Septal Deviation and Rhinosinusitis. *Indian J Otolaryngol Head Neck Surg*. 2013 Dec;65(4):363-6.
9. O'Reilly BJ, Simpson DC, Dharmaratnam R. Recurrent epistaxis and nasal septal deviation in young adults. *Clin Otolaryngol Allied Sci*. 1996 Feb;21(1):12-4.

10. Damar M, Dinç AE, Erdem D, Bişkin S, Eliçora SŞ, Kumbul YÇ. The role of the nasal and paranasal sinus pathologies on the development of chronic otitis media and its subtypes: A computed tomography study. *Niger J Clin Pract.* 2017 Sep 1;20(9):1156.
11. Sam A, Deshmukh PT, Patil C, Jain S, Patil R. Nasal Septal Deviation and External Nasal Deformity: A Correlative Study of 100 Cases. *Indian J Otolaryngol Head Neck Surg.* 2012 Dec;64(4):312–8.
12. Altundag A, Salihoglu M, Tekeli H, Saglam M, Cayonu M, Hummel T. Lateralized differences in olfactory function and olfactory bulb volume relate to nasal septum deviation. *J Craniofac Surg.* 2014 Mar;25(2):359–62.
13. Magliulo G, Iannella G, Ciofalo A, Polimeni A, De Vincentiis M, Pasquariello B, et al. Nasal pathologies in patients with obstructive sleep apnoea. *Acta Otorhinolaryngol Ital Organo Uff Della Soc Ital Otorinolaringol E Chir Cerv-facc.* 2019 Aug;39(4):250–6.
14. Sahin E, Songur MS, Kantekin Y, Bayhan HA, Can IH. Effect of Deviated Nasal Septum on Choroidal Thickness. *J Craniofac Surg.* 2020 Aug;31(5):e439.
15. Illum P. Septoplasty and compensatory inferior turbinate hypertrophy: long-term results after randomized turbinoplasty. *Eur Arch Oto-Rhino-Laryngol Off J Eur Fed Oto-Rhino-Laryngol Soc EUFOS Affil Ger Soc Oto-Rhino-Laryngol - Head Neck Surg.* 1997;254 Suppl 1:S89-92.
16. Kamani T, Yılmaz T, Sürücü S, Bajin MD, Günaydın RÖ, Kuşçu O. Histopathological changes in nasal mucosa with nasal septum deviation. *Eur Arch Oto-Rhino-Laryngol Off J Eur Fed Oto-Rhino-Laryngol Soc EUFOS Affil Ger Soc Oto-Rhino-Laryngol - Head Neck Surg.* 2014 Nov;271(11):2969–74.
17. Berger G, Hammel I, Berger R, Avraham S, Ophir D. Histopathology of the inferior turbinate with compensatory hypertrophy in patients with deviated nasal septum. *The Laryngoscope.* 2000 Dec;110(12):2100–5.
18. Sumaily I, Hudise J, Aldhabaan S. Relation between deviated nasal septum and paranasal sinus pathology. *Int J Otorhinolaryngol Head Neck Surg.* 2017 Sep 22;3(4):786.

19. Loyo M, Wang TD. Management of the Deviated Nasal Dorsum. *Facial Plast Surg* FPS. 2015 Jun;31(3):216–27.
20. Dhingra, P.L. (2004) Nasal septum. In Dhingra, P.L., Ed., *Diseases of ear nose and throat*, 3rd edition, Elsevier, New Delhi, 80-112.
21. Tripathi, K. D. (2018). *Essentials of medical pharmacology* (8th ed.). Jaypee Brothers Medical.
22. Ghavat, Chinmay, Nitin Bhola, Anendd Jadhav, Nupoor Deshpande, and Chetan Gupta. “Malignant Transformation of Solitary Cyndroma Involving the Frontonasal Region- A Rarity.” *JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH* 14, no. 4 (April 2020): ZD1–4.
<https://doi.org/10.7860/JCDR/2020/43006.13620>.
23. Jain, Shraddha, Prajakta Bhalerao, and Chandraveer Singh. “A New Endoscopic and Anatomical Classification of Deviated Nasal Septum with Clinical Relevance.” *MEDICAL SCIENCE* 24, no. 104 (August 2020): 2544–54.
24. Singh, Chandra Veer, Shraddha Jain, Sagar Gourkar, and Sandeep Iratwar. “Salvage of Failed Endovascular Management of Internal Carotid Artery Injury during Endoscopic Endonasal Pituitary Surgery.” *JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH* 14, no. 12 (December 2020): MD01–4.
<https://doi.org/10.7860/JCDR/2020/43778.14310>.
25. Singh CV, Jain S, Parveen S, Deshmukh P. The outcome of fluticasone nasal spray on anosmia and triamcinolone oral paste in taste dysgeusia in COVID-19 patients. *AMERICAN JOURNAL OF OTOLARYNGOLOGY*. 2021 Aug;42(4).
26. Singh CV, Jain S, Parveen S. The outcome of fluticasone nasal spray on anosmia and triamcinolone oral paste in dysgeusia in COVID-19 patients. *AMERICAN JOURNAL OF OTOLARYNGOLOGY*. 2021 Jun;42(3).