Original Article

Age And Sex Determination Using CT scan Nasal Bone Imaging

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Abstract

Age and sex determination are crucial in the biological identification of the remaining skeleton, especially in forensic circumstances. This study's main important focus is to gauge the dimension such as distance, width, size, and structure of the cranial bone. It still becomes most laborious when the body has been reduced to a skeleton. Between men and women: In men, the height or width of the nasal bone is higher than in women. The cranial capacity is higher in females as compared to males. The main task of this examination was sex estimation through the geometric morphometric analysis of the frontal bone. Occurred distinction in structure and magnitude through the glabellar region. The parameters of different components are used to determine sex, i.e., nasal aperture, etc.; Multi-Detector Computed Tomography (MDCT) helps in sex determination. MDCT plays a vital role in identifying age, sex, and determination using scans of various cranial bone parts. Computed tomography provides good image acquisition, greater spatial resolution, and excellent accuracy. This study's focus on forensics is to estimate the measurements such as length, width, etc. Glabella separated the female and male skulls with reasonable accuracy. For sex determination, mastoid size, nasal height measurements, and various anthropometric methods are used. Some studies indicate a distinguished purpose that also helps to determine the sex from the remaining skeleton. The main motive of this study is to present sex using a piriform aperture from a fragmented skull. The mean value of nasal height, nasal width, and nasal index is higher in men than women. The growth nasal septum is monitored in paediatrics for one year because the paediatrics gradually develop nasal septum during one year. In forensic circumstances, there is only one anatomical structure to determine sex and ages better. The lower region of the face is more different than the upper section of the face. In the Gastrointestinal intestinal period, nose length rises from 3.3 mm to roughly 16 weeks. At different ages, nose parameter is identified using MRI and magnetic resonance imaging; nasal structure and size are constant or growing after 35-year man and women. After a period of 45-year, thickness in the soft tissue of craniofacial.

Keywords: Sexual dimorphism, Measurements, nasal bone, piriform aperture, sex determination, computed tomography.

Introduction

The identification of humans is essential in forensic investigation not only in alive but also in dead bodies. The head is the central part of the human body, although they represent a small part of the surface. The head's bone is mainly derived from branchial arches and begins developing from the 4th week of pregnancy. The dead procedure means post-mortem in the forensic department. It is inescapable or required by social norms [1]. Skulls play an essential role in the identification of sex determination.

Anatomical knowledge is most determining in many cases, such as mass disasters and natural disasters when a small piece of the nasal remains in the skeleton. The nasal bone is eloquent with the frontal bone, which is called frontonasal sutures. Anterior nasal opening is known to perform aperture [2].

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Two nasal bones are divided from the midline to form an internasal suture. The fractures of the facial skeleton include nasal bone and pyriform aperture. The pyriform gap, perform gap, and anterior nasal aperture is pear-shaped, opening the human skull. Its long axis is the upright and tapering end upward. The shape and size of nasal bone are different in different ages, races, and climates. Nasal anatomy helps in the rhino logic procedure. Most of the Investigation is done by the nasal aperture. In clinical practice, it is engrossing to perform piriform aperture computation and shape [3]. The brain is closely correlated to cranial capacity. The cranial capacity contains the essential information, which helps connect with the cranial measurement. In clinical practice, the cranial or skull is used to check the abnormalities, shape, and size considering humans' age and sex, mainly the cranial capacity measuring in cubic centimetres. Sex is determined by measuring the head's vast breadth and articular height. Cranial capacity helps in abnormalities of size and shape of crania or skull. In the radiological method, some studies did on the dry head. Cranial capacity exhibits growth and circumstances [4]. Intact components of the skeleton and remaining bone help in identification. Many past studies have considered nasal aperture measurement and nasal index as part of human identification. The parameter of the nasal aperture helps in the determination of sex. There are different methods for reorganising leftovers of the human body [5]. Sex is determined in such a pattern: growth development, including hormones. Puberty, shape, and size differ in males and females of the skull [6]. Sex guessing used the traditional method, i.e., visual assessment of traits and standard scoring. Such cases have many superiorities of being straightforward, fast, and appropriate. Cranial feature include mastoid, glabella. The focus of this kind of study is quantitatively to assess and decide its value in forensic sex estimation. The definitive research determined that males have sloping foreheads compared to females [7]. Many studies of sex identification depend on biological differences between males and females. Males have larger bodies than females because males have more muscle mass. Using computed tomography, all computation in a study is more significant for male crania than female. The main aim of this kind of study is to investigate craniometric study on sexual dimorphism between male and female skulls [8]. For sexual dimorphism cranial, we used 3D digital data and geometric morphometrics. We used different approaches to facing other problems, i.e., minimising Intra and interobserver error rates in compliance. Some of these methods are complex and gradual, i.e., time-consuming in the forensic department. In 1988, Knussmann expanded an ordinal scoring scheme to frontal inclination categories, providing vast differences for the vertical, sloped, feeling forehead. Now appeal slightly modified version on a large and diverse sample of the documented skull. The discriminate functional analysis represents the identified sex rate and is used in the measurements. [9]

