Is there any association between direction of nasal deviation and hand dominance in male adolescents?

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April 16, 2024

Abstract

Objectives: This study aims to investigate incidence of nostril asymmetry and deviation of nasal bony pyramid and caudal septum and to examine their association with dominant hand in male adolescents. Methods: Totally 546 male healthy adolescents aged 15 to 17 years were included. Each participant was examined for presence or absence of nasal bone pyramidal deviation, caudal septal deviation, side of deviation, and nostril asymmetry. The dominant hand was recorded. Results: Of participants, 85 were aged 15 years, 291 were aged 16 years, and 168 were aged 17 years. Mean age was 16.148±0.667 years. Of all participants, 91% (n=497) were right-handed and 9% (n=49) were left-handed. Distribution of the dominant hand across age groups was comparable (p=0.921). In case of deviation to the right, 61.2% (n=74) were right-hand dominant, while 58.3% (n=7) of those with deviation to the left were left-hand dominant. According to hand dominance and size of nostrils, 92.1% (n=105) of those with a larger left nostril were right-handed and 7.9% (n=9) were left-handed. Conclusions: Male adolescents had a significant deviation of caudal septum to the right side with smaller right nostrils. However, hand dominance and side of deviation were not significantly associated with nasal bony pyramid and caudal septum.

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Conclusions: Male adolescents had a significant deviation of caudal septum to the right side with smaller right nostrils. However, hand dominance and side of deviation were not significantly associated with nasal bony pyramid and caudal septum.

Keywords: Nasal bone, Nasal Septum, Acquired Nasal Deformities, Handedness.

Key points:

- Hand dominance and its association with the dominant side in double organs.

- The etiological factors of nasal deviation can be classified into two main groups (developmental/genetic and acquired).
- In the study group, 91% were right-handed and 9% were left-handed.
- Comparison of hand dominance and deviations of the nasal bony pyramid showed that, of those with deviation to the right, 61.2% were right-hand dominant, while 58.3% of those with deviation to the left were left-hand dominant.
- In this study hand dominance and side of the deviation were not significantly associated with nasal bony pyramid and caudal nasal deviation.

Introduction

As the right-hand dominance is undoubtedly more common in the general population, hand dominance and its association with the dominant side in double organs such as feet, eyes (vision), ear (hearing), nostrils (smell and breathing), and whether such organs have also a dominant side have long been a matter of scientific curiosity and controversy. Some authors have shown a correlation between hand dominance and feet, ear, nostrils and eyes, while some others have not (1-7).

The etiology, prevalence, treatment, and complications of nasal deviation have also long been investigated. The etiological factors can be classified into two main groups. The first and larger group includes the developmental and genetic factors. Twin studies showed similar deviations in the bony septum, also called the posterior septum, as well as in the posterior part of the cartilage septum, while anterior septal deviations did not exhibit any similarities (8). These findings have led to the conclusion that posterior septal deviations are mainly caused by genetic factors, while the anterior septal deviations may be more related to developmental factors (8, 9). The second etiological group includes the acquired causes. In most cases, an individual sustains at least one minor or major nasal trauma during his/her lifetime. The most common reasons for nasal trauma during the neonatal period include the compaction of the fetus, facial compression in the birth canal, and facedown falls during the infancy where head control is not totally complete (10), whereas being punched on the face, falls, traffic accidents, sports injuries and similar conditions play a more important role in adolescents (11).

Caudal septal deviations involve the caudal part of the septum and may lead to cosmetic problems due to low nose tip, dorsal hump, asymmetry of the nostrils, or columella deviation (12). Depending on the severity of the deviation, varying degrees of respiratory difficulties may occur due to the narrowing of the internal nasal valve (13). In some cases, the caudal septal deviations may be accompanied by other deviations of both cartilage and bony septum. It has been proposed that caudal septal deviations are more likely to be caused by traumatic and iatrogenic factors (8).

In the present study, we hypothesized those congenital nasal dorsal deviations, caudal septal deviations, and nostril asymmetry could be linked with handedness. We, therefore, aimed to investigate the incidence of nostril asymmetry and deviation of the nasal bony pyramid and caudal septum and to examine their association with the dominant hand.

Materials and methods

This single-center, cross-sectional study was conducted at XXX University, School of Medicine, Department of Plastic, Reconstructive and Aesthetic Surgery Department between September 2017 and June 2018. A total of 546 male adolescents aged 15 to 17 years without any known history of major facial trauma and sport injuries were included in the study. Those with a history of major nasal trauma, nasal surgery, congenital and/or acquired cranio-facial and hand anomalies were excluded. The participants were randomly selected from six high schools of XXX municipality of XXX province. All participants were informed about the nature of the study and a written informed consent was obtained from parents and/or legal guardians of the participants. The study protocol was approved by the institutional Ethics Committee (No: 09.2016.275; Date: 01/04/2016). The study was conducted in accordance with the principles of the Declaration of Helsinki.

