



The Correlation Between Type and Degree of Septal Deviation and Incidence of Rhinosinusitis on CT Scan Imaging

Muhammad Bayu Seno Aji¹, Muchtar Hanafi^{1,2*}, Nanang Wiyono^{1,3},
Resta Farits Pradana^{1,2}

1. Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia

2. Department of Radiology, Hospital Universitas Sebelas Maret, Surakarta, Indonesia

3. Department of Anatomy, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia

Corresponding Author: muchtar.hanafi@staff.uns.ac.id

ABSTRACT

Introduction: Nasal septal deviation is a common anatomical abnormality associated with rhinosinusitis due to osteomeatal complex narrowing and mucociliary dysfunction. However, studies exploring this specific relationship remain limited and yield variable results. This study aimed to analyze the relationship between the type and degree of nasal septal deviation and the incidence of rhinosinusitis based on computed tomography (CT) imaging evaluation.

Methods: This observational analytical study used a cross-sectional approach at Sebelas Maret University Hospital from September to December 2025. 28 patients were recruited using a total sampling technique. Key variables evaluated through CT scans included the type of septal deviation (Mladina classification), the degree of deviation, and rhinosinusitis incidence. Data were analyzed using the non-parametric Spearman Rank correlation test.

Results: The sample was dominated by adult (82.1%) and female patients (82.1%). Based on the Mladina classification, type 2 septal deviation was the most prevalent (46.4%). The majority of patients (67.9%) had a mild degree of deviation (angles 0°–9°). Clinically, 46.4% of patients were diagnosed with rhinosinusitis. Statistical tests showed no significant relationship between the type of septal deviation and rhinosinusitis incidence ($p=0.313$; $r=0.198$). Similarly, no significant association was found between the degree of septal deviation and rhinosinusitis incidence ($p=0.703$; $r=0.075$).

Conclusion: There is no significant relationship between the type or severity of septal deviation and rhinosinusitis incidence. Structural anomalies in the nasal septum are not absolute predictors of paranasal sinus inflammation. The multifactorial nature of rhinosinusitis, osteomeatal drainage patency, and aerodynamic adaptation mechanisms play a more crucial clinical role.

Keyword: Septal Deviation; Mladina; Degree; CT Scan; Rhinosinusitis

INTRODUCTION

The nasal septum is a cartilage barrier that divides the nasal cavity into left and right sides. A common pathological condition affecting this structure is septal deviation, which is a shift in the septum's position from its normal straight position to one or both sides of the nasal cavity, causing narrowing of the airway (Mustain et al., 2022). The prevalence of septal deviation is high; for example, one study reported an incidence of up to 74.5% in the United Arab Emirates, and the condition can be found in a wide age range, from neonates to the elderly (Alghamdi et al., 2022). This anatomical abnormality not only causes discomfort during breathing but is also associated with other clinical complications such as obstructive sleep apnea (OSA) and olfactory dysfunction (Valsamidis et al., 2019;

Yeom et al., 2021). One significant health problem closely related to nasal anatomical abnormalities is rhinosinusitis, an inflammation of the nasal mucosa (rhinitis) and paranasal sinuses (sinusitis). According to the European Position on Rhinosinusitis and Nasal Polyps (EPOS), approximately 6–15% of the global population suffers from acute rhinosinusitis, while 5–12% experience chronic rhinosinusitis (Fokkens et al., 2020).

In Indonesia, the prevalence of this condition also varies, with high rates of visits among adults. This disease has a significant impact on public health because it can directly reduce patients' quality of life, hinder work productivity, and increase healthcare costs (Lengari et al., 2023). Pathophysiologically, nasal septal deviation is closely linked to the incidence of rhinosinusitis through two main mechanisms. First, a deviated septum triggers mechanical problems that narrow the osteomeatal complex. Second, this anatomical deviation has the potential to alter the direction of airflow within the sinuses, which in turn leads to impaired mucociliary function. Both conditions result in the retention of secretions within the nose, leading to sinus inflammation and infection (Alsaggaf et al., 2022). If damage to the osteomeatal complex is not properly evaluated and treated, it will lead to an increased incidence of chronic sinusitis in the future (Azzahra et al., 2022).

