

ASSOCIATION OF SINUSITIS WITH DEVIATED NASAL SEPTUM IN PATIENTS PRESENTING TO TERTIARY CARE HOSPITAL

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Abstract

The deviated nasal septum (DNS) is a variation in anatomy more than likely to have a major impact on the airflow and functionality of the nose. Numerous complications are often related to it such as sinusitis which is a disease that is characterized by the inflammation of the paranasal sinuses. The purpose of the cross-sectional study was to determine how frequent sinusitis occurs in patients with DNS and test the impacts of the side of DNS on the sinusitis. The study was carried out at the Khyber teaching hospital in Peshawar using 196 patients diagnosed with DNS and who had undergone functional endoscopic sinus surgery (FESS). Patient demographics such as age, gender, and body mass index (BMI) were recorded. Information was gathered on the side of nasal congestion and existence of sinusitis, which was established using endoscopic examination. The findings demonstrated a high rate of sinusitis among the patients with DNS and an important relationship between the side of the septal deviation and sinusitis. These results make clear the DNS in the pathophysiology of sinusitis and the relevance of the deviated septum in the treatment of patients with chronic sinus complications. The study proposes more research on the long-term effects of surgical procedures performed on DNS as a remedy to make the sinus healthier and against the occurrence of recurring sinusitis.

INTRODUCTION

The human nasal septum is the imperative structure of nasal cavity - consists of both bony and cartilaginous coverage - which divides the nasal cavity into two opposing parts, and is directly associated with the functionality and aestheticism of the nose. The main role of the nasal septum is to control the airflow and make the process of gasses exchange efficient during respiration stimulated by laminar flow in the nasal cavity. It further aids humidification and warming up of the inspired air, which is necessary in guarding the lower respiratory tract. Deviated Nasal Septum (DNS), which consists of a deviation of the septum, is a rather common anatomical variant, but also one of the most

diagnosed diseases in otolaryngology (Hassan et al., 2015). DNS may be caused by congenital malformations, trauma, or normal developmental processes and may result in significant influences on the dynamics of nasal airflow, and the resulting clinical conditions and complications vary widely (Kumar et al., 2018).

DNS can be categorized as two broad groups namely; septal deviation to the left or right side resulting in asymmetry within the nose openings. Although a large portion of people with DNS is not subject to any symptoms, the rest of them may have various symptoms (nasal congestion, mouth breathing, snoring, sleep disturbance) that may affect the quality

of life (Ramanathan et al., 2020). DNS may be mild with a few deviations to severe cases that lead to high rates of blocking the nose. Sinusitis, or the inflammation of the paranasal sinuses, is one of the most widespread complications in the DNS group; it may lead to the development of nasal discharge, pain in the face, headache, and dysfunction of the sense of smell (Demirci et al., 2016).

DNS and sinusitis are somehow linked together and although it had been determined that DNS is one of the aspects that result to the development of sinusitis, what specific pathophysiological processes have not been explicitly established, and it is something that scientists continue to investigate. DNS causes the disruption of the key role of nasal septum in smooth airflow and therefore causes the nasal airflow to be turbulent. This impairment is connected with obstructed mucociliary clearance, a mechanism of moving the mucus and pathogens out of the respiratory pathway (Wang et al., 2016). The change in the dynamics of airflow through the side effects of DNS can lead to insufficient aeration of the sinuses, which still favors the accumulation of mucus and the proliferation of pathogens, which increases the risks of developing sinusitis (Yang et al., 2020). Moreover, DNS may cause alterations of anatomy and physiology of the paranasal sinuses, such as its narrowing or stenosis, a potential significant drainage pathway to the maxillary, frontal, and anterior ethmoidal sinuses; the osteomeatal complex (Aro et al., 2020).

Generally, sinusitis can be categorized into two categories which include acute and chronic. Acute sinusitis is usually a result of viruses or bacteria infections, and it is often self-limiting, whereas chronic one lasts longer, more than 12 weeks, and usually relates to some underlying structural abnormalities, including DNS (Murray et al., 2019). Chronic sinusitis is more stubborn and a patient with this disease can experience a serious decrease in quality of his life with an attitude of nasal congestion, post-nasal drip, pain in the face and tiredness. It is therefore necessary that clinicians establish and treat the underlying causes of the chronic sinusitis including DNS in an attempt to design effective treatment options.

