EVALUATING CHARACTERISTICS OF THE NASAL PYRAMID IN ADULT VIETNAMESE PEOPLE ON 128-SLICE CT SCANS AT THE NATIONAL OTORHINOLARYNGOLOGY HOSPITAL

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Abstracts

Purpose: Providing a basic data of nasal indexes on 40 patients who underwent 128-slice CT scans at the Department of Diagnostic Imaging of the National Otorhinolaryngology Hospital. **Subjects and methods:** Retrospective cross-sectional study and nasal data were measured on CT films. **Results:** The width of the base of the nasal bone, the length of the back of the nasal bone and the wings of the nasal bone on the left and right sides were larger in men than in women ($p>0.05$). More than 50% of the nasal phenotypes belonged to type A according to the classification of the nasal bone by Tae-Sun Hwang and the rest were of type B. The average nasal length and width in men were larger than in women, respectively, in men at 50.97 ± 2.57 and in women at 47.43 ± 2.58 (mm) ($p>0.05$); The average nasal width in men and women was 40.63 ± 1.86 and 36.63 ± 1.96 (mm) respectively ($p>0.05$). According to Olivier's classification, the nasal index of the study group was mainly average, and only 1 woman had a slightly narrow nasal index; the remaining 6 people had a wide nasal index. The remaining parameters were all significant to each other through the correlation coefficient and linear equation with coefficients and constants > 0. **Conclusion:** The indexes in men were larger than in women, but the difference was not statistically significant. The average nasal index according to Olivier and the parameters were all correlated with each other.

Keywords: Nasal pyramid, CT 128, nasal index.

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1. Introduction

Anthropometry is a field of science that applies mathematical and statistical methods to measure and analyze the morphological characteristics and dimensions of the human body.[1] Although the face is a feature that exhibits both anthropological and aesthetic traits, facial anthropometry in particular is regarded as a field of exceptional significance, as well as closely related to the structure, function and health of humans.[2,3] In recent years, as science and technology advance, facial anthropometric data is used more and more in medicine, particularly in the diagnosis, treatment planning, and assessment of the outcomes of plastic-cosmetic surgery, as well as in the diagnosis and treatment of congenital malformations of the maxillofacial region, as well as in monitoring the development of facial morphology in different age groups.[4]

Additionally to being an olfactory organ, the nose is the first respiratory system organ that heats and filters air before it reaches the lungs[5]. The nose is positioned prominently. Because the nose is situated in the middle of the face, it serves both physiological purposes and contributes to the face's harmonious attractiveness.4 The nose, the most noticeable feature of the face, is composed of an intricate network of cartilage and bones that work together to support the midface. Due to its anatomical characteristics, located in the center and protruding forward, the nose is the organ most susceptible to injury on the face, leading to the risk of anatomical structure deformation as well as affecting respiratory function and smell.[6] In rhinoplasty, whether functional surgery or plastic-cosmetic surgery, the preservation and simultaneous restoration of both physiological function (ventilation, warming, humidifying and filtering air) and the aesthetic form of the nose are essential requirements. Any surgical intervention on the nose needs to be performed based on a solid understanding of the anatomy and anthropometric indicators of the nasal area to achieve optimal treatment results and limit complications, while maintaining aesthetic criteria.[2]

CT scanner is an imaging diagnostic method that provides high-resolution images, can create 3D models, and helps to accurately evaluate bone structures and soft tissues on the face.[7] In addition, creating a 3D facial model serves to measure, compare, or simulate before cosmetic surgery, especially to ensure that the structure, function and aesthetics of the nose improve better after surgery and treatment.[8]

With the increasingly developing society, the need for perfect beauty is becoming a prominent concern of people, in which facial aesthetics is an important factor contributing to that beauty, thereby forming unique characteristics for different races.[4] Because of its anatomical location in the center of the face, the nose plays an essential part in facial beauty and can be altered by cosmetic surgery. Determining the anthropometric features of the nasal tower in Vietnamese individuals is therefore a highly pressing necessity in the modern era, not only for the medical field

but also for numerous other professions. In order to contribute to providing constants with anthropometric values of the nasal tower in adult Vietnamese people, we carried out the topic "Evaluating characteristics of the nasal pyramid in adult vietnamese people on 128-slice ct scans at the national otorhinolaryngology hospital".