In establishing a clinical diagnosis and evaluating nasal abnormalities, a Computed Tomography (CT) scan plays an essential role. CT scans are a superior tool because they can provide accurate visualization for both assessing nasal bone abnormalities in septal deviations and detecting specific inflammation in the sinuses. Through CT scanning, septal deviations can be objectively assessed, including identifying the type of deviation (such as using the Mladina classification guidelines) and measuring the angle magnitude, which is categorized into mild, moderate, or severe degrees of deviation. Although previous medical literature has extensively discussed the general correlation between septal deviation and rhinosinusitis, studies that explore this relationship more specifically by simultaneously detailing the type and degree of septal deviation are still limited (research gap).

Given the importance of this anatomical specification in determining the optimal management approach, this study aims to analyze the relationship between the type and degree of septal deviation and the incidence of rhinosinusitis based on CT scan imaging evaluation. The findings of this study are expected to provide a stronger foundation for clinicians in detecting and preventively treating rhinosinusitis in patients with septal deviation.

METHODS

Research Design

This is an observational analytical study using a cross-sectional approach to evaluate the relationship between nasal anatomical abnormalities and the incidence of sinus inflammation. The study has obtained ethical clearance and a valid research permit.

Research Location

This research conducted at Sebelas Maret University Hospital from September to December 2025.

Sampling Techniques

Sample selection was conducted using a total sampling technique, where the entire population meeting the criteria was recruited into the study sample. This technique resulted in a total of 28 patients as the study sample. Data were collected and analyzed objectively through evaluation of CT scan radiology results, which included three main variables; Type of Septal Deviation: Assessed using the Mladina classification guidelines, which divides septal deviations into seven types (Type 1 to Type 7). Degree of Septal Deviation: Measured using a CT scan analysis application to determine the angle of deviation. This measurement was performed by drawing an angle from the line connecting the maxillary

nasal spine to the crista galli, and a line drawn from the crista galli to the most distant point of deviation. Rhinosinusitis Incidence: Rhinosinusitis status is confirmed through radiological findings of inflammation on CT scan imaging, such as the appearance of air-fluid levels or other inflammatory abnormalities in the paranasal sinus area.

Data Analysis Method

All CT scan data were then processed and analyzed using the Statistical Package for the Social Sciences (SPSS) software. Bivariate analysis was used to determine whether there was a statistical correlation between the independent variables (type and degree of septal deviation) and the dependent variable (rhinosinusitis incidence). The statistical method applied to test this hypothesis was the non-parametric Spearman's rank correlation test.

RESULTS

Patient Demographic Characteristics

A total of 28 patient data samples from medical records and CT scan imaging were included in this study. The age characteristics of the sample were dominated by the adult category (18–59 years) totaling 23 patients (82.1%), followed by the adolescent category (10–18 years) totaling 3 patients (10.7%), and the elderly (>60 years) totaling 2 patients (7.1%). Based on gender distribution, the majority of study subjects were female with a total of 23 patients (82.1%), while male patients numbered 5 patients (17.9%).

Distribution of Types and Degrees of Septal Deviation

Based on the Mladina classification, type 2 septal deviation was the most prevalent anatomical abnormality, occurring in 13 patients (46.4%). Other types of septal deviation included type 1 in 6 patients (21.4%), type 5 in 5 patients (17.9%), and type 4 in 2 patients (7.1%). Type 3 and type 7 deviations were each found in only one patient (3.6%), while type 6 septal deviation was not identified in the entire sample population.

Objective measurements using CT scan imaging showed that the angle of septal deviation in the sample ranged from 3.7° to the farthest point of deflection of 21.1°. Categorization based on severity showed that the majority of patients (67.9% or 19 samples) fell into the mild deviation category (0°–9°). Followed by moderate category septal deviation (10°–15°) in 7 patients (25%), and severe category (>15°) in 2 patients (7.1%).

Prevalence of Rhinosinusitis in Patients with Septal Deviation

Clinical and radiological evaluation (using CT scan findings) of rhinosinusitis in patients with septal deviation showed that 13 of 28 patients (46.4%) were diagnosed with rhinosinusitis. The remaining 15 patients (53.6%) showed no evidence of rhinosinusitis, either radiologically or in their medical records.