DNS and sinusitis have recorded correlations well in a number of studies. The study suggests that DNS

can predispose people to infections of the chronic sinusitis because of such structural and functional disruption of the nasal cavity (Demirci et al., 2016). Alsaggaf et al. (2022) showed that the prevalence of sinusitis was high in patients with DNS than in patients without DNS and that the septal deviation is associated with the development of sinusitis, indicating that septal deviation is a component of pathogenesis of sinusitis. In the same manner, Cengiz et al. (2013) revealed that mucociliary dysfunction and excess prevalence of sinusitis were common among patients with DNS, which makes the hypothesis that DNS is essential in the pathogenesis of sinusitis even stronger.

Though, DNS contributes to sinusitis very much, the exact processes by which DNS worsens sinusitis are yet to be fully understood. A suggested mechanism is the effect of DNS on sinus drainage pathway. This deviation of the septum may result in stenosis of or even blockage in the natural drainage pathways of the sinuses, including osteomeatal complex, a very important passageway in sinus ventilation and mucus drainage (Yang et al., 2020). This block may cause buildup of mucus in the sinuses which is a conducive place to breed the bacteria to cause sinus infections. Also, DNS could disrupt mucociliary clearance, which is one of the effective defensive actions to eliminate pathogens and sinus debris (Demirci et al., 2016). The mucus, when not cleared properly, is retained leading to elevated chances of colonization by bacteria and subsequently sinusitis.

The side of the septal deviation is another consideration of the connection between DNS and sinusitis. Researches have indicated that the severity of the sinusitis might differ in accordance with the side of deviation. Namely, sinusitis usually affects the concave side of the septal deviation more potently because the airflow becomes more turbulent and the mucociliary dysfunction more evident (Wang et al., 2016). The implication that can be drawn out of this finding is that to treat sinusitis adequately, the side of DNS should be a serious consideration during diagnosis and treatment because it can help influence clinicians when deciding the best treatment measure to take like whether to perform septoplasty or functional endoscopic sinus surgery (FESS).

The role of DNS on the noso-sinus anatomy emphasizes the fact that one has to act upon this condition in patients who present with chronic sinusitis. It has also been observed that surgical procedures, which include septoplasty to rectify the nasal septal deviation, have an ameliorating effect on sinus functionality and minimizes recurrence and severity of sinus infections (Aro et al., 2020). Septoplasty may improve the symptoms of sinusitis and decreases the requirement to have long term medical management by restoring normal nasal airflow and enhancing the process of mucociliary clearance. The combination of septoplasty and FESS, in patients with chronic sinusitis and DNS, can bring a lot of relief and general sinus health (Demirci et al., 2016).

Finally, DNS is a prevalent anatomic variant, which may considerably affect nasal and sinus health. The association between DNS and sinusitis is well established and DNS is reported to be among the factors that contributes to the development and worsening of sinusitis. Mucociliary, sinus aeration, and osteomeatal complex obstruction induced by DNS block up the nasal circulation, which results in sinus infection. DNS is a key factor in the development of sinusitis and its complete mechanism of action is very important in the design of treatment plans and outcome improvement. More studies are required to understand the long term capabilities of surgical interventions for the patients of DNS and chronic sinusitis regarding prevention of further infections and improvement of sinus health.

Objectives

The main objective of the study is to explore the correlation between Deviated Nasal Septum (DNS) and sinusitis; in patients attending in a tertiary care hospital. In this study, the scope will include the identification of the prevalence of sinusitis among the patients with DNS and also find out the correlation between the side of the nasal septal deviation and the relationship with the frequency of sinusitis or its severity. Through these relationships, the study aims at achieving deeper insights on the impact of DNS on the development and prevalence of Sinusitis, an ailment of the upper respiratory tract, which is common and a debilitating condition in many cases.

Primary Objective

The aim of the study is to identify the prevalence of sinusitis among the patients with DNS. Sinusitis is a common disease and the chronic one is especially difficult to treat, as it leads to frequent contaminations, reoccurring symptoms and significant diminishment in the quality of patients' lives. It is believed that DNS has a role to play in the occurrence of sinusitis because deviations of the nasal septum may cause distortion of the normal flow of air, insufficient sinus ventilation and denying the flow of mucociliary. The hypothesis of this research is that DNS patients will have a higher preponderance of sinusitis when compared to non-DNS patients. The study will confirm the prevailing rate of sinusitis in patients with DNS and thereby prove the importance of DNS as a risk factor of sinusitis in the tertiary care center.

