

The relationship between the direction and degree of nasal septal deviation and nasal bone morphology

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Abstract:

Background& aim: Many previous studies proved that nasal septal deviation has an important effect on the development of the bones of the nose, as well as morphology and other features of facial bones. Assessment of the morphology of the nose helps in obtaining favorable surgical outcomes. We designed this work to discover the association between nasal morphology and nasal septum deviation.

Patients & methods: This study included 120 patients over 18 years old with symptomatic nasal septum deviation who were exposed to CT scanning of the nose and paranasal sinuses. The following parameters were assessed; direction of nasal deviation and its angle in addition to nasal morphology; internasal angle of the nose, the nasal bone length, and the thickness of intermediate and lateral nasal bone on the two sides.

Results: Studied patients' mean age was 38.08 ± 17.27 years and the majority (70%) of them were males. Out of studied patients, 64 (53.3%) patients had deviated septum toward the right side while in 56 (46.7%) patients it deviated to the left side. It was observed that there were no important differences between types of deviation direction as regarding age, sex, and deviation angle ($P= 0.41, 0.09,$ and $0.61,$ respectively). Both sexes had insignificant differences as regarding nasal morphology with exception of significantly higher internasal angle (60.33 ± 8.15 vs. 56.19 ± 9.52 degree; $P= 0.02$), and left intermediate osteotomy thickness (1.92 ± 0.35 vs. 1.77 ± 0.41 mm; $P= 0.04$) in males' patients. Severe deviation was presented in 19 (15.8%) patients.

Conclusion: This work concludes that deviation of the septum of the nose might influence the morphology of the nasal bones as the length of nasal bone; thickness and lateral osteotomy thickness on the same side of the deviation were altogether more prominent than on the contralateral.

Keywords: Nasal bone, nasal septal deviation, nasal morphology, nasal angle

Introduction

At the middle of the nasal cavity, the septum of the nose is found and forms the main part of the nose. It is formed from anterior and posterior parts. Beside its anatomical value it has pathophysiological aspects attributed to

septal deviation due to its role in nasal cycle.¹⁻²

Deviated septum of the nose is one of the commonest anatomic changes in up to 80% of population.³⁻⁴ It may be associated with sinusitis, tedious

sneezing, epistaxis, sleep apnea and breathing difficulty.¹

Also, deviated septum of the nose is linked with variations in length of the middle turbinate at deviated side and the width of lateral lamina of the cribriform plate at deviated side.² To obtain best results from septoplasty operations, it's better to adequately nasal bone growth and facial morphologic parameters. It was noticed that age, gender, climate and race may affect the nasal morphological characteristics. This work was performed to assess the association of the degree and the deviation of deviated septum of the nose with the morphology of bones of the nose, alongside variables, for example, age and sex.

Patients and Methods:

With approval number 17100286 at August 2017 from Local Ethics Committee, this cross sectional prospective study was conducted in the period between October 2017 and March 2019 at Ear, nose and throat Department of Assiut University Hospitals. One hundred twenty patients complaining from symptoms of deviated nasal septum who went through CT scanning of nose and paranasal sinuses were enrolled. Informed consent was obtained from participants.

Patients with any of the following conditions were excluded; previous history of trauma of face and cranium, surgery of the nose especially plastic surgery, nasal mass or polyps, adenoids, nasopharyngeal lesions, craniofacial anomalies and nasal granulomas.

Method:

After a thorough history taking and full clinical evaluation, computed tomography (CT) was performed using a Ge Birdspecs 16 CT Scanner (GE HANGWEI Medical Systems, 2011

China) where the patient has a supine position. Multiplanar reconstructed sagittal and coronal pictures were produced on a computer utilizing Radiant DICOM Viewer (64-bit version) software. To correct measurement plane and avoidance the patient's malposition, reference lines were used.

Evaluation of the deviation of deviated septum of the nose (Figure 1):

It was done through assessment of;

1. Degree of convexity of septal deviation,
2. Deviation angle of the nose (evaluated on coronal CT pictures defined as the measured angle between the middle line of the nose and the most curved point of the nasal septum)
3. Middle line of the nose, line from crista galli to the palatum.