2. Subjects and methods

2.1. Subjects

The study was conducted on Vietnamese people randomly examined and treated at the national otorhinolaryngology hospital between November 2024 and May 2025. The study participants were Kinh ethnic, adults (aged 18-25), were assigned to have 128-slice CT scans of the nasal area and were explained and agreed to participate in the study. At the same time, the study excluded participants with congenital nasal tower anatomical abnormalities and/or were suffering from diseases or had previous surgeries that distorted the nasal pyramid morphology. Finally, the study was conducted with a sample size of 40 participants who met the mentioned conditions and criteria.

2.2. Methods

2.2.1. Method design

The study was conducted based on a retrospective cross-sectional descriptive method. We conducted a non-random convenience sampling, selecting patients suitable for the research subjects, which were 40 patients at the Department of Diagnostic Imaging, national otorhinolaryngology hospital from November 2024 to May 2025.

2.2.2. Materials

128-slice CT scanner, PACS image archiving system, HIS electronic file, Fino Pacs film reading software.

2.3. Indexes

After the nasal data is collected, it will be calculated and compared based on Olivier's classification scale[6,7] with the formula:

$$\text{Nasal Index} = \frac{\text{Nasal width}}{\text{Nasal length}} \times 100$$

The nasal data (Table 2.1) will be compared between men and women, using T-test, χ square to evaluate the difference of data based on gender difference. In addition, the data are also evaluated for correlation through writing linear regression equations, with specific slopes and constants calculated during data processing.

2.3. Data analysis

Data were entered, processed and analyzed using SPSS 20.0. Data are shown as Mean ± Standard Deviation for quantitative variables, qualitative variables: described by frequency, percentage statistics and the study used tests to compare the difference in proportions between groups. The tests are statistically significant when $p < 0.05$.

2.4. Ethics

This study was approved by the Ethics Committee in Biomedical Research of the University of Medicine and Pharmacy – Vietnam National University, Hanoi. Patients participated in the study voluntarily and all patient information was kept strictly confidential.

3. Results

3.1. General characteristics of research subjects

Table 3.1. Distribution by gender and age

Sex	Male	Female
N	23 (57.5%)	17 (42.5%)
Age (year)	23.04 ± 2.36	23.47 ± 1.81
p-value	0.46	
Total	40	

According to Table 3.1, there was no difference in age between men and women when participating in the study ($p > 0.05$). The patients participating in the study had an average age of about 23 years old.

3.2. Characteristics of the obtained parameters

Table 3.2 Main nasal bone dimensions

Sex / Khoảng cách (mm)	Male	Female
Chiều rộng gốc xương chính mũi	10.33±1.86	10,42±2.08
Chiều dài lưng xương chính mũi	27.83±2.79	25.44±3.24
Chiều dài cánh xương chính mũi bên trái	13.45±2.78	13.35±2.83
Chiều dài cánh xương chính mũi bên phải	13.19±2.40	13.08±2.27

The parameters in **Table 3.2** include the width of the nasal bone base, the length of the nasal bone back, the length of the left and right nasal bone wings in men are all larger than in women, however the difference is not statistically significant.

Bảng 3.3 Tae-Sun Hwang's classification of nasal bones [2-4]

Sex / Type	Male		Female	
	N	%	N	%
A	13	56.52	9	52.94
B	10	43.48	8	47.06
C	0	0	0	0
D	0	0	0	0
E	0	0	0	0

Among the study sample size, more than 50% of the nasal phenotypes belonged to type A according to Tae-Sun Hwang's classification of nasal bones. The rest belonged to type B. In addition, no other nasal phenotypes were found.

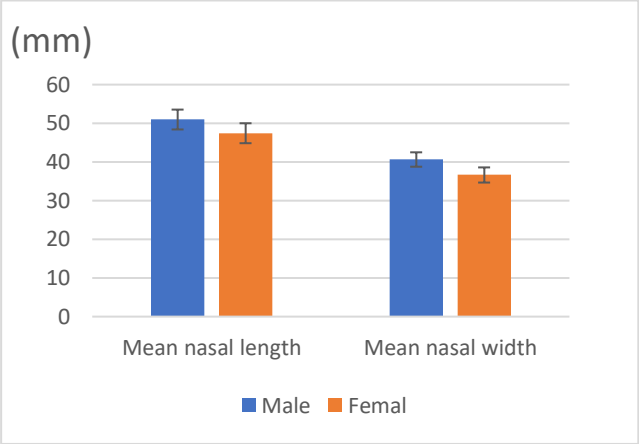

Figure 3.1. Average nasal length and width in both sexes.