Secondary Objective

The secondary goal of the present research is an evaluation of the relationship between the side of the deviated nasal septum and the existence or gravity of sinusitis. Left-sided or right-sided deviation DNS can be also distinguished and there is a risk that deviation may be reflected in the development of sinusitis. Part of the literature reports that sinusitis is more extensive on the concave side of the septal deviation, with air circulating more turbulently and mucociliary motility affected (Wang et al., 2016). This goal will examine the possibility of increased occurrence of sinusitis on the concave side of the deviation of DNS and thus provide knowledge on the anatomical/functional effects of deviation.

Tertiary Objective

Besides these objectives which are direct and indirect there is a broader knowledge contribution that the study makes in the area of otolaryngology which is to determine the possible treatment options of patients with DNS and sinusitis. These are some of the studies that involve the contribution of DNS correction (surgery) or septoplasty to the number and severity of sinusitis. The study points out the need of diagnosing and treating DNS early to avoid advances of sinusitis and its complications. With a deeper understanding of the pathways between DNS and sinusitis, clinicians can take up more useful

treatment regimens which could help to cut down the presence of long-term medical management and solutions that are to be taken by the sufferer thus improving his/her total patient outcome.

Long term objective

As well, the research design helps in production of evidence that can be utilized in making clinical decisions concerning diagnosis and care of patients of chronic sinusitis and DNS. The presentation of unprecedented information on the prevalence and correlation between DNS and sinusitis should bridge current knowledge gaps and guide best practice by otolaryngologists especially in the tertiary care medical complex where more complicated cases are handled. Hopefully, this research will result in design of customized treatment regimen which will take into account both structural and functional side of DNS in cases where the subject is sinusitis. Also, the results may promote future studies about the contribution of DNS in the overall scenario of the upper respiratory disorders which may result in better preventive measures and treatment methods of the victim.

The study offers valuable information on the linkage between DNS and sinusitis, how septal deviation affects the conditions of sinuses, and what goals can be taken by healthcare professionals to manage and treat such interdependent conditions. The research objectives are the determination of prevalence of sinusitis, determination of the effect of septal deviation on the severity of sinusitis and finally adding to the body of knowledge of evidence-based practice in the management of DNS-related sinusitis. With these objectives, the study enhances the management of patients in tertiary health-care institutions and offers a basis upon which other studies can be conducted in this branch of medicine, otolaryngology.

Methods and Materials

In this section of the research, the design, the setting of the study, sample selection, data collection process, and statistical analysis method are defined in a manner to explore the correlation between Deviated Nasal Septum (DNS) and sinusitis experienced by patients attending a tertiary care hospital. The methodology follows the rules of

transparency, replicability, and ethical research behavior, as the results of the study are not only valid but reliable.

This research implements a cross-sectional study design that is largely suitable in understanding a condition like sinusitis in a given population at a given time. The problem that can be assessed through cross-sectional approach is that the data about the prevalence of sinusitis in persons with diagnosed DNS will be gathered along with a sample of patients at a tertiary care hospital. This design can as well be used to study the relationships between DNS and sinusitis and the relationship between the side of nasal septal deviation and presence of sinusitis.

The study was carried out in the Department of Otolaryngology (ENT) Khyber Teaching Hospital (KTH), Peshawar, Pakistan. KTH is a tertiary medical institution which deals with advanced treatment services to patients in a wide geographical area. ENT department is a place where patients with DNS and chronic sinusitis come and that is why the hospital in the research is a good choice. The group of patients is different compared to others in terms of level of DNS and sinusitis, and this phenomenon explains why the connection between these two conditions can be thoroughly studied.

The research began in a span of six months after the research synopsis was approved. This time brought enough time to take an adequate number of patients, carry out endoscopic conclusions, and analyze the data. The 6 months duration of study also aided in the gathering of a large array of cases, which could be analyzed quite well statistically.

Calculation of Sample size

This study sample size was computed by the World Health Organization (WHO) sample size calculator. It was calculated that based on the expected percentage population of 51.3 of patients with DNS having sinusitis (obtained using existing literature), the number of participants needed to make a 7 percent margin of error and 95 percent level of confidence was 196. This sample will make the study have a statistical power to identify meaningful relationships and give a correct estimate of the prevalence of sinusitis among patients with DNS.

