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Original article

Types of septal deviation rate of each type morbidity and associated sinus pathology

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Abstract:

- ***Background***: Septal deviation is a common nasal disorder, but its role in the development of sinus pathology remains unclear. Different types of septal deviation may affect the paranasal sinuses in distinct ways. This study aims to determine the prevalence of various types of septal deviation, assess their associated morbidity, and identify related sinonasal pathologies.
- ***Methods:*** This Prospective observational study included 150 patients presenting with symptoms such as nasal obstruction, discharge, or facial pain for at least three months. All patients were evaluated at the outpatient clinic of Al-Yarmouk Teaching Hospital between April 2017 and August 2018. None had a prior diagnosis of septal deviation. Clinical evaluation included anterior rhinoscopy, rigid nasal endoscopy (0° and 30°, 4mm), and fiberoptic nasopharyngoscopy. All patients underwent CT imaging to assess the impact of the septal deviation type on the paranasal sinuses and to exclude other nasal or sinus pathologies. Data were collected and analyzed using statistical methods, including p-values for significance.
- ***Result:*** Among the 150 patients with symptomatic septal deviation, 91 (60.6%) had a C-shaped deviation and 59 (39.3%) had an S-shaped deviation. Sinus pathology was observed in 70 patients: 32 (45.8%) with C-shaped and 38 (54.2%) with S-shaped deviation. S-shaped deviations showed a statistically significant association with bilateral sinus disease, whereas unilateral sinus involvement was more common with C-shaped deviations.
- ***Conclusions:*** Septal deviation, particularly the S-shaped type, is significantly associated with sinonasal disease. Nasal obstruction is the most common presenting symptom.

- **Keywords:** Septal deviation, caudal dislocation, sinusitis, nasal obstruction.

INTRODUCTION

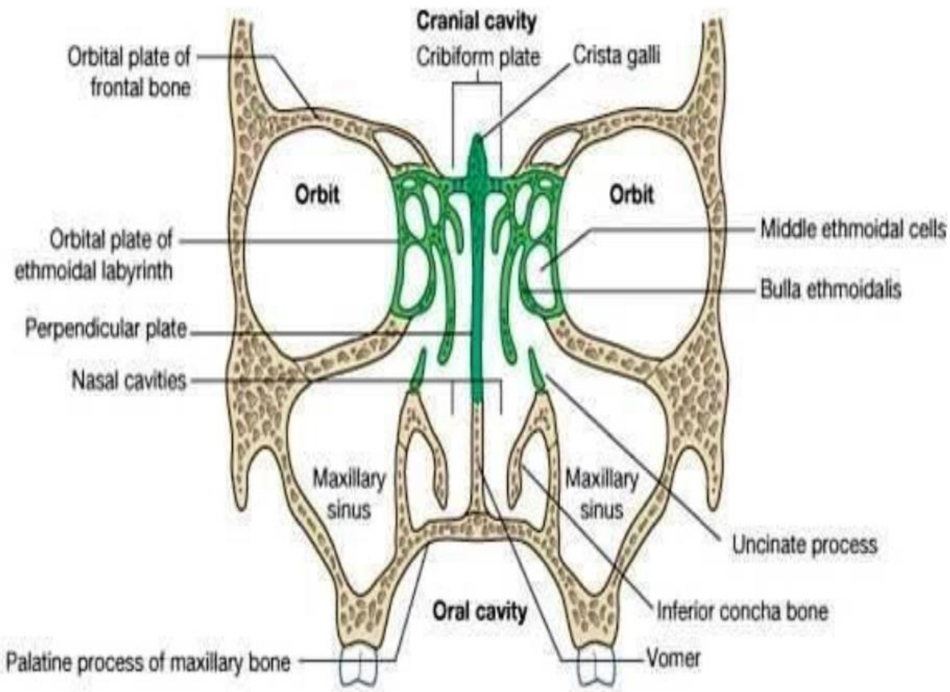
Understanding the detailed anatomy of the nose and paranasal sinuses is essential for accurately diagnosing and effectively managing a wide range of nasal and sinonasal conditions, including nasal septal deviation (NSD) and its associated complications. The nasal cavity, a complex and structured space, extends from the external nares (nostrils) to the posterior choanae, continuing into the nasopharynx. Vertically, it spans from the palate to the cribriform plate and is anatomically broader at the base than at the superior portion, which narrows into the olfactory cleft. A central septum divides the nasal cavity into two symmetrical halves, each consisting of a floor, roof, lateral wall, and medial (septal) wall [1].

