Anthropometric Study Of External Ear In Undergraduate Medical Students At Raipur, Chhattisgarh, India.

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ABSTRACT

The human auricle has attracted the attention of forensic scientists since a long for its unique morphological characteristics. The human ear was not only accessible for its morphological and morphometric variations, but also its existing bilateral, sex, and population differences. This descriptive cross-sectional study was conducted amongst 140 participants of medical college. Dimensions of external ear mainly height and width of ear along with Lobular height and width, were measured with the help of caliper. The data was entered in appropriate statistical software, descriptive statistics i.e. mean, standard deviation done and test of significant applied to find out the statistical significance of the measurements. In present study, all the parameters of external ear were slightly greater on right side than left side among both sexes which were statistically significant. Also present study observed gender differences in anthropometric measurements of external ear, all the parameters of external ear were found greater in males than female & the findings were statistically significant. Knowledge of the normal auricular dimensions is a prerequisite to be able to diagnose congenital malformations, syndromes, and acquired deformities of the ear. The present study provided a database of different ear parameters and also highlighted the sexual dimorphism and bilateral differences in ear morphometry among the study participants.

Keywords: Anthropometric study, external ear, undergraduate medical students.

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INTRODUCTION

Anthropometry refers to the measurements of human body structures for understanding physical variation as it plays an important role in plastic surgery, prosthetics etc. Identification is an important facet of any forensic investigation. The human ear is a defining feature of the face. Its subtle structures convey signs of ageand sex that are unmistakable yet not easily defined [1]. Anthropometry is a series of systematize measuring techniques that expressquantitatively the dimensions of human body and skeleton which shows variation according to age, gender and race. Various parameters have been established for identification of individuals. Anthropometry of external features of the pinna is one of them [2]. The human ear is divided into external, middle and internal ear. The pinna and the external acoustic meatus form the external ear. The lateral surface of the pinna is irregularly concave faces slightly forward and displays numerous eminences and depressions [3].

The importance of ear morphology lies in the fact that it also helps in the interpretation of the ear prints encountered at the crime scene in forensic settings. Moreover, it adds to the frequency of morphological characters of ears and allows for the prediction of the features on the ear impression [1].

Alphonse Bertillon, the Chief of the Judicial Identification Service of France was the first to investigate the potential of ears in human identification [8]. Kenny Meijerman L et al found an interesting association between the diagonal ear lobule crease and myocardial infarction risk [4]. *Alexander and Laubach* conducted a photogrammetric study and developed a technique that enables specified ear dimensions to be measured directly from photometric slides in a precise manner. Further, they devised regression equations for predicting various ear dimensions from ear length and ear breadth [5]. *Iannerelli* considered the ear as unique as fingerprints and explained the morphological basis for the application of the ear in ascertaining the identityof individuals [6]. The existence of abnormality of the external ear as an early diagnostic feature for existence of an abnormality of the urinary tract, due to concomitant development of the external ear and urinary tract during embryogenesis has been documented by Perrin et al [7].

MATERIALS AND METHODS

The present study was carried out in the Department of Anatomy attached to Medical College, after due approval from Research Advisory Committee (RAC) & Institutional Ethics Committee (IEC).

Study Type: Descriptive Cross-sectional study.

Study Population: First year MBBS students consenting for the study.

Sample Size: 140 participants.

Inclusion Criteria: First year MBBS students consenting for the proposedstudy.

Exclusion Criteria: Participants with congenital ear anomalies and ear surgeries were excluded from the study.

Methodology

Anthropometric measurements of Ear

The anthropometric landmarks of ear were identified on the subjects with careful inspection, and the same was marked with a colored pencil. The standardized anthropometric measurements of the ear were taken with precision and accuracy using sliding calipers (Fig.1-3).

Height of Ear: It was measured as distance from the most inferiorprojection of the ear lobule to the most superior projection of the helix.

Width of Ear: It was measured as most anterior and posterior pointsof the ear.

Lobular Height: It was taken as the distance from the most inferiorend of the lobule to the base of the

tragal notch.