Sampling Technique

The study used a non-probability consecutive sampling method in choosing the study participants. In the given approach, all the patients that had the inclusion criteria at the study period and appeared at the ENT department with DNS were included in the study. The absence of selection bias can be achieved through the consecutive sampling whereby all the patients who meet the requirements are considered regardless of the number of patients attending the hospital during the time frame set. This method is also especially popular with clinical research when there is an inability to randomly select the subjects, especially in an environment where pool of patients is easy to access.

Inclusion Criteria

The patients who participated in the study were those who fulfilled the following criteria:

1. Age: Thirty-four people joined the experiment who were aged between 18 to 60 years. This age category covers a significant percentage of patients who have high chances of developing DNS and sinusitis as both diseases are frequently identified among adults.
2. Gender: The study sample was also gender representative because the inclusion of both males and females was allowed.
3. Diagnosis: The study was open to any patient who was clinically diagnosed with Deviated Nasal Septum (DNS), as it was confirmed using a physical examination (speculum examination).
4. Surgical Procedure: Patients who were slated to have Functional Endoscopic Sinus Surgery (FESS) to tackle their problem of chronic sinusitis were also enrolled because the process also provides a chance to have the sinuses visible with the use of endoscope.

Exclusion Criteria

The patients who fulfilled the following characteristics were not selected:

1. Previous Nasal Surgery: The patient historically has undergone a previous nasal surgery and thus patients with previous nasal surgery would have had confoundery based on previous surgical interventions.
2. Nasal Trauma: Patients who had experienced nasal trauma in the past were to be avoided since nasal

trauma could inherently cause alteration of the nasal passages structure and functionality.

3. Perforated Nasal Septum: Patients with perforated nasal septum were eliminated as it was found that the later may have different pathological processes, independent of DNS.

Procedure of Data Collection

Some of the key steps included in data collection process were:

1. Informed Consent: All the patients in the study signed an informed consent. The knowledgeable process was provided to the participants involved in the study concerning the objectives of the study, the procedures required and the possible risks associated with the process. Informed consent was done by signing, and the ethical rules were followed.
2. Patient Demographics: The demographic characteristics of the patients were also noted and they included the age, gender, body mass index (BMI), residence (Urban / Rural), level of education, occupation and his/her socioeconomic status (SES). These are relevant because they could be associated with predisposition of DNS and sinusitis, and they have been accommodated to allow possible stratification in data analysis.
3. Nasal Examination: The speculum examination of nasal cavity was done to establish the side of DNS and its presence. DNS was defined as the condition when the deposition of the nasal septum was evident to one side, asymmetry of the nasal cavities results and one hole is evidently larger than the other.
4. Endoscopic Sinus Examination: A nasal endoscopy was performed on the patients using a 0 or 30 o rigid endoscope and enabled them to see the nasal cavity and the paranasal sinuses in detail. In the endoscopy, the diagnosis of sinusitis condition was performed according to the findings of the sinuses, such as the edematous mucosa, purulent mucus, and other indicators of inflammation. The abnormalities in these features were diagnosed with sinusitis.
5. Data Recording: The principal investigator (researcher) documented data carefully on a specially designed proforma (Annexure 1) and data would include all important clinical and demographic data which would be appropriately recorded in order to analyse the data.

Data Analysis

The analysis of the data was done using IBM SPSS version 25, a popular statistical software in the analysis of the clinical data. The statistical methods used are the following:

1. Descriptive Statistics: The descriptive statistics were calculated which means and standard deviations (SD) of continuous variables like age and BMI and frequencies and percentages of categorical variables like gender, residence and presence of sinusitis were calculated. This gave a description of sample characterization.
2. Normality Test: Shapiro-Wilk test was performed on the continuous variables (i.e. age and BMI) of each group to test the normalcy. In case of non-normality of data, median and interquartile range (IQR) were applied as summary statistics.
3. Chi-Square Test: The Chi-square test of associations for the categorical variables was used to determine the relationship between DNS and the existence of sinusitis. The statistical test decided whether it was statistically significant or not that there was a relationship between DNS and sinusitis. Fisher Exact Test was the alternative in cases where the frequencies were assumed small.
4. Stratified Analysis: Stratification was done on the basis of the age, gender and BMI to take care of any confounding effects. The relationships with these variables were considered by means of post-stratification analysis utilizing the Chi-square test to examine the relationship with DNS and sinusitis.
5. Significance Level: All the tests were statistically significant up to a p-value of <0.05.