Anatomical knowledge of these components is crucial in clinical practice. The nasal floor is primarily formed by the palatine process of the maxilla anteriorly and the horizontal plate of the palatine bone posteriorly. The nasal roof can be further divided into frontonasal, ethmoidal, and sphenoidal sections, each associated with distinct surgical and diagnostic implications. The lateral wall features several key structures such as the maxilla, lacrimal bones, and turbinates (inferior, middle, and superior), which create separate channels or meati. The inferior turbinate is a separate bone, while the middle and superior turbinates are extensions of the ethmoid bone. These anatomical elements play critical roles in nasal airflow, drainage, and filtration [1].

The nasal septum itself is composed of an anterior membranous part, cartilage, and several bones including the perpendicular plate of the ethmoid, the vomer, and the crests of the maxillary and palatine bones. The cartilaginous portion includes the quadrilateral cartilage, supported by upper and lower lateral alar cartilages, which contribute to the nasal valve region—an area of considerable functional importance [1].

Functionally, the ostiomeatal unit (OMU) is a central focus in rhinology, as it is the site where the drainage pathways of most paranasal sinuses converge. This region includes the uncinate process, semilunar hiatus, frontal recess, ethmoid bulla, ethmoid infundibulum, and the ostium of the maxillary sinus. These structures form a coordinated system essential for effective sinus ventilation and mucociliary clearance. The OMU is bounded medially by the middle turbinate and laterally by the lamina papyracea, and any anatomical or pathological variation in this area can significantly impact sinus function [4].

The paranasal sinuses—ethmoid, maxillary, frontal, and sphenoid—exhibit significant anatomical variability, which has diagnostic and therapeutic implications. The ethmoid sinus, centrally located, has a box-like configuration and is closely associated with the orbit and skull base. The lamina papyracea, forming the lateral ethmoid wall, is a critical barrier between the sinus and orbital contents, and the lateral lamella of the cribriform plate is the thinnest part of the skull base, making it vulnerable during endoscopic surgery [5].



Anatomy of Paranasal sinuses[5]

The maxillary sinus, the largest of the paranasal sinuses, is bordered anteriorly by the facial surface of the maxilla, posteriorly by the pterygopalatine fossa, and medially by the lateral nasal wall. Its natural drainage through the ethmoidal infundibulum can be hindered by anatomical variations or inflammation. Accessory maxillary ostia are present in 15–40% of individuals and can affect sinus ventilation and surgical planning [5].

The frontal sinus shows marked variability in size and pneumatization patterns. It drains via the frontal recess, which often assumes an hourglass configuration, with the narrowest part termed the frontal infundibulum. Aplasia of the frontal sinus occurs in about 5% of the population, and its surgical access remains one of the most challenging due to anatomical complexity [5].

The sphenoid sinus, deeply situated within the sphenoid bone, lies adjacent to vital neurovascular structures including the optic nerve and internal carotid artery. Variations in pneumatization—conchal, presellar, sellar, and mixed—affect surgical risk profiles. The sinus drains into the sphenoethmoidal recess, and its anatomy must be carefully evaluated, particularly before transsphenoidal surgery [4].

The turbinates—superior, middle, and inferior—are bony projections covered in ciliated epithelium, essential for air conditioning and mucociliary transport. The middle turbinate, due to its central location and frequent pneumatization, is a critical structure in endoscopic sinus surgery. The inferior turbinate contributes to the nasolacrimal duct system, and variations in turbinate size or structure can impact both breathing and sinus drainage [1,4].

The nasal mucosa features a sophisticated mucociliary clearance mechanism, comprising a superficial gel layer and a deeper sol layer, maintained by goblet cells and submucosal glands. Ciliary action propels mucus at a rate of 3–25 mm/min toward the nasopharynx. This defense mechanism is essential for maintaining nasal and sinus health, and any disruption can contribute to chronic rhinosinusitis [5,6].