Correlation Analysis of Independent Variables on Rhinosinusitis

To test the direction and significance of the relationship between anatomical abnormalities of the nasal septum and the incidence of rhinosinusitis, a non-parametric Spearman's rank correlation analysis was performed. The statistical test results of the correlation between the type of septal deviation and the incidence of rhinosinusitis showed a probability value (p-value) of 0.313 ($p > 0.05$), which represents the absence of a statistically significant relationship between the type of septal deviation (based on Mladina) and the incidence of rhinosinusitis. The correlation coefficient (r) value obtained was 0.198, indicating that the strength of the correlation between the two variables is very weak.

The correlation test of the degree of septal deviation against the magnitude of the septal deviation angle yielded a p-value of 0.703 ($p > 0.05$). This demonstrates that clinically and computationally, there is no significant association between the severity of septal deviation and the incidence of rhinosinusitis in this sample. The correlation coefficient (r) was recorded as very low at 0.075.

DISCUSSION

Based on the Mladina classification, this study found that type 2 septal deviation was the most dominant anatomical anomaly, accounting for 46.4% of the total sample population. This finding is consistent with previous studies, such as those by Jan et al. (2023) and Thakur et al. (2019), which also reported that type 2 septal deviation is the most common clinical nasal structural malformation (Jan et al., 2023; Thakur et al., 2019). A similar report by Damanik and Ratnawati (2023) at Sanglah General Hospital also noted a dominant prevalence of type 2 of 49% (Damanik & Ratnawati, 2023). However, other studies show heterogeneity; for example, Moshfeghi et al. (2020) found type 7 to be the most common, while Yildirim and Okur (2003) reported a predominance of type 1 (Moshfeghi et al., 2020; Yildirim & Okur, 2003).

These differences in distribution patterns indicate that the incidence of septal deviation types is variable and may be influenced by differences in patient demographics, ethnicity, or genetic factors and microscopic trauma during embryological development. In terms of severity, the majority of patients in this study (67.9%) fell into the mild deviation category with an angle range of 0° – 9° . This profile is slightly different from the findings of Sharma et al. (2022) who noted a high prevalence of severe septal deviation ($>8^{\circ}$ in their classification system) reaching 63.46% (Sharma et al., 2022). This variability is most likely due to the lack of uniformity in the standard categorization of deviation angles between institutions or differences in inclusion criteria in study design.

The primary hypothesis of this study—which suggested a relationship between the type and magnitude of the septal deviation angle and the pathogenesis of rhinosinusitis—could not be statistically proven. The Spearman correlation test showed a p-value of 0.313 for the type of deviation and $p = 0.703$ for the degree of deviation ($p > 0.05$), indicating no significant causal association between these variables. This lack of a significant relationship contradicts several previous studies, such as those by Jain & Deshmukh (2021) and Sonone et al. (2020), which suggested that sharper nasal structural deviations (higher deviation angles) were associated with a higher likelihood of triggering rhinosinusitis (Jain & Deshmukh, 2021; Sonone et al., 2020).

Furthermore, Bagri et al. (2018) also linked an increasing septal deviation angle to pathological abnormalities such as turbinate hypertrophy and sinusitis (Bagri et al., 2018). However, the independent findings in this study support other literature, such as clinical observations conducted by Prasad et al. (2013), who also failed to find a significant association between septal deviation and rhinosinusitis (Prasad et al., 2013). Mechanistically and physiologically, this pathophysiology can be explained. According to Tandon et al. (2019), although nasal septal deviation can theoretically damage the osteomeatal complex (OSC), in reality, not all septal curvatures trigger structural damage to the OSC or completely obstruct the mucociliary drainage pathways of the paranasal sinuses (Tandon et al., 2019). If the sinus ostia remain drained despite the septum being deflected, the accumulation of purulent secretions will not occur, preventing rhinosinusitis from developing. Furthermore, Prasad et al. (2013) explained that the incidence of sinusitis due to septal deviation often occurs randomly and is not always ipsilateral (in the same direction) to the location of the anatomical nasal deviation¹⁸.