The average nasal length and width in men were larger than in women, but the difference was not statistically significant. Specifically, the average nasal length in men was 50.97 ± 2.57 and in women was 47.43 ± 2.58 (mm). Meanwhile, the average nasal width in men and women was 40.63 ± 1.86 and 36.63 ± 1.96 (mm), respectively.

Bảng 3.4. Olivier's classification of nasal indexes[6,7]

Sex / Classification	Male	Female	Total
Very narrow (<39,99)	0	0	0

Moderately narrow (40-54,99)	0	0	0
Slightly narrow (55-69,99)	0	1	1
Mean (70-84,99)	19	14	33
Wide (85-99,99)	4	2	6
Moderately wide (100-114,99)	0	0	0
Very wide (>115)	0	0	0

According to Olivier's classification on the sample size of the study, the nasal index of the research group is mainly average (70-84.99). Specifically, there are 33 participants with average nasal index including 19 men and 14 women. Besides, there is only 1 female participant with nasal index belonging to the mild narrow classification (55-69.99) and 6 people including 4 men and 2 women with nasal index belonging to the wide classification (85-99.99) according to Olivier.

Table 3.5. Correlation between the obtained data

Relationship indexes	**Sex**	**r**	**p**	**Equation coefficients**	**Constant**
Nasal deck width and nasal width	Male	0.31	0.1	0.15	36.61
	Female	0.61	0.32	0.31	28.45
Nasal length and back of nasal length	Male	0.05	0.002	0.06	24.99
	Female	0.47	0.2	0.37	37.94
Length of the nasal bone and nasolabial angle	Male	0.18	0.03	0.08	17.39
	Female	0.22	0.05	0.15	4.73
Protruding upper lip and nasal tip	Male	0.02	0.001	0.17	118.95
	Female	0.19	0.04	0.04	25.69
Tip angle and back length of nose	Male	0.33	0.111	0.23	4.44
	Female	0.51	0.26	0.33	9.79

The paired parameters are significant to each other through the correlation coefficient and linear regression equation with coefficients and constants both > 0.

4. Discussion

Nasal anthropometry plays an increasingly important role in medicine, especially in improving the understanding of anatomy and as a basis for plastic surgery.[4] Therefore, a specific and detailed set of data on the morphology, structure and characteristics of the nasal tower is an essential basis for applications in medicine. In particular, based on that set of nasal data, doctors can use artificial intelligence to sketch and build images of the nasal structure, as well as compare the differences before and after surgery.[9]

In this study, we conducted a survey of the nasal tower characteristics on 128-slice CT scans in Vietnamese adults, aged 18 to 25, at the national otorhinolaryngology hospital. The research subjects were randomly selected, without congenital malformations or diseases, surgical interventions affecting the nasal morphology. The results obtained contribute to describing the nasal anatomical structure in a young, healthy population, representing the current Vietnamese adults.

The results of this research demonstrate that the Vietnamese nasal tower's morphological indices fall within the range of variance found in earlier local and international investigations. Ho Nguyen Anh Tuan et al.'s research. (2024), with 182 participating students, the average age of 22 had an average nasal tower height and average nasal length that tended to be lower than in our study.[10] This can be explained through the research design, our study measured on high-resolution 128-slice CT scans and measured directly on software images, in addition, the difference in study sample size and gender distribution of the research group also contributed to this difference. Meanwhile, compared with data from Koreans or Europeans published by Lee et al. (2019) and Farkas et al. (2005), the Vietnamese nasal tower has a lower profile, a smaller nasolabial angle, and a larger nasal base width, reflecting the anthropometric characteristics of people in the Asia-Southeast Asian region.[11,12]

The differences in nasal tower morphology between ethnic groups may be related to genetic factors, environmental factors, and biological adaptation characteristics. Factors such as bone-cartilage ratio in the nasal structure, soft tissue thickness, or climatic characteristics may contribute to shaping the characteristic nasal shape of each population group.[13] Understanding this characteristic is important in clinical practice, especially for cosmetic and reconstructive surgery of the nasal area, helping doctors have a basis to adjust techniques to suit the anatomical characteristics of Vietnamese people.