Nasal septal deviation (NSD), affecting nearly 80% of the population, is among the most common anatomical variations of the nasal cavity [10]. Though often asymptomatic, it can contribute to significant clinical problems including nasal obstruction, sinusitis, epistaxis, headaches, anosmia, and sleep disturbances such as snoring and obstructive sleep apnea. NSD can result from congenital anomalies or trauma and is classified by severity into mild, moderate, or severe types, depending on the extent of deviation and its impact on the lateral nasal wall [11].

A comprehensive assessment of patients includes a detailed clinical history focusing on nasal symptoms and their impact on quality of life [7]. Physical examination begins with external inspection, anterior rhinoscopy, and nasal endoscopy. Rigid nasal endoscopy using 0° or 30° scopes remains the gold standard for internal nasal evaluation, with flexible nasopharyngoscopy serving as a valuable adjunct in certain cases.

Imaging, especially computed tomography (CT), is the modality of choice for evaluating sinonasal anatomy and pathology. CT provides superior bone-air contrast and is indispensable in preoperative planning and diagnosis of sinus disease. Contrast enhancement is typically reserved for suspected neoplasms or complications [8].

Septal deviations are broadly categorized into C-shaped or S-shaped patterns, each with distinct effects on nasal airflow and sinus drainage [9]. Understanding these anatomical intricacies is vital for accurate diagnosis, surgical planning, and successful outcomes in the management of sinonasal conditions.

Types of septal deviation

C-shape: rt side vertical S-shape: rt side vertical

. Types of septal deviation [9]

PATIENT and METHOD

This prospective study was conducted at the outpatient clinic of Al-Yarmouk Teaching Hospital between April 2017 and August 2018. A total of 150 patients were included, all of whom presented with symptoms of nasal obstruction, nasal discharge, facial pain, or other related complaints persisting for at least three months. None of the patients had a prior diagnosis of nasal pathology. All were selected based on the presence of symptomatic nasal septal deviation.

Each patient underwent a comprehensive nasal examination, beginning with anterior rhinoscopy using a headlight and Killian nasal speculum. This was followed by rigid nasal endoscopy using Hopkins rod telescopes (4 mm and 2.7 mm) with 0° and 30° lenses, as well as flexible nasopharyngoscopy. A computed tomography (CT) scan was performed for each patient to evaluate the type and extent of septal deviation, its effect on the paranasal sinuses, and to exclude other intranasal or sinus pathologies.

Data were collected using a structured questionnaire and analyzed statistically. The significance of results was determined using the p-value method: a p-value less than 0.05 was considered statistically significant, while values above 0.05 were considered non-significant. The analysis focused on identifying the rate of each type of septal deviation, its associated morbidity, and the relationship between deviation type and sinus pathology.

Inclusion Criteria

1. Patients aged 18 years and above
2. Symptomatic septal deviation
3. Moderate to severe deviation:
4. *Moderate:* cross-deflection not contacting the lateral wall
5. *Severe:* deflection touching or obstructing the lateral wall

Exclusion Criteria

1. Mild septal deviation
2. Allergic rhinitis
3. Concha bullosa or paradoxical middle turbinate
4. Intranasal mass
5. Posterior nasal mass

Questionnaire Content

- Name, Gender
- Age group, Occupation
- Address
- Chief Complaint(s):
    1. Nasal obstruction
    2. Nasal discharge
    3. Epistaxis
    4. Facial pain
    5. Other

Clinical Findings

Anterior Rhinoscopy

- Type of deviation: S-shaped / C-shaped
- Associated findings: turbinate hypertrophy, septal spur, caudal dislocation

Endoscopic Findings

- Type of deviation: S-shaped / C-shaped
- Associated findings: turbinate hypertrophy, septal spur, caudal dislocation

CT Findings

Assessment included the presence of sinus involvement (bilateral or unilateral) in the:

- Maxillary sinuses
- Ethmoid sinuses
- Frontal sinuses
- Sphenoid sinuses

Patients were then classified into subgroups based on:

- **C-shaped septal deviation** with or without associated sinusitis
- **S-shaped septal deviation** with or without associated sinusitis