This is influenced by the body's autonomic compensatory mechanisms; for example, deviation to one side is often accompanied by hypertrophy of the concha on the contralateral (opposite) side to balance airflow. This adaptive mechanism allows aerodynamic flow disturbances to occur on both or

opposite sides of the nose, thus weakening the linear statistical correlation between the point of deviation and the location of sinus inflammation. Furthermore, rhinosinusitis is a disease with a multifactorial etiology that can be triggered by allergic rhinitis, ciliary dysfunction, and even pathogenic infections (viruses/bacteria). Therefore, structural anomalies such as septal deviation do not stand as a single predisposing factor.

CONCLUSION

Based on the results of radiological evaluation using CT scan imaging and statistical analysis, this study concluded that there was no significant relationship between the type of septal deviation (based on the Mladina classification) or the severity of septal deviation with the incidence of rhinosinusitis. This finding indicates that structural anomalies in the nasal septum are not an absolute predictor or primary cause of inflammation in the paranasal sinuses. The occurrence of rhinosinusitis in patients with septal deviation is more influenced by a multifactorial etiology. Drainage patency in the osteomeatal complex (OCM) and the aerodynamic adaptation mechanisms of the nasal cavity are thought to have a more crucial clinical role in the pathophysiology of sinus obstruction than simply the location, type or magnitude of the septal deflection angle itself. Given the limitation of this study to a single-center observational design with a limited sample, further studies with a large-scale prospective multicenter design are highly recommended. Future research should also involve multivariate analysis models to evaluate the interaction between deviation anatomy and other predisposing factors, such as allergic rhinitis, mucociliary dysfunction, and history of infection.

ACKNOWLEDGEMENT

The author would like to express his deepest gratitude to Universitas Sebelas Maret and the radiology department of the UNS hospital for their facilities and technical support during the implementation of this research. The author would also like to thank to the UNS Hospital radiographer who helped retrieve the CT scan data, the UNS Hospital medical records department who helped retrieve the medical records, the UNS Hospital research department who helped issue the research permit, the UNS Hospital thesis department who helped issue the ethics letter, and other institutions who played a role in the research that the researcher cannot mention one by one.

BIBLIOGRAPHY

- Alghamdi, F. S., Albogami, D., Alsurayhi, A. S., Alshibely, A. Y., Alkaabi, T. H., Alqurashi, L. M., Alahdal, A. A., Saber, A. A., & Almansouri, O. S. (2022). Nasal septal deviation: A comprehensive narrative review. *Cureus*. <https://doi.org/10.7759/cureus.31317>
- Alsaggaf, Z. H., Almadfaa, A. O., Marouf, A. A., Alfawaz, K. S., Niyazi, R. A., Ibrahim, N. K., & Ajlan, A. M. (2022). Sinusitis and its association with deviated nasal septum at a tertiary hospital: A retrospective study. *Journal of Taibah University Medical Sciences*, 17(6), 1065–1069. <https://doi.org/10.1016/j.jtumed.2022.06.001>
- Azzahra, A., Sulistyanto, A., & Ayuningtyas, P. R. (2022). Hubungan kelainan deviasi septum dengan lokasi sinusitis pada CT Scan SPN. *Prosiding KONSTELASI ILMIAH MAHASISWA UNISSULA (KIMU)* 7, 206–215. <http://jurnal.unissula.ac.id/index.php/kimukes/article/view/20294>
- Bagri, N., K., K., Chandra, R., Agarwal, Y., Gupta, N., & Mandal, S. (2018). Nasal septal angle deviation: Effect on lateral wall in nasal obstruction. *International Journal of Research in Medical Sciences*, 7(1), 90. <https://doi.org/10.18203/2320-6012.ijrms20185095>