Severity of nasal septum was classified based on deviation angle of the nose either mild ($<9^\circ$), moderate ($9- <15^\circ$) and severe ($\geq 15^\circ$).

Assessment of nasal morphology (Figure 1):

- A) The thickness of nasal bone: the lateral nasal bone thickness was estimated by the thickness of bone at the level of the suture connecting the nasal and maxillary bones (nasomaxillary) while the intermediate nasal bone thickness was estimated at the point midway between the rhinion and the suture connecting the nasal and maxillary bones (nasomaxillary).
- B) The length of nasal bone, it was estimated on sagittal plane by the distance between the suture connecting the frontal and nasal bones (frontonasal) to the point at end of the nasal bone .
- C) The internasal angle, it was estimated at the location of the

nasion point on coronal MPR pictures.

Statistics:

Information was gathered and examined utilizing SPSS (Statistical Package for the Social Science, version 20, IBM, and Armonk, New York). Data of continuous type was communicated in type of average (mean) \pm SD. while of nominal type was communicated in type of percentage.

In this work, we used Chi²-test in comparison the nominal data of various groups while we used student t-test in comparison average of various two groups and ANOVA test for simile more than two groups. The standard of certainty was hold at 95% and thus, if the P value was < 0.05 , it was considered as critical or significant.

Results:

Baseline data and CTs' findings of study population

One hundred twenty patients (84 male, 36 females; mean age, 38.08 ± 17.27 years) were included. The enrolled 120 patients over 18 years old with deviated septum of nose resulting in nasal symptoms were incurred to CT scanning of nose and paranasal sinuses. CT's findings are epitomized at table number1.

Studied patients' average age was 38.08 ± 17.27 years and majority (70%) of them was males. Out of studied patients, 64 (53.3%) patients had deviated septum toward right side while in 56 (46.7%) patients it was deviated to left side.

Nasal deviation side, angle and morphology (Table 2-4):

It was observed that there were no significant variations between types of deviation direction as regarding age, sex

and deviation angle (P= 0.41, 0.09, and 0.61, respectively) (table 2).

It was realized that the variations between male and female as regarding nasal morphology were insignificant with exception of significantly higher internasal angle (60.33 ± 8.15 vs. 56.19 ± 9.52 degree; P= 0.02), and left intermediate osteotomy thickness (1.92 ± 0.35 vs. 1.77 ± 0.41 mm; P= 0.04) in males' patients (table 3).

This study showed that variations between the same side of deviation and the other side were insignificant as regarding morphology of the nose with exception of significantly higher lateral osteotomy thickness (either right or left), and nasal bone length (either right or left) in ipsilateral deviation in comparison to contralateral deviation (table 4).

Nasal morphology based on nasal deviation angle group (Table 5):

It was noticed that 41 (34.2%), 60 (50%) and 19 (15.8%) patients had mild, moderate and severe deviation, respectively. Between nasal septal deviation angle groups, it was realized that the variations in the internasal angle were insignificant, and bone thicknesses neither lateral nor intermediate, while the length of nasal bone was increasing significantly with the severity of the septal deviation.

Table (1): Baseline data and CTs' findings of study population

Variables	N= 120
Age (years)	38.08 ± 17.27
Sex	
Male	84 (70%)
Female	36 (30%)
Direction of deviation	
Right	64 (53.3%)
Left	56 (46.7%)
Deviation angle (degree)	10.95 ± 3.76
Internasal angle (degree)	57.75 ± 9.29
Right lateral osteotomy thickness (mm)	1.97 ± 0.42
Left lateral osteotomy thickness (mm)	1.87 ± 0.42
Right intermediate osteotomy thickness (mm)	1.97 ± 0.34
Left intermediate osteotomy thickness (mm)	1.84 ± 0.37
Right nasal bone length (mm)	17.05 ± 5.44
Left nasal bone length (mm)	17.56 ± 5.50

Table (2): Nasal deviation side in relation to age, sex and deviation angle

	Right deviation (n= 64)	Left deviation (n= 56)	P
Age (years)	41.14 ± 17.70	38.50 ± 16.81	0.41
Sex			0.09
Male	41 (64.1%)	43 (76.8%)	
Female	23 (35.9%)	13 (23.2%)	
Deviation angle (°)	11.24 ± 3.68	10.88 ± 3.79	0.61

Data was expressed in form of frequency (percentage), mean (SD). *P* value was significant if < 0.05.