Furthermore, there are particular constraints to our study. The nasal pyramid data by age and gender, the association between the measured variables, and the variance in structure and morphology are all not fully reflected by the study sample size, which is still modest (40 instances), primarily in the 18–25 age group. Furthermore, larger-scale multi-center surveys are required to obtain a more thorough and representative picture of the Vietnamese community because the study subjects are all. The application of high-resolution 128-slice CT images, which enable precise description of the nasal pyramid bone and cartilage structure and provide trustworthy data for anthropometric research and clinical applications, is the study's strongest point. In addition, this is one of the first studies to use measuring parameters on the nose to identify and provide the foundation for a truly useful data collection.

5. Conclusion

After analyzing 40 cases of 128-slice CT scans at the national otorhinolaryngology hospital in a group of young people (average age 23) of both sexes, some nasal tower characteristics in Vietnamese adults were obtained as follows:

- Parameters including the width of the nasal bone base, the length of the nasal bone back, the length of the left and right nasal bone wings in men were larger than in women, however the difference was not statistically significant.
- More than 50% of nasal phenotypes belonged to type A according to the classification of nasal bone by Tae-Sun Hwang. The rest were type B. In addition, no other nasal phenotypes were found.
- The average nasal length and width in men were larger than in women, however the difference was not statistically significant. Specifically, the average nasal length in men was 50.97 ± 2.57 and in women was 47.43 ± 2.58 (mm). Meanwhile, the average nasal width in men and women was 40.63 ± 1.86 and 36.63 ± 1.96 (mm) respectively.
- According to Olivier's classification, the nasal index of the study group was mainly medium (70-84.99, specifically, 33 participants had an average nasal index including 19 men and 14 women and only 1 female participant had a nasal index in the mild narrow classification (55-69.99); the remaining 6 people including 4 men and 2 women had a nasal index in the wide classification (85-99.99).
- The remaining parameters were all significant to each other through the correlation coefficient and linear equation with the coefficient and constant both > 0.

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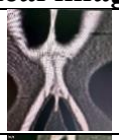
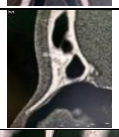
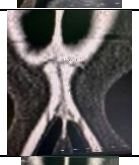
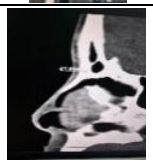
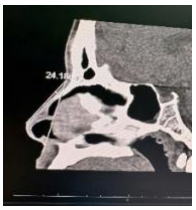
Appendix

Table 2.1. Nasal pyramid indexes in the study

Index	Plane	Convention	Real image
Width of the base of the nasal bone	Coronal	A straight line connecting the base of the right nasal bone to the base of the left nasal bone	
Length of the nasal bone	Sagittal	Distance from the nasolabial junction to the midpoint of the nasal bone	
Length of the left nasal bone	Coronal	Length from highest point to lowest point of left nasal bone	
Right nasal bone length	Coronal	Length from highest point to lowest point of right nasal bone	
Length of the back of the nose	Sagittal	Length from the most concave point of the bridge of the nose to the highest point of the tip of the nose	
Nasal length	Sagittal	A straight line connects the most concave point of the bridge of the nose to the point of the upper lip.	
Nasal floor width	Coronal	A straight line connects the right upper lip and nose wing point to the left upper lip and nose wing point.	

Nasal width	Coronal	A straight line connects the outermost point of the right nostril to the outermost point of the left nostril	
Protruding nose tip	Sagittal	A straight line connecting the upper lip to the highest point of the tip of the nose	
Naso-forehead angle	Sagittal	The angle formed by the straight line connecting the most prominent point of the mid-forehead line to the lowest point of the root of the nose and the straight line connecting the lowest point of the root of the nose to the highest point of the tip of the nose	
Nasal projection	Sagittal	The angle formed by the straight line connecting the highest point of the tip of the nose to the lowest point of the root of the nose and the straight line connecting the lowest point of the root of the nose to the point of the upper lip	
Tip-nose angle	Sagittal	The angle formed by the straight line connecting the lowest point of the root of the nose to the highest point of the tip of the nose and the straight line connecting the highest point of the tip of the nose to the point of the nose-lip column	
Upper-lip nose angle	Sagittal	The angle formed by the line segment connecting the most prominent point of the nasal column to the nasolabial column and the line segment connecting the nasolabial column to the most prominent point of the upper lip