Questionnaire that used in the study

Name: ____________________ Gender: ____________________

Occupation: ____________________ Age Group____________________
Address:
____

Chief Complaint: ____________________ Duration: ____________________

1. Nasal obstruction ☐

2. Nasal discharge ☐

3. Epistaxis ☐

4. Facial pain ☐

5. Others: ____________________

Finding
Anterior Rhinoscopy

C ☐

☐ Turbinate hypertrophy ☐ Spur ☐ Caudal dislocation

Endoscopic Finding

S ☐ C ☐

☐ Turbinate hypertrophy ☐ Spur ☐ Caudal dislocation

CT Finding
Maxillary Ethmoid Frontal Sphenoid

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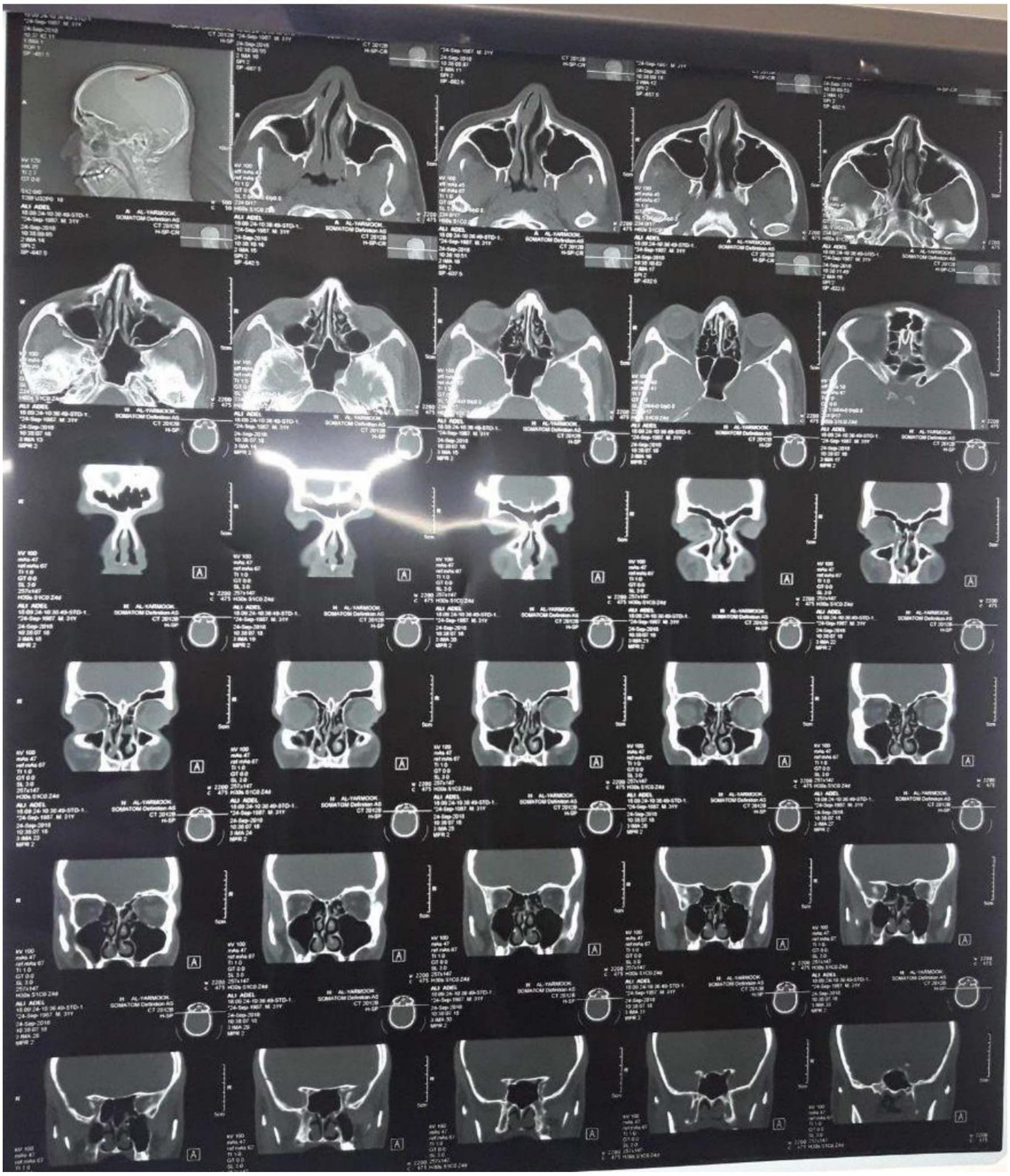