Anatomy

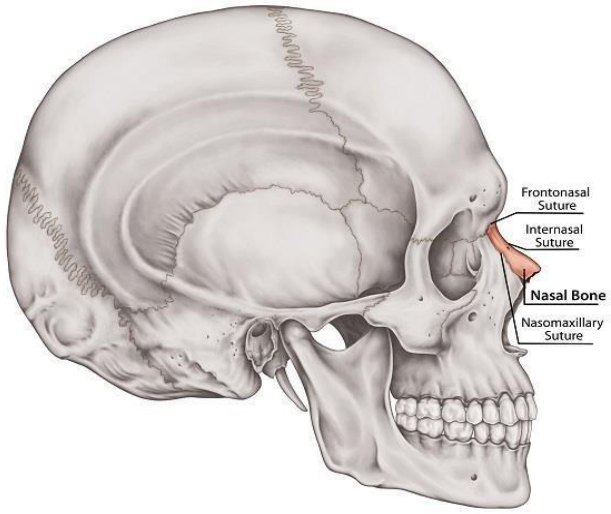

Fig.1: Human skull with suture

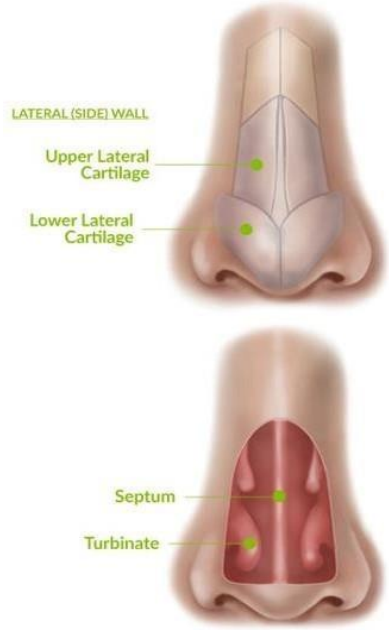

Fig.2: Location of nasal bone

Sex determining features-

- Supraorbital prominent is more in men.
- The palate is more prominent in males.
- The skull of women is smaller and smoother than men
- In men, the frontal sinus is bigger females have a smaller and highly pointed mastoid process, while males contain more oversized and extra unsharp.
- Zygomatic arch minor in women and broad extensive in men

Table no.1 Mean of Nasal height, Nasal width, Nasal index of a different gender

Gender	Age	Nasal height	Nasal width	Nasal index	Mean
Male	4yr	0.423	0.031	0.074	0.479
Male	10yr	0.235	0.352	0.852	0.871
Male	18yr	4.10	3.74	90.96	38.16
male	25yr	4.29	3.80	88.76	37.68
Female	4yr	0.322	0.453	0.034	0.788
Female	10yr	0.659	0.232	0.765	1.146
Female	18yr	4.02	3.825	90.01	37.85
Female	25yr	48.56	31.65	61.65	100.76

