



## Patterns of nasal septum as a tool in forensic investigation: A Review

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### ABSTRACT-

The nasal septum, a central structure within the facial anatomy, plays a significant role in forensic science as a diagnostic tool. This review examines the application of nasal septum analysis in forensic investigations, highlighting its utility in identification, trauma assessment, and the differentiation between post-mortem and ante-mortem injuries. The nasal septum's unique anatomical features, including deviations and fractures, can serve as critical markers in cases where other identification methods are challenged. Furthermore, the review discusses how congenital and trauma-induced deviations provide insights into a victim's medical history and the events leading to death or injury. The integration of advanced imaging techniques, such as CT scans and MRIs, has enhanced the precision of forensic analysis, allowing for detailed assessment of the nasal septum's condition. This article underscores the nasal septum's value in forensic diagnostics, emphasizing its relevance in both criminal and civil investigations.

**Keywords:** Nasal septum, Nasal septum deviation, Forensics, OPG, CBCT

### Introduction

Nasal septum is the wall between two nostrils. When it gets displaced to one side, it is known as nasal septum deviation. It separates the nasal cavity anatomically and physiologically into right and left sides. It is acknowledged that nasal septum deviations of some degree are typical and that absolutely straight nasal septa are uncommon<sup>1</sup>. Deviated nasal septum (DNS) has been linked to a number of circumstances, including trauma, racial characteristics, birth shaping during parturition, and developmental abnormalities of the septum<sup>2</sup>.

Forensic radiology is crucial to gender determination and personal identification in the event of a natural disaster, criminal case investigation, or when a body is burned or destroyed. Other biological tools, like DNA analysis and fingerprint analysis, are unable to accurately identify the body in these situations. Because each person's skull structure is different, it can be a valuable tool in forensics. There are various patterns, including Others (O) (epsilon and reverse epsilon type; unusual types), Straight (S'), Left deviated (L') or Right deviated (R'), Sigmoid type (Si), and Reverse sigmoid type (RSi)<sup>4</sup>.

Mladina's system<sup>12,13</sup> classifies nasal septum deviation into seven types out of which two types are most important from forensic medicine perspective are types 5 and 6, which are clinically proven to be inherited. The types are-

1. Type 1- when unilateral vertical septal ridge in the valve region did not reach or disturb the function of the nasal

valve itself.

2. Type 2- when the unilateral crest touches and disrupts the function of the nasal valve causing +ve Cottle's symptom after raising nostril.
3. Type 3- when the unilateral crest is deeper, reaching the head of the middle concha.
4. Type 4- S-shaped, where one crest is reaching the middle conchal head, and the other disturbs the valve functions.
5. Type 5- nearly horizontal septal spur.
6. Type 6- presence of massive unilateral bone spur.
7. Type 7- presence of a variation of these types from one to six.

### Anatomical features and identification

Variations in the nasal cavity's architecture may affect airflow but have minimal impact on warmth. The

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differences between the various forms of nasal deviation were clearly visible. As a result, a significant deviation in the nasal septum will impair regular breathing, resulting in sinusitis, snoring, and nasal obstruction<sup>7</sup>.

The nasal septum can serve as a distinctive anatomical marker in forensic identification, especially in cases where other identifying features are compromised. Variations in septal structure, such as deviations or unique configurations, can be compared with medical records, photographs, or descriptions provided by acquaintances, contributing to the identification of unknown remains. This is particularly valuable when dealing with skeletal remains where soft tissue features have decomposed, leaving the septal structures relatively intact.

#### **Trauma Assessment**

In the affected group, the deviated septum is usually present but asymptomatic. While there is still debate on the relationship between the style of delivery and past history, it may indicate a trauma<sup>8</sup>. Examining patients for nasal deviation and blockage in cases of recurrent, unexplained epistaxis is particularly crucial<sup>9</sup>. The nasal septum is often involved in facial traumas due to its central location and prominence in the facial structure. Fractures or dislocations of the septum can indicate blunt force injuries, which are common in cases of physical assault, vehicular accidents, or falls. Forensic pathologists can analyze the nature of septal injuries to determine the force and direction of impact, potentially linking injuries to specific traumatic events. Moreover, understanding whether a septal deviation is congenital or trauma-induced can help in reconstructing a victim's history of injury, which is crucial in criminal investigations.

Septoplasty is the most often utilized surgical technique for treating NSD in adults<sup>10</sup>. A typical otolaryngological surgical surgery called septoplasty involves straightening up a deviated septum in order to widen the nasal channel and provide enough airflow<sup>10-11</sup>. Septoplasty is indicated for lead point headaches, acquiring access for endoscopic sinus surgery, and septal deviation with symptomatic obstruction<sup>11</sup>.

#### **Post-Mortem vs. Ante-Mortem Injuries**

Distinguishing between post-mortem and ante-mortem injuries is a critical aspect of forensic analysis. The nasal septum's condition can be used to differentiate between

injuries sustained before death and those occurring after death, which is essential for accurately determining the cause and manner of death. For example, fractures with evidence of healing or inflammation indicate ante-mortem trauma, whereas fractures without such signs suggest post-mortem damage. This distinction aids forensic experts in piecing together the timeline of events surrounding a person's death.