All examinations were performed by a single plastic surgeon through inspection. The midline was determined

using the midpoint of the nasion and nasal spine. Accordingly, each participant was examined for the presence or absence of nasal bone pyramidal deviation, caudal septal deviation, side of the deviation, and nostril asymmetry. The data were recorded in the Microsoft Excel table.

The dominant hand was recorded on the personal profile of the participant for the preferred hand mostly used for activities such as writing, using forks and knives, throwing objects, grabbing door handles, and waving.

According to the XXX District Governorship data, there were a total of 34,612 high school students with the overall district population of 712,000 individuals at the time of this study, representing 5% of the population (14). Using the simple random sampling, minimum 203 participants were required with d=0.03 and p=0.05.

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) for Windows version 23.0 (IBM Corp., Armonk, NY, USA). Descriptive data were expressed in mean ± standard deviation (SD), median (min-max) or number and frequency, where applicable. The normality was checked using the Shapiro-Wilk test. As the normality was not achieved, non-parametric Mann-Whitney U test was used for pairwise comparisons. The Kruskal-Wallis H test was used for multiple comparisons. A p value of <0.05 was considered statistically significant.

Results

A total of 633 male adolescents were examined, 87 were excluded according to exclusion criterions and 546 healthy were included. Of these participants, 85 were aged 15 years, 291 were aged 16 years, and 168 were aged 17 years. The mean age was 16.148±0.667 (range, 15 to 17) years. Dominant hand, deviation of the nasal bony pyramid, and caudal septal deviation according to age groups are shown in Table 1.

In the overall study group, 91% (n=497) were right-handed and 9% (n=49) were left-handed. The distribution of the dominant hand across the age groups was comparable (p=0.921). The association between hand dominance and nasal bony pyramid deviation, caudal septal deviation, and nostril asymmetry are shown in Table 2.

Of all cases with deviation of the nasal bony pyramid (n=133, 24.4%), the deviation was to the right in 59.4% (n=79) and to the left in 40.6% (n=54). Although there were more cases with deviation to the right, it did not reach statistical significance (p=0.190).

The caudal septum was in the midline in 74.4% of the participants (n=406), while it was deviated in 25.6% (n=140). Of the deviations, 74.2% (n=104) was to the right, and 25.8% (n=36) was to the left. Although the incidence of caudal septal deviations declined with increasing age, it did not reach statistical significance (p=0.309).

Examination of the nostril asymmetry showed symmetrical nostrils in 72.3% (n=395) and asymmetrical nostrils in 27.7% of the participants (n=151). Asymmetry was reduced with aging, although this reduction was not statistically significant (p=0.325).

Comparison of hand dominance and deviations of the nasal bony pyramid showed that, of those with deviation to the right, 61.2% (n=74) were right-hand dominant, while 58.3% (n=7) of those with deviation to the left were left-hand dominant. Although the side of the deviation of the nasal bony pyramid tended to favor the side of the dominant hand, it did not reach statistical significance (p=0.158).

According to the association between hand dominance and caudal septal deviation, of those with caudal septal deviation to the right, 76.6% (n=98) were right-handed and 50% (n=6) of those with deviation to the left were left-handed (p=0.077). According to the hand dominance and the size of nostrils, 92.1% (n=105) of those with a larger left nostril were right-handed and 7.9% (n=9) were left-handed; however, the difference was not statistically significant (p=0.333).

In 84.6% of the participants with caudal septal deviation to the right, the nasal bony pyramid deviation was toward the right side. In 91.2% of the participants with septal deviation to the left, the nasal bony pyramid

deviation was to the left side. This tendency was statically significant ($p<0.05$). Among those with caudal septal deviation to the right, 95.2% had a smaller right nostril, while the left nostril was smaller in those with a deviation to the left, indicating a statistically significant association ($p<0.05$) (Table 3).

Discussion

Although the mechanisms underlying the asymmetry of the human face has been subject to comprehensive research, no conclusive results have been obtained to date. Several factors including developmental or genetic factors, as well as those related to soft tissue orientation, prenatal stress, and environment (low temperature) have been described in the literature (15, 16). One of the hypotheses proposed by Moss is that the septal deviation has a negative impact on facial development, with the affected side being less well-developed (17). Another hypothesis has proposed that the nasal septum is also asymmetrical and deviated as a result of the development of the facial bones (18, 19).