Lobular Width: It was measured as the horizontal width of lobule at the midpoint of lobular height.

Figure 1: Height of the ear   **Figure 2: width of the ear**

Figure 3: Lobular height

Anthropometric measurements of the Ear and Ear Lobule

Data Analysis

All data was entered in Microsoft Office Excel. All statistical analysis was carried out using Excel and SPSS-20, like mean, SD and test of significance like Pearson's Chi Square Test.

RESULTS

Total 140 study participants were included in the study having majority female participants (N=86) as compared to male participants (N=54). The descriptive statistics i.e. Mean & standard deviation using the statistical software and test of significance applied.

As per Table 1 mean height, width of external ear & lobular height & width were having higher

values on right side as compared to left side and the observed difference is statistically significant. Also further analysis on gender basis show higher values for all parameters in males as compared to females on both right & left side and the observed distance is statistically significant (Table 2).

Table 1: Different parameters of right and left external ear among studypopulation

Parameters	Side ofEar	Mean±SD (cm) N=54	p-value	Mean±SD (cm) N=86	p-value	Mean±SD {cm} N=140	p-value
Height of Ear	Right	6.53 ± 0.48	<0.05	5.86 ± 0.40	<0.05	6.12 ± 0.54	<0.05
	Left	6.33 ± 0.52	<0.05	5.66 ± 0.41	<0.05	5.92 ± 0.55	<0.05
Width of Ear	Right	3.02 ± 0.63	<0.05	2.90 ± 0.27	<0.05	2.94 ± 0.27	<0.05
	Left	2.83 ± 0.24	<0.05	2.72 ± 0.29	<0.05	2.76 ± 0.28	<0.05
Lobular Height	Right	2.28 ± 0.44	<0.05	2.14 ± 0.30	<0.05	2.12 ± 0.36	<0.05
	Left	2.18 ± 0.41	<0.05	2.05 ± 0.31	<0.05	2.10 ± 0.36	<0.05
Lobular Width	Right	2.31 ± 0.41	<0.05	2.06 ± 0.32	<0.05	2.15 ± 0.38	<0.05
	Left	2.10 ± 0.34	<0.05	1.96 ± 0.31	<0.05	2.02 ± 0.33	<0.05

Table 2: Comparison of different parameters of external ear in males and females in study population.

Parameters	Right				Left		
	Male(N=54)	Female(N=86)	p-value		Male(N=54)	Female(N=86)	p-value
Height of Ear	6.53 ± 0.48	5.86 ± 0.40	<0.05		6.33 ± 0.52	5.66 ± 0.41	<0.05
Width of Ear	3.02 ± 0.63	2.90 ± 0.27	<0.05		2.83 ± 0.24	2.72 ± 0.29	<0.05
Lobular Height	2.28 ± 0.44	2.14 ± 0.30	<0.05		2.18 ± 0.41	2.05 ± 0.31	<0.05
Lobular Width	2.31 ± 0.41	2.06 ± 0.32	<0.05		2.10 ± 0.34	1.96 ± 0.31	<0.05

DISCUSSION

In present study, all the parameters of external ear were slightly greater on right side than left side among both sexes which were statistically significant, which correlates to findings of Rashi Nigam, Kiran Kumar P, SaurabhKulshreshtha[1].Shireen S and Karadkhelkar VP also reported the similar results in their study [9], while M.G. Taura et al., also found that all parameters were higher on right sidethan left side except height of ear which was same on both sides [8].

Also D. Deopa et al., found that all parameters were more on left side than right side but it was not statistically significant [10].

Sharma N also compared the anthropometry of external ear between left and right side, which reported the insignificant difference [2].