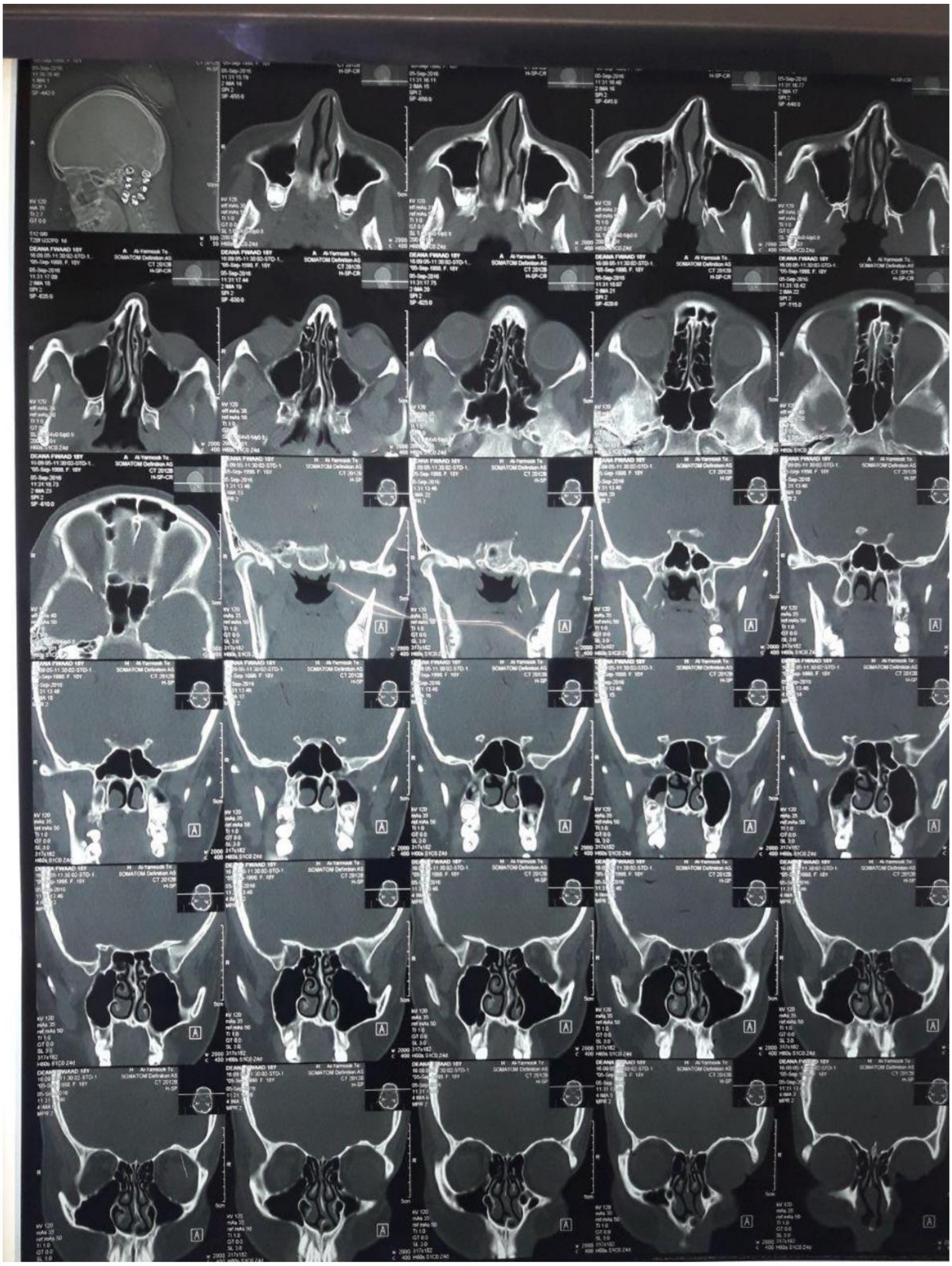

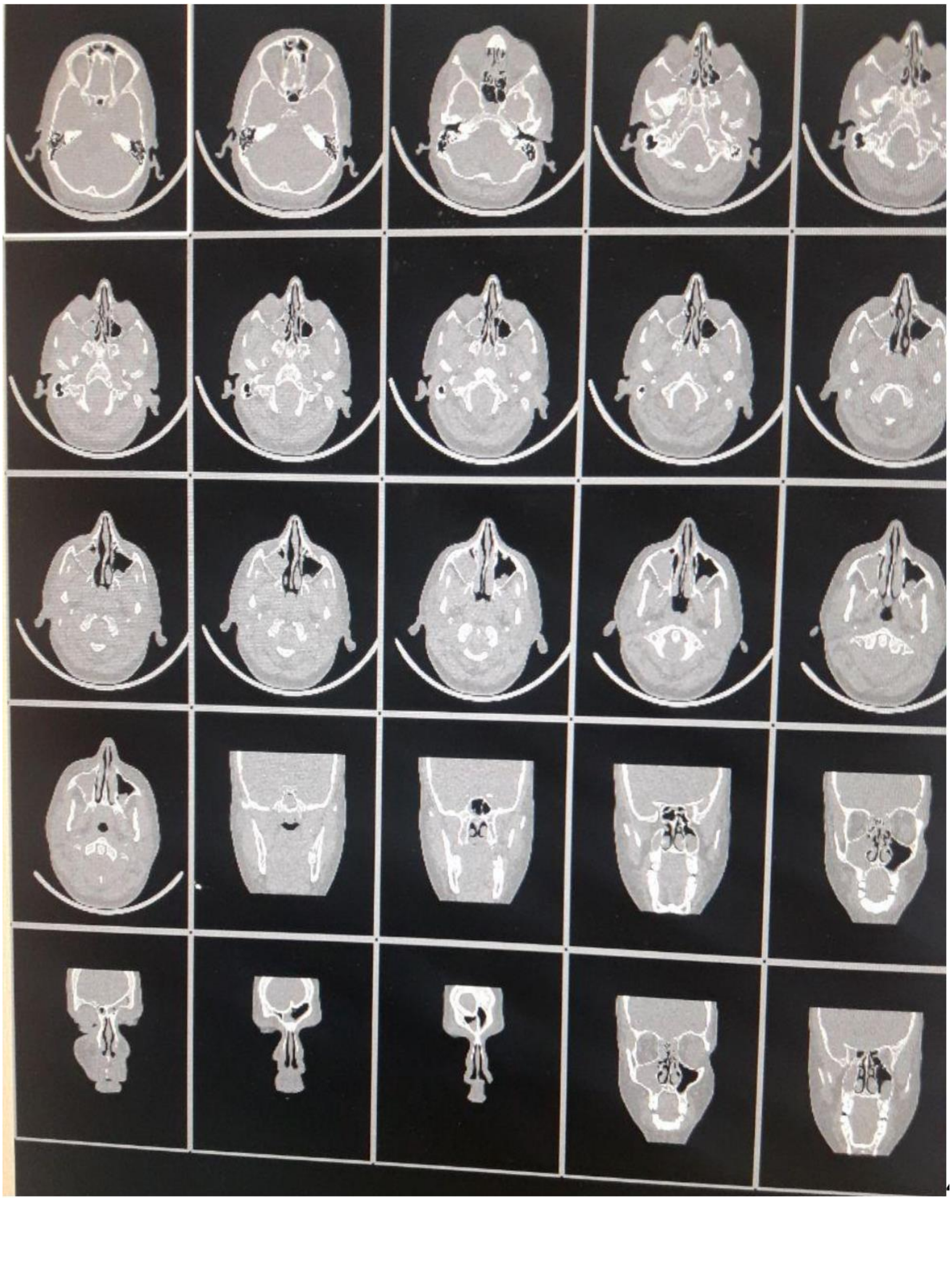

RESULTS

Table 1 shows the gender distribution and frequency of each type of septal deviation. Among the 150 patients, 86 were male (57.3%) and 64 were female (42.6%). C-shaped deviation was more common (60.6%) compared to S-shaped (39.3%). The difference was not statistically significant ($p > 0.05$).

As shown in Table 2, the most frequent symptom was nasal obstruction, present in 98% of cases. Other reported symptoms included postnasal drip (49.3%), nasal discharge (42.6%), facial pain (37.3%), and epistaxis (4%).