- Damanik, M. A. D., & Ratnawati, L. M. (2023). Karakteristik penderita deviasi septum di RSUP Sanglah Denpasar periode Januari 2019–Desember 2020. *Intisari Sains Medis*, 14(1), 480–483. <https://doi.org/10.15562/ism.v14i1.1597>
- Fokkens, W. J., Lund, V. J., Hopkins, C., Hellings, P. W., Kern, R., Reitsma, S., Toppila-Salmi, S., Bernal-Sprekelsen, M., & Mullol, J. (2020). Executive summary of EPOS 2020 including integrated care pathways. *Rhinology Journal*, 58(2), 82–111. <https://doi.org/10.4193/Rhin20.601>
- Jain, S., & Deshmukh, P. T. (2021). A review on deviated nasal septum: Classification, clinical features and management. *Journal of Pharmaceutical Research International*, 33(60A), 432–437. <https://doi.org/10.9734/jpri/2021/v33i60A34504>
- Jan, S., Pachipulusu, B., & Govindraju, P. (2023). Prevalence of nasal septal deviation and its effects on concha bullosa, maxillary sinus mucosal thickness, and depth of palatal arch: An observational CBCT study. *Journal of Indian Academy of Oral Medicine and Radiology*, 35(3), 403. https://doi.org/10.4103/jiaomr.jiaomr_165_23
- Lengari, Y., Sutanegara, S., & Dewantara, I. P. (2023). Kualitas hidup penderita rinosinusitis kronis yang menjalani irigasi nasal di Poli THT-KL Rumah Sakit Umum Pusat Sanglah Denpasar Bali periode Februari 2020–April 2021. *Jurnal Medika Udayana*, 12(2). <http://ojs.unud.ac.id/index.php/eum>
- Moshfeghi, M., Abedian, B., Ghazizadeh Ahsaie, M., & Tajdini, F. (2020). Prevalence of nasal septum deviation using cone-beam computed tomography: A cross-sectional study. *Contemporary Clinical Dentistry*, 11(3), 223. https://doi.org/10.4103/ccd.ccd_110_19
- Mustain, A., Idris, N., & Baan, J. (2022). Hubungan deviasi septum nasi pada pasien yang menjalani pemeriksaan CT Scan sinus paranasalis dengan derajat obstruksi nasi berdasarkan skor NOSE. *Jurnal Biomedik*, 4, 76–81. <https://doi.org/10.35790/jbm.v14i1.35560>
- Prasad, S., Varshney, S., Bist, S. S., Mishra, S., & Kabdwal, N. (2013). Correlation study between nasal septal deviation and rhinosinusitis. *Indian Journal of Otolaryngology and Head & Neck Surgery*, 65(4), 363–366. <https://doi.org/10.1007/s12070-013-0665-3>
- Sharma, Y., Mishra, G., Pancholi, K., & Govindarajulu, P. (2022). Does degree of nasal septal deviation measured with CT PNS have a role in management of deviated nasal septum? *Indian Journal of Otolaryngology and Head & Neck Surgery*, 74(S2), 1665–1667. <https://doi.org/10.1007/s12070-021-02831-2>
- Sonone, J. K., Garg, D., & Solanke, P. S. (2020). Occurrence of deviated nasal septum in terms of angles and its relation with sinus disease in patients of chronic rhinosinusitis: A computed tomography scan study. *International Journal of Otorhinolaryngology and Head and Neck Surgery*, 6(5), 889. <https://doi.org/10.18203/issn.2454-5929.ijohns20201681>
- Tandon, S., Giridher, V., & Juneja, A. (2019). Symptomatic septal deviation: Its nasal endoscopy and computed tomography-aided correlation with chronic rhinosinusitis. *An International Journal of Otorhinolaryngology Clinics*, 11(1), 5–8. <https://doi.org/10.5005/jp-journals-10003-1325>
- Thakur, S. K., Yadav, B., Bedajit, R. K., & Anwar, A. (2019). Clinical presentations of deviated nasal septum and Mladina's classification. *Journal of Chitwan Medical College*, 9(2), 60–64. <https://doi.org/10.3126/jcmc.v9i2.24536>
- Valsamidis, K., Printza, A., Titelis, K., Constantinidis, J., & Triaridis, S. (2019). Olfaction and quality of life in patients with nasal septal deviation treated with septoplasty. *American Journal of Otolaryngology*, 40(5), 747–754. <https://doi.org/10.1016/j.amjoto.2019.07.008>

Yeom, S. W., Kim, M. G., Lee, E. J., Chung, S. K., Kim, D. H., Noh, S. J., Lee, M. H., Yang, Y. N., Lee, C. M., & Kim, J. S. (2021). Association between septal deviation and OSA diagnoses: A nationwide 9-year follow-up cohort study. *Journal of Clinical Sleep Medicine*, 17(10), 2099–2106. <https://doi.org/10.5664/jcsm.9352>