In our study, all the parameters of external ear were found statistically significant greater in males than female, which were in accordance with the findings of Rashi Nigam, Kiran Kumar P, Saurabh Kulshreshtha [1]. Taura M.G. et al., also reported similar findings in their study amongst Nigerian population [8]. D. Deopa et al noticed that all the measurements were higher in males than females on both sides. They also observed that total height of ear and ear width were found to be significantly greater among male. They observed the left ear indices were found to be higher than the right ones for all the subjects which was not in accordance with the present study. But, in female subjects, the right indices were found to be greater than the left ones. Lobular indices were found to be higher on right side than the left ones for all the subjects [10], supporting present study results.

Sangeeta S and Anisha B studied the height and width of ear lobule & found greater on right side than left side, which was statistically significant and lobular width was more in male than female which was also statistically significant whereas there was no statistical significance of lobular height among males and females [11]. *Wang et al.,* observed that lobule dimensions are not significantly difference in

two genders [12] which was non-concurrent to present study results. The present study reported sexual dimorphism in the auricular dimensions on both sides & significant differences were observed on right and left sides respectively. The differences in males and females may be linked to the statement that auricle expansion starts earlier in males than females, which continues up to the older age [8]. The variations in gender may also be influenced by genetic factors which vary with sex.

CONCLUSION

The present study provided a database of different ear parameters and alsohighlighted the sexual dimorphism and bilateral differences in earmorphometry among study population. This anthropometric study may be useful in identification of congenital deformities, acquired deformities due to traumatic injuries. So, the measurements are implicated in the plastic reconstructive surgeries to correct the deformities and also useful in making the hearing aids or prosthesis, ear phones and head phones.

REFERENCES

[1]   Brucker MJ, Patel J, Sullivan PK; Department of Plastic Surgery, Brown Medical School and Rhode Island Hospital, Providence, 02905, USA. A morphometric study of the external ear: age-nd sex-related differences. Plast Reconstr Surg.2003 Aug;112(2):647-52.
[2]   Sharma N. Anthropology measurement and Cross-sectional surveying of ear pinna characteristics in Northern India. J Exp Clin Anat 2016;15:102-6.
[3]   Williams PL, LH Bannister MM. Berry P Collins, M Dyson JE, Dusseck and MWJ Ferguson. 1987. Grays's Anatomy. 37th Edn, Churchill Livingstone, New York, London, Madrid, ISBN:0443071683, pp: 1367-1370.
[4]   Kenny Meijerman L, Thean A and Maat G. Earprints In forensic Investigations.Forensic Sci Med Pathol 2005;1:4:247.
[5]   Alexander M, Laubach LL. Anthropometry of the Human ear (A photogrammetricstudy of USAF flight personnel). Aerospace Medical Research Laboratories-TR 1968; 67-203.
[6]   Iannerelli A. Ear Identification, Forensic Identification Series, Paramount Publishing Company, Fremount, California, 1989.
[7]   Perrin P, H Baithelme D Moyot, C Pem and M Schmitt. External ear and abnormality of the urinary tract: A Comparative study of 2 series (100 And 150 cases). Rev Laryngol Otol Rhinol (BOrd) 1999;112:399-403.
[8]   Taura MG, Adamu LH, and Modibbo MH. External Ear anthropometry among Hausas of Nigeria; the Search of sexual dimorphism and correlations World Journal of Medicine and Medical Science Research 2013;1(5);091-095..
[9]   Mohite PM, Keche AS, Mohite DP, Keche HA. Correlation of the Dimensions ofHand & Feet with Stature of an Individual: A Study on Central Indian Adults. J Indian Acad Forensic Med 2015;37 (2):160-164.
[10]   D Deopa, HK Thakkar, Chandra Prakash, R Niranjan, MP Barua. Anthropometric measurement Of external ear of medical student in Uttarkhand Region. Journal Of The Anatomical Society Of India 2013;62:79-83
[11]   Sangeetha S and Anisha B Anthropometric measurements of human ear lobule in adult student population. Int J Anat Res 2017;5(2.2):3748-87.
[12]   Wang B, Dong Y, Zhao Y, Shizhu BS, Wu G. Computed tomography measurement of the auricle In Han population of North China. J Plast Reconstr Aesthet Surg 2011;64(1):34-40