Ethical Considerations

The investigation was done in accordance with the ethical requirement as set out in the declaration of Helsinki and the study was accepted; it was reviewed by the Research Ethics Review Board (IRB) of Khyber Medical College and Khyber Teaching Hospital, Peshawar. Patient enrolment was done only after an ethical approval and patient confidentiality was observed during the study process. Data were stored in a safe place and the privacy of all personal and clinical data was maintained so that no one could access the data.

Limitations

Although this study has given good knowledge on the connection between DNS and sinusitis, a number of limitations should be noted. The cross-sectional design restricts the possibility of drawing the causal relationships between the DNS and sinusitis. Moreover, the single-tertiary care hospital may restrict the ability to generalize might be limited to other contexts. Evidence that can support this relationship can be enhanced through further investigations of longitudinal designs and multi-center studies.

Discussion and Results

This study was mainly done to examine the relationship between Deviated Nasal Septum (DNS) and sinusitis among the patients, who attended an apex care hospital. One hundred and ninety six patients who fit the inclusion criteria were recruited in the study. Table 1 presents the demographic nature of the study population.

Demographic Characteristics

The participants included in the study had a mean age of 38.4 12.5 years with an axis of 18-60 years. The gender structure was quite equal (102 male patients or 52 percent and 94 female patients or 48 percent). There were 67 percent participants with an urban background and 33 percent with a rural background. The participants possessed the body mass index (BMI) of 18.5 to 35.6 kg/m² with the mean of 25.2 +/- 3.5 kg/m². The participants were mostly educated (high school education or above, 78 %), and most patients were working in jobs that needed physical effort (65 %).

Extent of Sinusitis in patients of DNS

Among the 196 patients with DNS, sinusitis was established in 107 (54.6 %) of them and 89 (45.4 %) of our patients had no signs of inflammation of the sinuses. The presence of sinusitis was established counting the endoscopic examination results, namely edematous mucous lining, purulent mucus and other signs of inflammation seen in the paranasal sinuses. Such observations concurred with the diagnostic criteria of sinusitis, as available in the literature (Murray et al., 2019).

It was found that sinusitis was more found in patients with severe DNS, in which there was significant blockage of the nasal airway because of septal deviation. In particular, 72 per cent of severe DNS patients had sinusitis, whereas 47 per cent of mild DNS patients did not reveal this problem. Based on this finding, it could be considered that the severity of septal deviation is related to the incidence of sinusitis and proves earlier studies demonstrating DNS as a risk factor of sinus pathology (Demirci et al., 2016).

DNS and side of Sinusitis

The existence of the connection between the side of DNS and the occurrence of sinusitis was one of the main purposes of this research. The findings provided evidence that the side of DNS is connected significantly to sinusitis ($p < 0.05$). Sinusitis was more frequent with respect to the convex side of the septal deviation, with interruption of the airflow. Out of 107 patients diagnosed with sinusitis, 75 percent of them had sinusitis of the concave side of the septum as compared to the other 25 percent with sinusitis of the convex side. The result corresponds with prior research, which demonstrated that the concaveside of DNS was likely to be more severe than sinusitis because of a changed mucociliary clearance and airflow dynamic (Wang et al., 2016).

Demonstration Variables of Demographics Gender, Age, and Others

The study also sought to establish whether other demographic factors like age, gender, BMI and residence (rural or urban) played roles in establishing the correlation between DNS and sinusitis. A stratified analysis of sinusitis showed that it occurred more in older patients whereby the prevalence in patients at 40 years and above was 60 percent compared to younger patients who had 49 percent prevalence. Nevertheless, this difference was not significant ($p = 0.08$), which makes it possible to conclude that age is not a factor that significantly affects the presence of sinusitis in DNS patients.

The gender of patients was almost equally distributed between sinusitis male-only patients 56% and female-only patients 53%; however, the gap was insignificant with a p value of 0.67. On the same note, even though the prevalence of sinusitis was

slightly increased in patients with a higher BMI (overweight and obese), the association was weak, with $p = 0.12$.

The severity of Sinusitis

The degree of sinusitis in DNS patients was classified according to the level of the sinus involvement on the endoscope examination. Most cases of sinusitis were found to be mild (40 percent), moderate cases were 35 percent, and the number of severe cases was 25 percent of all cases. Interestingly, there was a positive correlation between the degree of septal deviation and severity of sinusitis; the severity of septal deviations showed a positive correlation with severity of sinusitis, where in, patients with high degrees of septal deviations tend to portray moderate or severe sinusitis in nature. This observation implies that DNS not only promotes the risks of sinusitis but can also worsen its condition, which could be caused by the prolonged congestion and ineffective aeration of the sinuses (Aro et al., 2020).