Table (3): Nasal morphology based on Sex distribution of study population

	Male (n= 84)	Female (n= 36)	P
Age (years)	39.53 ± 17.01	40.77 ± 18.09	0.72
Deviation angle (degree)	11.48 ± 3.92	10.11 ± 3.05	0.06
Deviation direction			0.09
Right	41 (48.8%)	23 (63.9%)	
Left	43 (51.2%)	13 (36.1%)	
Internasal angle (degree)	60.33 ± 8.15	56.19 ± 9.52	0.02
Right LOT (mm)	2.10 ± 0.40	1.94 ± 0.43	0.06
Left LOT (mm)	1.99 ± 0.43	1.90 ± 0.37	0.24
Right IOT (mm)	1.99 ± 0.31	1.88 ± 0.41	0.11
Left IOT (mm)	1.92 ± 0.35	1.77 ± 0.41	0.04
Right NBL (mm)	18.01 ± 5.45	17.49 ± 5.46	0.64
Left NBL (mm)	18.28 ± 5.55	17.62 ± 5.43	0.55

Data was expressed in form of frequency (percentage), mean (SD). *P* value was significant if < 0.05. LOT: lateral osteotomy thickness; IOT: intermediate osteotomy thickness; NBL: nasal bone length

Table (4): Nasal morphology based on deviation side of study population

	Ipsilateral (n= 64)	Contralateral (n= 56)	<i>P</i>
Deviation angle (degree)	11.24 ± 3.68	10.88 ± 3.79	0.96
Internasal angle (degree)	58.36 ± 8.81	56.36 ± 9.79	0.30
Right LOT (mm)	2.14 ± 0.43	1.97 ± 0.38	0.03
Left LOT (mm)	2.02 ± 0.43	1.91 ± 0.39	0.02
Right IOT (mm)	1.95 ± 0.36	1.97 ± 0.32	0.79
Left IOT (mm)	1.86 ± 0.40	1.89 ± 0.34	0.73
Right NBL (mm)	18.67 ± 5.66	17.37 ± 5.25	0.01
Left NBL (mm)	18.76 ± 5.85	17.38 ± 5.15	0.03

Data was expressed in form of frequency (percentage), mean (SD). *P* value was significant if < 0.05.

LOT: lateral osteotomy thickness; IOT: intermediate osteotomy thickness; NBL: nasal bone length

Table 5: Nasal morphology based on nasal deviation angle group

	Mild (n= 41)	Moderate (n= 60)	Severe (n= 19)	<i>P</i>
Internasal angle (°)	56.87 ± 10.26	58.18 ± 9.24	56.26 ± 7.28	0.65
Right LOT (mm)	1.97 ± 0.34	2.10 ± 0.47	2.07 ± 0.36	0.26
Left LOT (mm)	1.90 ± 0.33	2.01 ± 0.46	1.96 ± 0.40	0.39
Right IOT (mm)	1.89 ± 0.32	1.99 ± 0.35	2.01 ± 0.31	0.24
Left IOT (mm)	1.82 ± 0.31	1.88 ± 0.40	1.95 ± 0.43	0.43
Right NBL (mm)	17.67 ± 4.95	17.75 ± 6.06	18.53 ± 4.49	0.03
Left NBL (mm)	17.92 ± 5.20	17.99 ± 6.01	18.71 ± 4.44	0.04

Data was expressed in form of frequency (percentage), mean (SD). *P* value was significant if < 0.05.