Anthropometric measurements

The measurement landmark is as follows_

Nasion, the nasal root's midline, the nasofrontal suture, the columella base midpoint, and the nasal tip are most prominent. A familiar landmark was noted for taking anthropometric measurements. The anthropometric measurement helps in plastic surgery and Reconstructive surgery. It also plays a vital role in scientific research study. The nasal bone is helpful in the determination of age and sex as well as it also plays a crucial role in race or nationality. The nasal index is more extensive in men as compared to women. Each ethnicity had its nasal index [10].

Abbreviation parameters used for measurement

Nose height: from nasion to nasospinale; Nasal width: mase space of nasal aperture; Anatomic nasal index: nose width ratio to ratio of nose height. Anatomic width of the nasal bone. Nasal volume: from the volume of two tetrahedra. prosodic index = face length or face width× 100. Parameters of naso index and nasal width index. Cranial length: straight distance from glabella to opisthocranion; Bizygomatic breadth: distance between the lateral side of both orbits. The variables include mastoid length on both sides, Foramen magnum length, Nasal width and height, bizygomatic arch breadth, and Upper facial length and breadth. Biorbital breadth. The particular measurement was obtained from a different site. It's identified the size of the male skull is larger than the female. Cranium measurement consists of high sex determination power. Male skull sexual determination is by osteometric techniques [8].

Sex determination by bar bodies:

Determine sex by x and y chromosomes which are present in the cell. It depends on humidity and temperature. X chromosomes are also called bar bodies. The results of this method are shown four weeks after the death. Bar bodies are stored in dehydrated pulp for a minimum of 1 year. It retains for use in diagnosis after being heated at 100-degree C. [11]

Piriform Aperture

Piriform aperture shows ethnic and geographical differences due to different climates. Piriform aperture size is different in both genders. In males, 24.75 approximately and in females 22.77 approximately. Male has larger piriform aperture as compared to female. The structure and magnitude of the piriform gap showed remarkable sexual dimorphism. This forensic investigation for sexual purposes narrows the inferior border that connects to the lateral cartilage of the nasal and contributes to the frontal nose orifice known as piriform aperture breakage on the facial bone form of frequent detecting. Resection intercession for masses of frontal and median cranial or skull bases that need piriform gap provide toward in piriform aperture there is an ethnic difference in shape structure and size that under the account of neurosurgery and rhinology. Piriform apertures form triangular to oval shapes. The mean height of the piriform gap is higher in men. The piriform gap is present in the middle of the piriform facial cleft.[3]

Forensic sex assessment

In the skull nasal is a common skeleton element for gauging sex. The facial and pelvis are two significant parts that differentiate gender hole skeleton are not always mentioned to forensic practitioners. Dissimilar methods have diversified accuracy rates for estimating sex skeleton sex calculated using Morphoscopic and morphometric methods. Matric is appropriate to evaluate sex. In sexually dimorphic Morphoscopic sex guag in aperture piriform aperture based on inspection of the skeleton.[10]