Discussion

The results of our research papers are significant evidence on the relationship between DNS and sinusitis among patients who arrive in a tertiary care institution. The prevalence of sinusitis among the study population was significantly high in the DNS patients with 54.6 percent of the study population recording sinusitis. This finding is in line with the published literature that considers DNS as one of the predisposing factors in the occurrence of sinusitis because it influences the airflow of the nose and mucociliary clearance (Hassan et al., 2015; Demirci et al., 2016). Results of the study also indicated that the extent of septal deviation in most cases determines the frequency and severity of sinusitis where severe DNS had greater sinusitis.

Pathophysiological Mechanisms

A connection of DNS with sinusitis can be described through multiple pathophysiologic processes. DNS interferes with typical air movement through the nasal passages making movement turbulent and interrupting mucociliary clearance, an extremely critical approach to eliminating mucus, pathogens, and particulate matter in the sinuses (Yang et al., 2020). Interference of such a clearance process

enhances the retention of mucus and causes sinus congestion increasing the chances of infection. Also, DNS can lead to value blockage of the osteomeatal complex (OMC) that serves as a crucial drainage route of the sinuses, such as the maxillary, anterior ethmoidal, and frontal sinuses (Wang et al., 2016). In case of the crookedness of the septum, the pathway can be blocked, which leads to the difficulty in draining the sinuses and providing them with air. This leads to mucus being trapped in the sinuses where bacteria or virus could grow perfectly and lead to the condition called sinusitis.

Sinusitis and side of DNS

The issue of the effect of the side of septal deviation on development of sinusitis was also to be investigated. The results indicated a considerable relationship between DNS and sinusitis on the concavo side of the septal deviation. This finding is congruent with other studies which have indicated that the concave side of DNS tends to become susceptible to sinusitis given the lack of the dynamics of the airflow, which aggravates mucociliary dysfunction (Demirci et al., 2016). The airway through the concave side of the nose is frequently blocked and therefore creates poor drainage and aeration of the sinuses, predisposing the person to chronic sinusitis.

There is also a greater likelihood of inflammation to occur on the concave side since the flow of air is altered, enhancing further the sinus pathology. This observation emphasizes the value of evaluating the side of DNS in clinical management of sinusitis, which could affect therapeutic choices, especially regarding surgical procedures (septoplasty, function endoscopic sinus surgery (FESS)), (Aro et al., 2020).

Demographic Factors and sinusitis

Demographic factors like age, gender and BMI in development of sinusitis in DNS patients was also explored. Though the research showed higher incidences of sinusitis in the elderly populations and high BMI, the two were not statistically linked. Past research has also confirmed that although some aspects related to demography could affect the prevalence of sinusitis, there is a stronger relationship between DNS and sinusitis and the structural deviations portrayed in the nasal septum as

opposed to some demographic factors such as age or sex (Kumar et al., 2018).

Clinical Implications and Treatments Implications

The findings of this study are significant to clinical practice with patients having DNS and sinusitis. The results indicate that DNS is a risk factor of sinusitis but the version of septal deviation is substantial. This provides emphasize that, in patients with chronic sinus symptomatic patients, it is important to assess DNS as correcting the underlying septal deviation can potentially serve to lessen the future episode of sinusitis and its severity.

Clinically, septoplasty is still the gold standard of correcting DNS and enhancing air passages of the nose. Various researches proved that surgical correction of DNS could bring about the significant improvement of sinus functionality testing, because in this case, sinus airflow is restored, and the mucociliary clearance is stimulated (Aro et al., 2020). Also, during the concomitant use of septoplasty and Functional Endoscopic Sinus Surgery (FESS), the drainage of the sinuses can be optimized even more and alleviate the chronic sinusitis symptoms. In case of severe DNS and sinusitis, a combination of septoplasty with FESS is frequently prescribed to enhance health of nose and sinuses.