#### **Imaging techniques in forensic analysis**

Advancing techniques such as cone-beam computed tomography (CBCT), computed tomography (CT) scans and magnetic resonance imaging (MRI), have become valuable tools in forensic analysis of the nasal septum. These modalities provide detailed views of the nasal structures, allowing for precise assessment of deviations, fractures, and other abnormalities. Imaging can reveal subtle injuries or anatomical variations that might not be apparent during a standard autopsy, enhancing the accuracy of forensic investigations. The digital orthopantomogram (OPG) is also an option for the investigation but due to its 2D limitation and shadow appearance of other landmarks make it difficult to use. Many studies have been done with different radiographic views as well as different combinations of landmarks can result in better results. The nasal bone, maxillary sinus, maxillary bone, mandible, styloid process, temporomandibular joint, alveolar bone, and cervical vertebrae are among the anatomical landmarks that are easily apparent in the OPG<sup>5</sup>.

Also, Postmortem Computed Tomography (PMCT) can detect nasal septum defects and can be valuable in distinguishing between preexisting and postmortem defects by providing detailed high-resolution 3D images of bone and soft tissues, making it highly effective in identifying nasal septum fractures, deformities and defects. It can assess the patterns of fractures, and it can be used alongside external examination findings to provide context on whether nasal septum defects occurred due to traumatic events or arose from postmortem handling or autopsy procedures.

#### **Conclusion**

The nasal septum is a valuable diagnostic tool in forensic science, offering insights into identification, trauma assessment, and the determination of post-mortem versus ante-mortem injuries. Its unique anatomical features and susceptibility to injury make it a crucial element in forensic



investigations, especially when combined with modern imaging techniques. As forensic methodologies continue to evolve, the nasal septum will likely remain an essential focus in the analysis and interpretation of forensic evidence. The patterns of the nasal septum and frontal sinus can be used in conjunction with other personal identification methods. These patterns are stable throughout adulthood and are clearly visible on PA skull views<sup>14</sup>.

### References

1. Gray LP. Deviated nasal septum. Incidence and etiology. *Ann Otol Rhinol Laryngol.* 1978;87:3-20.
2. Neskey DM, Eloy JA, Casiano RR. Nasal, septal and turbinate anatomy and embryology. *Otolaryngol Clin North Am.* 2009;42:193-205.
3. David MP, Saxena R. Use of frontal sinus and nasal septum patterns as an aid in personal identification: A digital radiographic pilot study. *J Forensic Dent Sci.* 2010;2(2):77-80.
4. Taniguchi M, Sakoda S, Kano T, Zhu BL, Kamikodai Y, Fujita MQ, et al. Possible use of nasal septum and frontal sinus patterns to radiographic identification of unknown human remains. *Osaka City Med J.* 2003;49(1):31-8.
5. Altug HA, Ozkan A. Diagnostic imaging in oral and maxillofacial pathology. Croatia: Intech Europe; 2011. p. 216-26.
6. Li L, Zang H, Han D, London NR Jr. Impact of varying types of nasal septal deviation on nasal airflow pattern and warming function: a computational fluid dynamics analysis. *Ear Nose Throat J.* 2021;100:NP283-9.
7. Kamani T, Yilmaz T, Sürücü S, Bajin MD, Günaydın RÖ, Kuşçu O. Histopathological changes in nasal mucosa with nasal septum deviation. *Eur Arch Otorhinolaryngol.* 2014;271:2969-74.
8. Salihoglu M, Cekin E, Altundag A, Cesmeçi E. Examination versus subjective nasal obstruction in the evaluation of the nasal septal deviation. *Rhinology.* 2014;52:122-6.
9. O'Reilly BJ, Simpson DC, Dharmaratnam R. Recurrent epistaxis and nasal septal deviation in young adults. *Clin Otolaryngol Allied Sci.* 1996;21:12-4.
10. van Egmond MM, Rovers MM, Tillema AH, van Neerbeek N. Septoplasty for nasal obstruction due to a deviated nasal septum in adults: a systematic review. *Rhinology.* 2018;56:195-208.
11. Most SP, Rudy SF. Septoplasty: basic and advanced techniques. *Facial Plast Surg Clin North Am.* 2017;25:161-9.
12. Mladina R. The role of maxillar morphology in the development of pathological septal deformities. *Rhinology.* 1987;25(3):199-205.
13. Rao JJ, Kumar ECV, Babu KR, Chowdary VS, Singh J, Rangamani SV. Classification of nasal septal deviations—relation to sinonasal pathology. *Indian J Otolaryngol Head Neck Surg.* 2005;57(3):199-201.
14. Verma K, Nahar P, Singh MP, Mathur H, Bhuvaneshwari S. Use of frontal sinus and nasal septum pattern as an aid in personal identification and determination of gender: a radiographic study. *J Clin Diagn Res.* 2017 Jan;11(1):ZC71-ZC74.