LOT: lateral osteotomy thickness; IOT: intermediate osteotomy thickness; NBL: nasal bone length

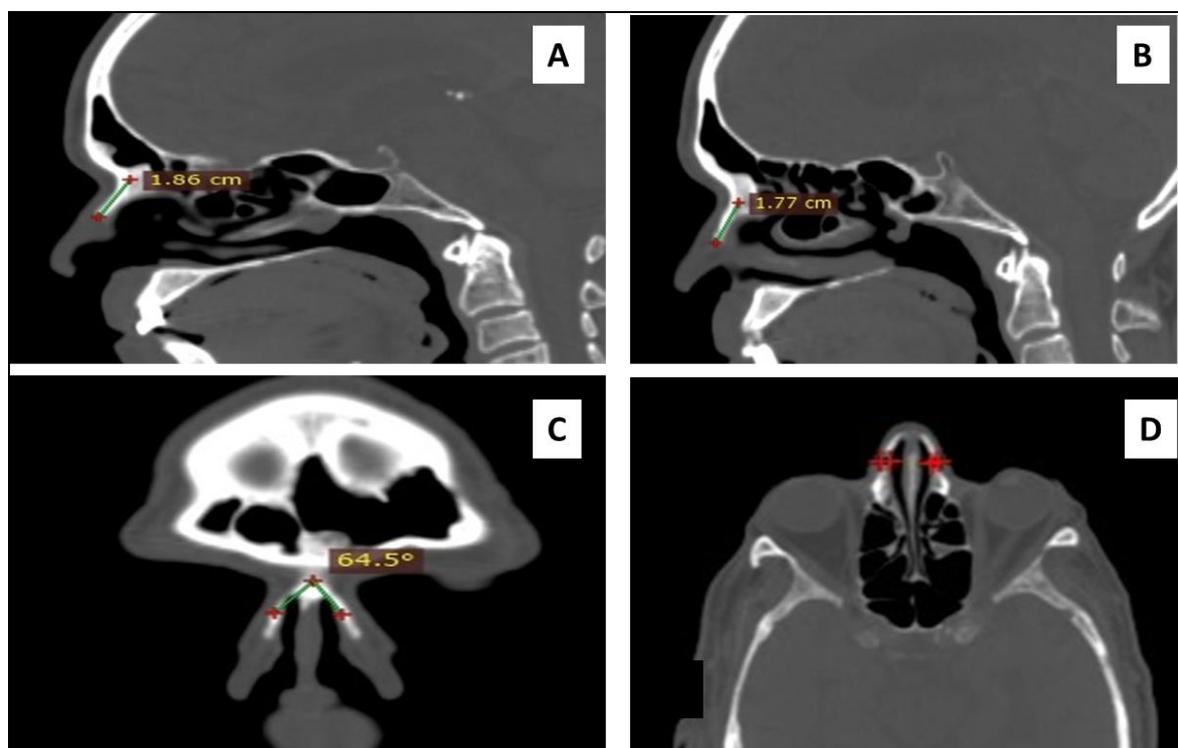


Figure 1: Assessment of nasal morphology with CT. A) Length of left side of nasal bone, B) length of right side of nasal bone, C) internasal angle in coronal section, D) lateral nasal bone thickness

Discussion:

Based on the current study and in consistent with other previous study, it was found that only the anterior nasal septum deformities were associated with underdeveloped cartilaginous noses and a shorter antero-posterior dimension for the maxilla.^(3, 4)

Surprisingly, an insignificant association was noticed between the development of the anterior nasal spine and anteriorly located septum deformities, considering the close relationship of these structures through the septopremaxillary ligament.⁽⁵⁾

Freng et al revealed that patients complaining from deviated nasal septum had resistance to ordinary airflow through the nose as they have non-suitable septal cartilage with shorter posterior facial height.⁽⁶⁾ Another study found that closure one side of the cavities of the nose surgically did not vary the anatomy and/or histology of the mucosa of the maxillary sinus.⁽⁷⁾

This study enrolled 120 patients over 18 years old with deviated nasal septum bring about nasal complaints and was exposed to maxillofacial CT to assess the connection between the degree and direction of deviated septum of the nose with morphology of the nose according to factors for example gender and age.