Limitations and Recommendations

However, several limitations should be noted despite the fact that the study in question gives important information about the correlation of DNS and sinusitis. The cross-sectional design imposes a bias to determine causality between DNS and sinusitis. Moreover, this research was carried out in one tertiary care hospital that potentially restricts the application of results to other facilities. The prospective study would help more in future studies as longitudinal research design would be applicable in understanding the long-term effects of DNS correction on incidence and severity of sinusitis. Multi-center researches would also assist to legitimize the results and make the results more generalizable. Finally, it is shown in this study that there is a close relationship between sinusitis and DNS with more severe conditions in the former presenting higher cases of sinusitis. The concave side of the DNS was proven to have a significant effect on the prevalence

of sinusitis, whereby sinusitis prevailed in the concave side of the deviation. Findings indicate that DNS treatment by surgery, especially septoplasty and FESS can be a source of important clinical gains to the patients with chronic sinusitis with respect to nose/sinus health improvement. These results require further studies, especially in the realms of longitudinal research, to be verified; the long-term impacts of DNS correction as a sinusitis prevention and treatment option should be researched, though.

Conclusion

This paper has given strong arguments on how large is the correlation between Deviated Nasal Septum (DNS) and sinusitis among patients who report in a tertiary care hospital. The results are that DNS is a frequent anatomical variant and a predisposing factor of development and aggravation of sinusitis. In a case where 54.6 percent of the patients with the DNS also exhibited sinusitis, the study brings out the high rate of sinusitis in cases with DNS. The fact that the severity of DNS is closely correlated with the severity of sinusitis also proves the concept that DNS contributes significantly to the process of pathogenesis of the problems in the taste of the sinuses. More specifically, it was discovered that the side of septal deviation significantly influences sinusitis with the concave side of such deviation being more subject to sinus infections because of the proper air circulation being disturbed and of the mucociliary action being impaired.

The paper also highlights the need to know the pathophysiological ways through which DNS affects sinus well-being. DNS interferes with the airflow, a fact which results to turbulence that adversely influences mucociliary clearance and sinus ventilation. This interference causes retention of mucus and conducive environment to sinusitis, especially on the concave side of the septal deviation whereby the airflow dynamics is most affected. These results justify the importance of comprehensive clinical assessment of DNS patients and chronic sinusitis in particular because it may change the results of the treatment greatly due to the recognition of DNS as one of the pathologic factors. In addition, as shown by the study, surgical operations including septoplasty and functional endoscopic sinus operation (FESS) are imperative in

the treatment of DNS-related sinusitis. Septoplasty has the potential to restore normal nasal airflow and enhance mucociliary activity and relieve sinusitis-associated symptoms, as well as to decrease the incidence of sinus infections. The combined intervention strategy using septoplasty and FESS is particularly therapeutic to patients experiencing more serious cases of DNS or chronic sinusitis as not only does this approach enhance nasal health but it also enhances the well-being of the sinuses.

The results of this investigation correlate with the current literature existing in the field that attributes an augmented risk of sinusitis to DNS, and confirms such a hypothesis of DNS criticality of sinus infections development and evolution (Hassan et al., 2015; Wang et al., 2016). Nevertheless, the cross-sectional nature of the research narrows down the possibility to formulate the causation relationships between DNS and sinusitis due to the inability to follow the development of the condition through the passage of time. These findings would be helpful in the confirmation of the results and the investigation of the long-term consequences of DNS correction in the prevention of sinusitis with the help of longitudinal studies.

Also, although the study was performed at one tertiary care facility, the results of this study will be highly applicable in similar care facilities where clinicians will deal with the two patient groups with DNS and sinusitis, seeking treatment. The multi-center studies may further support these findings and give Cliao an idea about the place of DNS in other populations. More diverse sample would also assist in understanding whether these results may be generalized to other region/geographic locations or care settings.

Finally, the study points out the important role of DNS in health conditions of sinuses and it also provides the critical information on the role of DNS in the occurrence and exacerbation of sinusitis. The fact that sinusitis is a common condition affecting DNS patients (particularly those with greater septal deviations) is something that must be given great attention when dealing with the care of such a person. Surgical treatment of DNS can be of significant help to those patients with either DNS and chronic sinusitis who expect to become healthier and not require continued medical procedures. The

further studies are necessary to understand the controversies about DNS and its connection to sinusitis in order to enhance the quality of diagnosis, treatment regimen, and clinical outcomes of patients suffering with these two related disorders. By further research and optimization of treatment approaches, healthcare professionals will be able to meet the requirements of patients with DNS-induced sinusitis more effectively, promote better lives and evade chronic sequela of the track record.

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