Table 3 outlines the associations between various subtypes of septal deviation and anatomical abnormalities. C-shaped deviations were most commonly associated with caudal dislocation (16%) and inferior turbinate hypertrophy. S-shaped deviations frequently involved inferior turbinate hypertrophy (13.3%) and multiple abnormalities. This distribution was statistically highly significant ($p = 0.000046$).

Age distribution according to deviation type is presented in Table 4. The most affected age group was 21–30 years (30%), followed by 31–40 years (22.6%) and 41–50 years (23.3%). There was no significant correlation between age group and type of deviation ($p > 0.05$).

Table 5 compares the prevalence of sinonasal pathology in relation to the type of septal deviation. S-shaped deviations were more frequently associated with sinonasal pathology (64.4%) compared to C-shaped deviations (35.16%). This finding was statistically highly significant ($p = 0.00045$).

CT scan findings based on deviation type are presented in Table 6. Patients with S-shaped deviation demonstrated a higher rate of bilateral involvement across all sinuses, particularly the ethmoid and sphenoid sinuses. This association was found to be statistically significant ($p < 0.05$).

Table 1. Gender distribution&percentage of each type

Gender	C-shape	S-Shape	Total %
Male	48	38	86(57.3%)
Female	43	21	64(42-6%)
Total	91(60.6%)	59(39.3%)	150(100%)

P.value >0.05 not significant

Table 2. Morbidity of septal deviation

Symptoms	No of cases (150)	%
Nasal obstruction	147	98%
Postnasal drip	73	49.3%
Nasal discharge	64	42.6%
Facial pain	57	37.3%
Epistaxis	6	4%

Table 3. Association with each type of deviation

Types of deviation	No of cases (150)	%
C_shape+caudal	24	16%
C-shape+caudal+Inferior turbinate hyperatrophy	10	6.6%
C_shape+spur	14	9.3%
C-shape+spur+inferior turbinate hyper atrophy	9	6%
C_shape	20	13.3%
C-shape+ inferior turbinate hyper atrophy	13	8.6%
S_shape +caudal dislocation	11	7.3%
S-shape +caudal+ inferior turbinate hyper atrophy	8	5.3%
S_shape +spur	4	2.6%
S-shape+spur+ inferior turbinate hyper atrophy	7	4.6%
S_shape	10	6.6%

S-shape+ inferior turbinate hyper atrophy	**20**	**13.3%**
Total	**150**	**100%**

P.value =.000046 highly significant

Table 4. Age distribution

Age group	C_shape	S-shape	Total no.	%
18-20	13	7	20	13.3%
21-30	29	16	45	30%
31-40	20	14	34	22.6%
41-50	19	16	35	23.3%
51-above	10	6	16	10.6%
Total	91	59	150	100%

P.value >0.05 not significant

Table 5. Septal deviation associated with sinonasal pathology

Types of deviation	With S.N pathology	Without S.N pathology
C-shape (91)	32(35.16%)	59(64.8%)
S-shape (59)	38(64.4%)	21(35.5%)
Total (150)	70(46.6%)	80(53.3%)

P.value =0.00045 highiy significant

Table 6. CT scan finding according to each type of septal deviation

Types of septal deviation	Maxillary sinus opacity		Maxillary ethmoid Sinus opacity		Ethmoid frontal sinus opacity		Maxillary ethmoid frontal Sinus opacity		Maxillary ethmoid frontal sphenoid Sinus opacity	
	U	B	U	B	U	B	U	B	U	B
C-shape	10 2		6	1	4	1	5	0	3	0
S-shape	0 2		1	8	0	5	2	6	1	13

P.value < 0.05 significant

DISCUSSION

The relationship between nasal septal deviation (NSD) and chronic rhinosinusitis is explained by three primary theories. The first is the mechanical theory, which suggests that narrowing of the ostiomeatal complex leads to secretion retention and subsequent infection, ultimately resulting in chronic rhinosinusitis. The second, the aerodynamic theory, attributes decreased mucociliary activity and mucosal dryness due to altered airflow to the pathogenesis of sinus disease. The third is Bachert's pressure theory, which proposes that posterior septal deviation alters sinus pressure and airflow dynamics, particularly within the maxillary sinuses, thereby contributing to chronic rhinosinusitis [12].