Hafezi et al. evaluated facial asymmetry in deviated noses and reported that the left side of the nose, left half of the face, and left side of the body were greater in size, and that the nose was deviated to the less well-developed side (20). Furthermore, Ercan et al. (2008) found higher dimensions in the anatomical structures forming the left half of the face in a Turkish cohort. In our study, the bony nasal pyramid was deviated to the right and left in 59.4% and 40.6% of those participants with an asymmetric bony nasal pyramid, respectively. Although the difference was statistically insignificant, a trend for right-sided deviation was observed.

In a previous study examining whether nasal growth differed by sex, the nasal growth was completed at 15.8 and 16.9 years of age in boys respectively, indicating a statistically significant difference (21). In another study evaluating the extent of variation in timing, duration, and intensity of growth in the craniofacial complex during childhood and adolescence, Nahhas et al. reported that, in male adolescents, as opposed to females, the peak velocity of the anteroposterior growth of the maxilla occurred earlier than 14 years of age, and that the growth continued until the age of 20 years, although it was at a lower rate(22). In the current study including male adolescents aged 15, 16, and 17 years, the nasal bony pyramid deviation, caudal septal deviation, and nostril asymmetry did not increase and, on the contrary, a minimal, insignificant degree of reduction was observed. Based on these findings, we can speculate that male adolescents in these age groups reach a stable point during nasal growth.

Caudal septal deviations refer to deviations of the one-third caudal portion of the nose. Although review of the literature reveals several studies on problems (aesthetic and/or functional) associated with the caudal septal deviations and proposing treatment recommendations, there is no study available examining its incidence during adolescence (between 15 and 17 years of age). The classification for septal deviation proposed by Mladina et al. (1987) includes Type 1, 2, and 4 caudal septal deviations and allows a diagnosis to be established by inspection and Cottle's maneuver. In another study Marin and Mladina (2001) reported that the overall incidence of Type 1, 2, and 4 deviations among patients aged between 15 and 18 years was 40.7%. Although no significant correlation was observed with caudal deviations and sex, Type 1 was the most common type with a significant decline with aging. In the aforementioned studies, no data regarding the side of the deviation were given. In contrast, 25.6% of the participants had caudal septal deviation and, of these, 74.2% were to the right in our study. Since septal deviation has an impact on the size of nostrils, it is not surprising to observe smaller nostrils in participants with septal deviation to the right. Similarly, in 75.5% of the adolescents with asymmetric nostrils, the right nostril was smaller.

In general, questionnaires and performance studies are utilized to evaluate the hand dominance. Among these, questionnaires are more frequently used tools thanks to their practical nature. In this study, we asked participants to choose one of their hand as dominant according to daily tasks such as writing, use of knives and forks, throwing, and tooth brushing. Some large-scale studies have reported a prevalence of 89.6% to 94.1% for right-hand dominance (23). Consistent with these reports, 91% and 9% of our participants were right- and left-hand dominant, respectively. Since nasal deviations without a major trauma are thought to have developmental and genetic underlying mechanisms, we attempted to evaluate the possible relationships between hand dominance and nasal deviations in our study. To the best of our knowledge, there is no study

available investigating this potential link. Among our adolescent boys cohort, 61.2% of those with a nasal deviation to the right had right-hand dominance, while 58.3% of those with nasal deviation to the left were left-hand dominant. Although these associations were not statistically significant, a trend in nasal deviations was noted toward the side of the hand dominance.

Furthermore, in those with caudal septal deviation to the right, 76.6% were right-hand dominant, while 50% were left-hand dominant in those with a deviation to the left. Again, these associations were not significant. This might be due to a small number of adolescents with caudal septal deviation and left-hand dominance. In our study, the caudal part of the septum was evaluated through inspection, without the use of any equipment (speculum, endoscope) or imaging studies such as direct X ray or computed tomography. Inspection allows the assessment of the nasal bony pyramid and caudal septum only. This examination method was chosen on the basis of the fact that it was non-invasive and associated with minimal discomfort, suitable for adolescents under 18 years of age with no history of trauma. Although inspection is considered adequate for the accurate evaluation of the asymmetry, quantitative measurements (speculum and endoscopic examination) and imaging studies would allow better quantification of such conditions.

Another main finding of the present study is that 84.6% of those with caudal septal deviation had nasal bone pyramid deviation to the right, and 91.2% of those with a septal deviation to the left had nasal bone pyramid deviation to the left. This finding supports the axiom "as the septum goes, so goes the nose" proposed by Maurice Cottle and suggests that the nasal septum also determines the direction of the external deviation. In this context, it may be worth noting that the importance of the cartilage septum on the development of the nose and maxilla was underscored by Verwoerd and Verwoerd-Verhoef (24).

