



## Correlative Analytic Overview of Anthropometric and Morphological Parameters of Pinna

Vishnu S Reddy<sup>1</sup>, Belaldavar BP<sup>2</sup> and Prathiba Reddy T<sup>3\*</sup>

<sup>1</sup>Department of Otorhinolaryngology, Care hospital, Banjara hills, Hyderabad, India

<sup>2</sup>Department of Otorhinolaryngology, Jawaharlal Nehru medical college, Belgaum, India

<sup>3</sup>Department of Otorhinolaryngology, Care hospital, Banjara hills, Hyderabad, India

\*Corresponding author: Prathiba R, Department of Otorhinolaryngology, Care hospital, Banjara hills, Hyderabad, India, Tel: 8050129130; E-mail: prathu90reddy@gmail.com

Received date: March 23, 2021; Accepted date: April 09, 2021; Published date: April 19, 2021

### Abstract

**Introduction:** The morphology of pinna is quite complex. The knowledge of anthropometry of normal pinna is required to surgeons for surgical reconstructions, to the manufacturers for the design of hearing aid instruments and to forensic specialist for identifying a person.

**Objective:** This study aimed at determining the mean values of various anthropometric measurements of pinna, about sex related dimensions and right-left symmetry.

**Methodology:** The measurements are taken from 100 healthy young medical students aged 17-30 years using a digital vernier caliper. The parameters measured were Total Length of Pinna (TLP), Width of Pinna (WOP), Physiognomic Index (PI), Postaural Angle (PAA). The presence or absence of Darwin's tubercle and degree of lobule attachment was also studied.

**Result and Conclusion:** The mean values for TLP, WOP, PAA in female subjects were found to be respectively 61.3 mm, 33.1 mm, 26 deg for the right ear and 60.9 mm, 32.6 mm, 26.4 deg for left ear. However, in male subjects, these values were, respectively 62.9 mm, 34.2 mm, 27.4 deg for right ear and 62.7 mm, 33.4 mm, 27.5 deg for left ear. The morphology of pinna according to our study is short and circular with Physiognomic Index >50. The Darwin's tubercle was present in 45%. The lobule was adherent in 14% of subjects.

**Keywords:** Pinna; Anthropometry; Post aural angle; Plastic surgery

### Introduction

The pinna performs important physiological role and also influence the aesthetic role. According to earlier views, the pinna was rather recognized as a cosmetic organ and its importance was more related to the facial aesthetics and physiognomy [1].

The word pinna is derived from Greek word meaning 'feather of a wing'. Being situated at the outer contour of face, the pinna is one of the major factors in determining facial proportionality and is particularly influential in determining its beauty. Though the beauty of an individual is not defined by ears, any deformation or malposition of pinna can detract from one's appearance and can be a source of psychological distress as they focus on it and may impair their social life.

The appearance and symmetry of pinna, enormously contributes to the facial aesthesis. Cosmetic surgery and facial rejuvenation is becoming quite popular. The morphology of pinna is quite complex. Therefore, detailed knowledge about its typical dimension is needed for cosmetic surgeons to determine accurately the position and orientation of the auricular framework and to avoid mutilation [2,3].

This study gives the mean values of various anthropometric measurements of pinna and also the geographical influence in this part of world.

### Materials and Methods

#### Subjects

This study was carried out in Jawaharlal Nehru medical college, KLE institutions, Belgavi, Karnataka, on 100 medical students from different states of India, aged 17-30 years, with no evidence of congenital ear anomalies, trauma to pinna and previous pinna surgeries [4-8]. The purpose of the study was explained to all the subjects and their willingness to participate in the study was considered. Before starting this study ethical clearance was obtained from institutional ethical committee.

#### Anthropometric measurements

The parameters measured were:

- Total Length of Pinna (TLP)
- Width of Pinna (WOP)
- Post Aural Angle (PAA)
- Physiognomic Index (PI)
- For each subjects right and left pinna by using digital Vernier caliper.
- Length: From supraaurale to subaurale
- Width: Distance between otobasion superior to outer most point of posterior helical rim
- Postaural angle: It was measured from the mastoid prominence to corresponding outermost point of the helix
- Physiognomic Index: Auricular width/auricular height  $\times 100$
- Morphological parameters studied were:
- Presence or absence of Darwin's tubercle
- Type of lobule attachment

In order to minimize the bias, all the measurements were taken by the single investigator.

The numerical data was analyzed statistically by using Statistical Package for Social Sciences (SPSS) version 20.0 [9-13]. Comparison of the measurements according to the gender and comparison of the right and left ear measurements were performed.

## Results

The measurements and comparison of results are shown in Tables 1-6. The mean values for TLP, WOP, PAA in female subjects were found to be respectively 61.3 mm, 33.1 mm, 26 deg for the right ear, and 60.9 mm, 32.6 mm, 26.4 deg for the left ear. However, in male subjects, these values were, respectively 62.9 mm, 34.2 mm, 27.4 deg for the right ear and 62.7 mm, 33.4 mm, 27.5 deg for the left ear. According to Table 2, TLP and WOP were more in males than females [14,15]. There was no significant difference of the respective parameters of pinna between the right and left sides. Pinnas were short and circular with Physiognomic Index >50.