Mean age of studied patients was 38.08 ± 17.27 years and majority (70%) of them was males this may be attributed to high possibility of trauma to men. Out of studied patients, 64 (53.3%) patients had deviated septum toward right side while in 56 (46.7%) patients it was deviated to left side

This study shows that deviated septum of the nose might be important agent impacting nasal bone morphology as thickness of the bones of the nose; their length and lateral osteotomy thickness on the same side of deviation were significantly bigger than on the

side faraway the deviation. The explanation may be due to the anatomical and embryological association between septum and nasal structures.^(3, 4, 8)

In the current study the variation between the lateral and intermediate osteotomy thickness was 0.80 while in a study done by Lee et al showed this difference was 1.21 mm, and in another research was 0.28 mm. This diversity between our work and the preceding researches is due to geographic or racial factors.⁽⁹⁾

Ismail Serifoglu found that the mean right nasal bone length in Turkish patient with deviation of the nasal septum was 22.9mm in males but 21.05mm in females and the average length left nasal bone was 22.62mm in males but it was 20.74mm in females.⁽¹⁰⁾

However, in this current study the nasal bone length in Egyptian with deviation of nasal septum was 17.05 ± 5.44 in right nasal bone and 17.56 ± 5.50 in left nasal bone. We explained these differences secondary to racial and geographical factors.

Other studies found that the nasal septum in Turkish patients was deviated to the right in 49.3% and to the left in 50.7%⁽²⁾. Although in this current study, we found that the nasal septum in Egyptian patients was deviated to the right in 53.3% and to the left in 46.7%. This may be due to birth molding theory.⁽¹¹⁾

At this work to assess the connection between the degree and direction of deviated nasal septum and morphology of the nasal bone confirms that in patients complaining from deviation of nasal septum, the nasal bone length and bone thicknesses on the same side of deviated septum were bigger than that on the other side⁽¹⁰⁾. This is consistent with our study and so, nasal bone length and lateral osteotomy thickness were

significantly higher in comparison to contralateral deviation. This is explained secondary to delay in growth of the face on the side far away from the deviation of nasal septum⁽¹²⁾.

Although side of deviation of nasal septum greatly affects length of nasal bone and its thickness, there is no connection between the surface area of nasal septum and the level of deviation of nasal septum⁽¹³⁾. Poorey et al.⁽¹⁴⁾ reported that nasal deviation angle not influence sinusitis and this not related to the level of septal deviation of the nose⁽³⁾.

On the other hand, Hatipoglu et al.⁽¹⁵⁾ found severe deviation of nasal septum has been reported as an important agent for sinusitis. Other studies found that patients with less deviated septum are associated with less asymmetry in facial skeleton.⁽³⁾ Kapusuz Gencer et al. found that the size of the maxillary sinus more associated with severe deviation nasal septum⁽¹⁶⁾. This agreed by this current study as we found that the nasal bone length was increasing significantly with increasing the severity of deviated septum of the nose.

The thickness and length of nasal bone estimated in previous research were bigger on either side in male patients and their study confirms the changes in morphological features of the bones of the nose between the genders, as detailed in past researches⁽¹⁰⁾.

In contrast, Karadağ et al. revealed that there was no important change between the genders in thickness of nasal bone, though length of nasal bone was revealed to be bigger in males⁽¹⁷⁾. Other studies found that both right-left lengths of nasal bone and the length of these bones on the median plane were bigger in males than in females.⁽⁸⁾

And this is supported by our study as we reported that gender affects the parameters of nasal morphology as significantly higher internasal angle and contralateral intermediate osteotomy

thickness in males' patients in comparison to females' patients. This can explained by change in size and shape of the bones of the nose depending on geographical conditions, racial, sex, and age.⁽⁸⁾

Conclusion:

This study shows that nasal septum deviation may be a factor affecting nasal bone morphology as nasal bone thickness; length and lateral osteotomy thickness on the deviated side were significantly greater than on the contralateral. CT scanning of the nose can evaluate these effects.

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Informed Consent and Statement: Informed Written consent was obtained from all patients involved in the study.

Conflicts of Interest: The authors declare no conflict of interest.

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