Nonetheless, there are some limitations to this study. First, no imaging tool such as CT or nasal endoscopy was used for a more accurate evaluation of the septal deviation. Determination of nasal septal deviation was done by purely visual analysis, so there would be many false negatives which would skew the data. Second, the hand dominance was evaluated for the left and right hands and ambidexterity was disregarded. In general, two tests are used to evaluate hand dominance: one for self-report questionnaire and the other one for functional ability and skills. In this study, however, hand dominance was evaluated by questioning the preference of hand during daily living activities such as writing. We used this method to improve the attention of adolescents to the questionnaire. Also, the school setting did not allow for a functional evaluation. Third, this study does not cover girls since it was conducted in schools where only boys attend. We are of the opinion that it will be appropriate to include girls in the next studies to obtain the correct results.

Conclusions

In conclusion, our study results showed that adolescents had a significant deviation of the caudal septum to the right side with smaller right nostrils. However, hand dominance and side of the deviation were not significantly associated with nasal bony pyramid and caudal septum.

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Tables

Table 1. Dominant hand, deviation of the nasal bony pyramid, and caudal septal deviation according to age groups.

	Dominant hand	Dominant hand	Dominant hand	Nasal bony pyra-mid deviation	Nasal bony pyra-mid deviation	Nasal bony pyra-mid deviation	Caudal sep-tal deviation	Caudal sep-tal deviation	Caudal sep-tal deviation	Nostril asymmetry	Nostril asymmetry	N
Age, years	Right	Left	Total	None	Right	Left	None	Right	Left	None	Right Bigger	L
15 n	80	7	87	65	15	7	62	18	7	59	9	1
%	92.0%	8.0%	100.0%	74.7%	17.2%	8.0%	71.3%	20.7%	8.0%	67.8%	10.3%	2
16 n	263	28	291	218	40	33	212	57	22	206	20	6
%	90.4%	9.6%	100.0%	74.9%	13.7%	11.3%	72.9%	19.6%	7.6%	70.8%	6.9%	2
17 n	154	14	168	130	24	14	132	29	7	130	8	3
%	91.7%	8.3%	100.0%	77.4%	14.3%	8.3%	78.6%	17.3%	4.2%	77.4%	4.8%	1
Total n	497	49	546	413	79	54	406	104	36	395	37	1
%	91.0%	9.0%	100.0%	75.6%	14.5%	9.9%	74.4%	19.0%	6.6%	72.3%	6.8%	2
p	0.850	0.850	0.850	0.736	0.736	0.736	0.518	0.518	0.518	0.325	0.325	0

Data are given in number and frequency, unless otherwise stated. p<0.05 indicates statistical significance

Table 2. Association between hand dominance and nasal bony pyramid deviation, caudal septal deviation, and nostril asymmetry.

	Nasal bony pyra-mid deviation	Nasal bony pyra-mid deviation	Nasal bony pyra-mid deviation	Caudal septal deviation	Caudal septal deviation	Caudal septal deviation	Nostril asymmetry	Nostril asymmetry	No asy
Dominant hand	Right	Left	Total	Right	Left	Total	Right Bigger	Left Bigger	To
Right hand									
n	74	47	121	98	30	128	32	105	13
%	61.2%	38.8%	91.0%	76.6%	23.4%	91.4%	23.4%	76.6%	90.
Left hand									
n	5	7	12	6	6	12	5	9	14
%	41.7%	58.3%	9.0%	50%	50%	8.6%	35.7%	64.3%	9.3
Total									
n	79	54	133	104	36	140	37	114	15
%	59.4%	40.6%	100.0%	74.3%	25.7%	100%	24.5%	75.5%	10
p	0.551	0.551	0.551	0.077	0.077	0.077	0.333	0.333	0.3

Data are given in number and frequency, unless otherwise stated. p<0.05 indicates statistical significance.

Table 3. Association between nasal bony pyramid and caudal septal deviation and nostril asymmetry.

	Caudal septal deviation	Caudal septal deviation	Caudal septal deviation	Nostril asymmetry	Nostril asymmetry	Nostril asymmetry
Nasal bony pyramid	Right	Left	None	Right Bigger	Left Bigger	None
Right						
n	66	3	10	4	66	9
%	63.5%	8.3%	2.5%	10.8%	57.9%	2.3%
Left						
n	12	31	11	28	15	11
%	11.5%	86.1%	2.7%	75.7%	13.2%	2.8%
None						
n	26	2	385	5	33	375
%	25.0%	5.6%	94.8%	13.5%	28.9%	94.9%
p	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*

Data are given in number and frequency, unless otherwise stated. *$p<0.05$ indicates statistical significance.

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