Variables		Gender	N	Min	Max	Mean	SD	SE	95 % CI for Mean	
									Lower bound	Upper bound
Total length of pinna	Right	Male	25	56.4	68.4	62.9	4	0.8	61.3	64.6
		Female	75	53.3	68.4	61.3	3.5	0.4	60.5	62.1
		Total	100	53.3	68.4	61.7	3.7	0.4	61	62.4
	Left	Male	25	54.5	68.8	62.7	4	0.8	61.1	64.4
		Female	75	51.6	68.2	60.9	3.5	0.4	60	61.7
		Total	100	51.6	68.8	61.3	3.7	0.4	60.6	62.1
Width of pinna	Right	Male	25	31.3	37	34.2	1.6	0.3	33.6	34.9
		Female	75	27.2	38	33.1	2.1	0.2	32.7	33.6
		Total	100	27.2	38	33.4	2	0.2	33	33.8
	Left	Male	25	30.2	36	33.4	1.6	0.3	32.7	34
		Female	75	27.8	38.2	32.6	2.1	0.2	32.1	33.1
		Total	100	27.8	38.2	32.8	2	0.2	32.4	33.2
Post auricular angle	Right	Male	25	18	35	27.4	4.3	0.9	25.7	29.2
		Female	75	3	34	26	4.7	0.5	24.9	27.1

		Tot al	10 0	3	35	26. 4	4.6	0.5	25. 5	27. 3
	Lef t	Ma le	25	18	35	27. 5	4.4	0.9	25. 7	29. 3
		Fe ma le	75	16	34	26. 4	3.9	0.5	25. 5	27. 3
		Tot al	10 0	16	35	26. 7	4	0.4	25. 9	27. 5

**Table 1:** Summary of all variables in the study by gender.

Variables	Sides	Male		Female		t-value	p-value
		Mean	Std. Dev.	Mean	Std. Dev.		
T. L. P	Right	62.93	3.95	61.29	3.52	1.96	0.053
	Left	62.74	3.96	60.85	3.49	2.27	0.0253*
W. O. P	Right	34.2	1.58	33.13	2.08	2.35	0.0209*
	Left	33.4	1.57	32.63	2.11	1.67	0.097
P. A. A	Right	27.44	4.33	26.03	4.71	1.32	0.189
	Left	27.52	4.36	26.4	3.93	1.2	0.233

**Table 2:** Comparison of male and females with respect to different parameters by t test. \*: p<0.05.

Variables	Right side		Left side		t-value	p-value
	Mean	Std. Dev.	Mean	Std. Dev.		
T. L. P	61.7	3.69	61	3.69	0.7215	0.4715
W. O. P	33.4	2.02	33	2.01	2.0486	0.0418*
P. A. A	26.4	4.64	27	4.05	-0.4872	0.6266

**Table 3:** Comparison of right and left sides with respect to different parameters by t test. \*: p<0.05.

n	>50		<50	
Sides	Right	Left	Right	Left
100	80	80	20	20
Impression	Short, Round		Long, Thin	

**Table 4:** Physiognomic index.

Darwins Tubercle	n
Bilateral	17
Right	19

Left	9

**Table 5:** Presence of Darwin's tubercle.

Attachment of lobule	Male	Female	Total
Right			
Adherent	5	9	14
Free	8	31	39
Intermediate	12	35	47
Left			
Adherent	5	9	14
Free	8	31	39
Intermediate	12	35	47

**Table 6:** Attachment of lobule.

## Discussion

In depth knowledge of the dimensions and position of pinna is essential for its reconstruction and also for manufacturing hearing aids and for forensic purposes. Although the anthropometric measurements can be done by direct or indirect methods, direct anthropometry is ideal [16-18].

In the study by Brucker et al. on the morphometric of external ear, age and sex related differences; a mean total ear height of 63 mm was obtained. In the study by D. E. O. Eboh on 386 Urhobo individuals obtained a total ear length and width of  $56.79 \pm 4.26$  mm and  $30.47 \pm 1.99$  mm respectively. Bozkir et al. in their study obtained the mean height of left ear in men and women as 63.1 mm and 59.7 mm respectively [19].

In the present study, we observed that the mean length of auricle in males was 62.9 mm and 62.7 mm in right and left ears respectively and in females 61.3 mm and 60.9 mm. It was noted that the mean length of auricle in males was more than that in females, irrespective of right or left [20]. However, in another Indian study on the Northwest sample the mean length of pinna was lesser than our study. As our sample has subjects from most parts of India, we believe that our data are more representative. It is observed in our study that there is no significant difference between the mean length of right and left ears.

The mean ear breadth in our study was found to be 34.2 mm and 33.4 mm in males in right and left ears and 33.1 mm and 32.6 mm in females respectively. It was seen that the mean width of pinna in males was more than that in females.

The mean post aurial angle in males was 27.4 deg and 27.5 deg in right and left ears and 26 deg and 26.4 deg in females respectively. The values were high in males but are not significant statistically [21]. A thorough search of literature revealed that similar studies for mean postural angle are not available and this makes our study the first study to measure postural angle.