Fig.3: Piriform Aperture

Discussion

Every person has a unique and different property. Such as their physical and mental property; this technique is called anthropometry. Anthropometry is used for the measurement of the dead as well as alive bodies or human beings.[5] It plays an essential role in forensic medicine. Everyone has a variable shape and size. The measurement of the nasal aperture is more in males than females. We correctly classified 71% as female and 66% 0f male gender. The nose is a stand-out part of the face. It is alterable in shape and size. Using an MDCT 2D scan, we obtain greater nasal aperture in males than females. The perfection of gender identification was 80% for males and 90% for females by applying discriminate functional analysis [5]. In anthropologic classification, the racial difference between nasal bone and perform aperture through the shape and size. Mean values show higher significance in men than females. Perform aperture is in the oval shape of the skull. The mean height of the piriform gap is 39 mm and saw more value in males. We take the help of 3D CT construction. 3D reconstruction and finding mean piriform aperture height in females and males. The maximum piriform aperture in males is 25mm, and in females, 22mm for this study. The shape of the pyriform aperture was triangular to the oval of the skull [3]. Many studies were done on the dry head using linear dimensions. The cranial capacity increases from birth as growth progresses; most progress is made in five years, between 16 and 20. Cranial capacity changes within 20 years. After that, the size of the cranial cannot change. Cranial volume in males was 1132.16 cm; in females, the cranial volume was 1172.9cm. The result obtained from the research is higher than the result obtained from the study. We get more results from analysis because of fundamental differences like tribe, morality, etc. [4-10]. For SDI, the different significance is calculated. The extra size samples obtained from 150 skulls contain different shapes and sizes. The ratio of women and men is higher than one for all others. The differences include different sexual dimorphic variants. The variable is the length of the mastoid, the height of the nasal, forehead width, and cranial length. All have variable measurements only nasal bone lengths are the same in males and females. The size of the cranial is more significant in males than in females. Cranial measurements have strong sex discriminating power. The nasal bone is less in breath in females [11-15]. In many studies, the main focus is on the glabellar region; a new quantitative method is used to estimate frontal inclination for sex determination. Cranial is measured by distance, volume, area, etc. It shows sex differences in frontal propensity and also different ages. All quantifying were done on the cranial 3Dimenstional model, which earlier has been shown to recognise accurate quantification of cranial geometry in term of interrelating, separation and volumes. [16-20] The highest sex grouping rates were acquired for Europeans and U.S. we observed that differences in the forehead shape are tremendous apparent between men and women. These results are compatible with preceding reports of more significant sexual dimorphism in glabellar prominence. Males have prominent glabella and sloped foreheads. For proper and detailed investigation, we used MRI, and C.T. Glabellar gives more appropriate accuracy than supra-glabellar to determine sex, whether male or female. The men's frontal inclination angle is different. It is larger than the females. There are two essential features of the glabellar region, i.e., glabellar prominence and sloped forehead. Fewer numbers of landmarks present in inclination angle measurements are to be detected on the skull. [21]

In the study of Omotoso et al., there was 99.25 male and 88.64 female in Nigeria's population, which placed higher in the studies, which shows difference significant in different sexes. It is necessary to know each race has its nasal index, which is higher in males than in females. The disadvantage is that only medical students enrolled in this study. [22] From the research and observation of different authors, we examined that the piriform aperture and nasal region show different results in diverse populations. The investigation led in 2018 by Araujo et al. and other authors used classical morphometric methods of the piriform aperture using sexual dimorphism. As a result, the height of the piriform gap is more significant in the skull of males than in females. Irene Magia et al., using geometric morphometrics, examined the sexual dimorphism of the nasal, and it came to an end, i.e., concluded that the higher meatus of the nose is more significant in males and more minor in females. It shows the difference in structure and size of hoan between males and females. Alves et al. examined that gender determination is mainly based on piriform aperture. Parameter height to the piriform gap is best for the determination of gender. The structure of the piriform aperture is between oval and triangular in both genders. [23-24]

Conclusion

The primary and essential characteristic of determining the men or women is sex determination using physical

anthropometry. To determine sex-these factors are used - nasal height, nasal width, etc. This study provides a parameter of the nasal index. This study also includes information on the pyriform aperture. Show the correlation between age and sex of cranial capacity. Female and male crania determine the age. By doing MRI and CT, we get more detailed information. The data show that the inclination angle measurements are straightforward but use a 3D scan. It is beneficial to identify the sex and age of a human being. This study provides morphological characteristics of the pyriform aperture with no proper monogram for all populations. The nasal index of males is more extensive in comparison to females. For identification, sex determination becomes a first 'priority in case of a nuclear bomb, natural disaster, or any case investigation.

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