In our study involving 150 patients, 86 were male (57.3%) and 64 were female (42.6%). Among those with C-shaped deviation, 48 were male and 43 were female, while the S-shaped group comprised 38 males and 21 females. These findings are comparable to those of Syed Mohammad Shoib and B. Viswanatha [12], where out of 200 patients, 112 were male

(56%) and 88 female (44%). Madani et al. [14] also reported male predominance at 68.3%.

Nasal obstruction was the most common complaint in our cohort, observed in 98% of patients. Postnasal drip (49.3%), nasal discharge (42.6%), facial fullness (50%), epistaxis (13%), snoring (20%), and disturbances of smell (10%) were also reported. M. Musharaf Baig and Ifra Saeed [15] reported nasal obstruction in 82% and hyposmia in 32%, while Yugandhar Etigadda and Juveria [13] found nasal obstruction in all patients (100%), with facial pain in 86% and snoring in 23%.

C-shaped deviation was more common in our study (61%) compared to S-shaped (39%). This aligns with the findings of Syed Mohammad Shoib and B. Viswanatha [12], who reported 70.5% C-shaped and 29.5% S-shaped deviations. Similarly, Dr. Yugandhar Etigadda and Dr. Juveria Majeed [13] observed higher C-shaped rates (49.9%) than S-shaped (13.3%).

In our study, C-shaped deviations were frequently associated with caudal dislocation (16%) and inferior turbinate hypertrophy. S-shaped deviations also showed a high frequency of turbinate hypertrophy (13.3%). These findings are consistent with Shoib and Viswanatha [12], who reported C-shape associations with caudal dislocation (20%) and spur formation (36.5%).

The majority of patients in our study were in the 21–30-year age group (30%). Similar trends were observed in studies by Shoib and Viswanatha [12], as well as Yugandhar Etigadda and Juveria Majeed [13], both of whom identified the 21–30-year range as the most affected group.

Out of 150 patients in our study, 70 (46.6%) had sinus pathology. Among these, 64.4% were associated with S-shaped deviations and 35.15% with C-shaped. This trend matches findings by Prayaga N. Srinivas Moorthy and Srikanth Kolloju [16], who reported sinusitis in 54% of patients with NSD, more commonly with S-shaped deviations (66.6%). J. Jardhan Rao and E.C. Vinay Kumar [17] reported a 26% association rate.

CT findings in our study revealed that S-shaped deviations had a higher incidence of multi-sinus involvement, particularly pansinusitis (14 cases), compared to C-shaped deviations (3 cases). Similar findings were reported by Shoib and Viswanatha [12], who noted pansinusitis in 5.5% of S-shape cases, and by Etigadda and Juveria [13], who found pansinusitis in 9 S-shape cases versus 4 in C-shape. Rao and Vinay Kumar [17] also found more frequent sinus involvement in S-shape patients. These findings support the notion that septal deviation is a significant risk factor for sinusitis, with our study showing an overall association rate of 46.6%.

CONCLUSION

This study confirms that a deviated nasal septum (DNS) is significantly associated with sinonasal disease, with S-shaped deviations showing a statistically stronger correlation with sinus pathology compared to C-shaped deviations.

Nasal obstruction emerged as the predominant symptom among patients with moderate to severe septal deviation. Of the total 150 patients, C-shaped deviations were more common than S-shaped ones. The highest prevalence of septal deviation was observed in the 21–30-year age group, accounting for 30% of the cases.

Importantly, S-shaped deviations were more frequently linked to sinus disease than C-shaped deviations. Bilateral sinus involvement was more common in S-shaped deviations, while unilateral sinus disease was more often associated with C-shaped deviations. Furthermore, pansinusitis was observed only in patients with S-shaped deviations, with no cases reported in the C-shaped group.

These findings support the notion that septal deviation—particularly the S-shaped variety—is a notable risk factor for developing chronic rhinosinusitis.

Ethical Clearance:

In accordance with the 2013 WMA Helsinki Declaration, all ethical aspects of this study were approved. Before enrolling the participants, an informed oral consent was obtained from their families as an ethical agreement. Additionally, approval from the hospital administrator was obtained.

Financial support and sponsorship:

Nil.

Conflicts of interest:

There are no conflicts of interest.

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