There was no significant difference between right and left ears with respect to various parameters. However, the mean length and width of

right pinna was high in both males and females though it was not statistically significant.

The physiognomic ear index in our study was  $>50$  in 80 subjects and  $<50$  in 20 subjects.

The Darwin's tubercle was present in 45 subjects.

The adherent type of lobule was rare i.e. 14% and majority had intermediate i.e. 47% followed by free i.e. 39%.

On comparing our study with other similar studies, we find that there is a difference in values and these discrepancies could be due to factors such as race, genetic variables, environment, age and human error.

## Conclusion

There is significant association between genders, anthropometric changes of the pinna. The female pinnas are smaller and narrower whilst male pinnas are longer and broader. The pinnas are shorter and circular in Indian scenario.

Thus the crux of this study is that it is essential to know the accurate dimensions and morphology of pinna which influences tremendously to conquer knowledge and predictably guides the cosmetic surgeon during various manoeuvres as it is the essence of proper corrective surgery of the pinna.

## References

1. Akpa AOC (2013) Anthropometrical study of pinna among southeast Nigerians. *J Exp Res*.
2. Skaria Alexander K (2011) A morphometric study of human ear. *J Plast Reconstr Aesthet Surg* 64: 41-47.
3. Deopa D, Thakkar HK, Chandra Prakash, Niranjana R, Barua MP, et al. (2013) Anthropometric measurements of external ear of medical students in Uttarakhand region. *J Anat Soc India* 62: 79-83.
4. Ito I, Ikeda M, Sueno K, Sugiura M, Suzuki S, et al. (2001). Anthropometric study on normal human auricle in Japan. *Nippon Jibiinkoka Gakkai Kalho* 104: 165-174.
5. Healthcote JA (1995) Why do old men have big ears? *BMJ* 311: 1668.
6. Meijerman L, Cor VDL, Maat GJR (2007) Cross-sectional anthropometric study of the external ear. *J Forensic Sci* 52: 286-293.
7. Sforza C, Grandi G, Binelli M, Tommasi DG, Rosati R, et al. (2009) Age and sex related changes in the normal human ear. *Forensic Sci Int* 100: e1-110. e7.
8. Deopa D, Thakkar HK (2013) Anthropometric measurements of external ear of medical students in Uttarakhand region. *J Anat Soc India* 62:79-83.
9. Isamu I, Masato I, Minoru I, Kouhei S, Tomio A, et al. (2001) A morphological study of age changes in adult human auricular cartilage with special emphasis on elastic fibres. *Laryngoscope* 111:881-886.
10. Nathan N, Latham K, Cooper J, Perlyn C, Gozlan I, et al. (2008) Anthropometry of the external ear in children with cleft lip and palate in comparison to age-matched controls. *J Craniofac Surg* 19: 1391-1395.

11. Sforza C, Dellavia C, Tartaglia GM, Ferrario VF (2005). Morphometry of the ear in Down's syndrome subjects: A three-dimensional computerized assessment. *Int J Oral Maxillofa Surg* 34: 480-486.
12. Purkait R, Singh P (2007) Anthropometry of the normal human auricle: A study of adult Indian men. *Aesthetic Plast Surg* 31: 372-379.
13. Wang B, Dong Y, Zhao Y, Bai S, Wu G, et al. (2011) Computed tomography measurement of the auricle in Han population of north China. *J Plast Reconstr Aesthet Surg* 64: 34-40.
14. Gualdi-Russo E (1998) Longitudinal study of anthropometric changes with aging in an urban Italian population. *Homo* 49: 241-59.
15. Ferrario VF, Sforza C, Ciusa V, Serrao G, Tartaglia GM (1999) Morphometry of the normal human ear: A cross-sectional study from adolescence to mid- adulthood. *J Craniofac Genet Dev Biol* 19: 226-33.
16. Sforza C, Grandi G, Binelli M, Tommasi DG, Rosati R, et al. (2009) Age- and sex-related changes in the normal human ear. *Forensic Sci Int* 187: 110 e1-110 e7
17. Ekanem AU, Garba SH, Musa TS, Dare ND (2010) Anthropometric study of the pinna (Auricle) among adult Nigerians resident in Maiduguri metropolis. *J Med Sci* 10: 176-80.
18. Bozkir MG, Karakas P, Yavuz M, Dere F (2006) Morphometry of the external ear in our adult population. *Aesth Plast Surg* 30: 81-85.
19. Kalcioğlu MT, Miman MC, Toplu Y, Yakinci C, Özturan O, et al. (2003) Anthropometric growth study of normal human auricle. *Int J Pediatr Otorhinolaryngol* 67: 1169-1177.
20. Barut C, Aktunc E (2006) Anthropometric measurements of the external ear in a group of Turkish primary school students. *Aesthet Plast Surg* 30: 255-259.
21. Brucker MJ, Patel J, Sullivan PK (2003) A morphometric study of the external ear: Age and sex-related differences. *Plast Reconstr Surg* 112:647-652.