Journal Of Medical Science And Clinical Research
IGM Publication   An Official Publication Of IGM Publication

To evaluate the anthropometric profile of auricle among school going children in tribal belt of Chhattisgarh, India

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Abstract
Background: *The auricle was resides outside the head. Auricle was different size and shape affected by both sex, all age, races and play an important role in forensic investigation. Otapostasis was the most common deformity of the auricle.*
Aim: *To study the morphometric measurements of the auricle and to evaluate otapostasis among school going children in tribal belt of Chhattisgarh.*
Materials and Methods: *School children of three tribal belt of Chhattisgarh, were selected at random and their morph metric measurements like auricle lengths, auricle projection and front of face height of both auricles were taken with the help of a digital vernier caliper. Total 550 healthy students aged group 9 to 15 years included in current research. Children with any auricle deformity, previous auricle surgeries, auricle tumors, history of auricle trauma were excluded from the current research.*
Result: *In present study, mean auricle height was 48.95±5.75 (right auricle) and 48.98±5.77 (left auricle) and otapostasis was 18.86±4.09 (auricle ear) and 18.87±4.10 (left auricle) among all students. Mean auricle height and otapostasis was higher in males than in females. Gender related differences were found not significant. Among all study participants 25.81% had an otapostasis left auricle while 25.09% had an otapostasis right ear. Among male students, 28.48 % had otapostasis right and left ears while female students, 23.63% had right auricle otapostasis and 24.67% otapostasis left auricle.*
Conclusion: *otapostasis more in males than females among tribal school children. These measurements are keen and valuable in evaluation of auricle abnormalities, reconstruction and in otomorphology for identification of tribal belt children.*
Keywords: *Tribal belt, Digital Vernier calipers, Otapostasis, Auricle.*

Introduction

The human auricle is divided into external, middle and internal parts; auricle and external acoustic meatus from the auricle. The auricle is composed of three primary components, the helix – antihelix complex, the conchal complex and the lobes[1]. Next to finger print auricle constitutes he most unique design characteristic feature and peculiarities for the purpose of Identification[2]. Auricle increase in both length and width increase in age[3].

Humans show a wide range of biological variation; this variation makes us unique and distinguishes one individual from another. People vary in shape, size, skin color and many numbers of other characteristics. A characteristic that is

often overlooked is the structure of the human external ear. The external ear is highly variable to the point that even two ears of a single individual may be notably different[4]. In human ear is the most defining feature of the face and its structure shows the signs of age and sex[5].Many research of auricle morph metric in the literature. The shape, size and orientation of auricle was as individual as a finger print but it was possible to make some generalization, men have larger ears than women, auricle increase in both length and otapostasis with increasing age and overall ear size differs according to ethnic group[6].

Researcher was not aware of any studies looking at the evolution of otapostasis auricle deformity in the Chhattisgarh population. This research was done to find out the anatomical height, otapostasis of the auricle among school children aged 9 – 15 yr in tribal belt. This research keen would useful in defining local standards and the findings in this research would also help plastic surgeons in reproducing an anatomically correct auricle among children of tribal belt Chhattisgarh during correction of abnormalities like congenital, traumatic or post tumors resection. This research was to find out, very common the problem otapostasis was in tribal belt Chhattisgarh among the school going children.

Materials and Methods

The present research was carried out on 550 school students of age group 9 – 15 years, Grades 5 to 8 from tribal belt- Govt. school Amoda, Govt. school Murhipar, Govt. girls ashram Raipur, Chhattisgarh. The purpose of the study was explained to them and informed consent was taken from the school head. All the standardized measurements were taken according to landmark point defined by De Carlo et al[7]. The measurement of the auricle and face height were recorded on data collection sheets, Height and Weight in all healthy students, Grade 5 – 8 (9 – 15 year olds) of both sexes were also obtained. Students those have any congenital deformity of the auricle, previous auricle surgeries, auricle

tumors and history of auricle trauma were excluded from the research.

Observation and Result

Our current research, the students head in Frankfort horizontal plane, measurements were taken with the help of digital vernier caliper marking of 0.01mm. Auricle length/ height (right & left auricle) – measured as the distance between the highest point of auricle and lowest point of the auricle. Otapostasis auricle (right & left ear) – measured as the distance from the auricle helix to the mastoid process at tragal level, Face height was measured as distance from the nasion to the gnathion. [Figs.1- 4]. All related our data was recorded on the data collection sheets: age sex, height, weight, auricle length/height, otapostasis auricle and face height. The auricle– face index (auricle height/face height x 100) to define the auricle proportion was also calculated. Our sample size for this student's research was determined by three factors – the evaluation, prevalence, the desired level of confidence, the margin of error. The epidemiological surveys were used for calculation of sample size. The current data was divided into groups, the right and left auricle as well as males and females and calculated all mean and standard deviations, data was analyzed by SPSS program. After then a two- tailed "t" test at the 95% confidence interval also was used to research the bilateral variation as well as check for statistical significance and p – value of less than 0.05 was considered to be statistically significant.

All the measurements and compared the right and left auricle of all students was brief in **table 1** and the mean right auricle height was 48.95 ± 5.75 and the mean left auricle height was 48.98 ± 5.77, the difference between the two value was statistically significant (p=0),the left auricle was noted to be more otapostasis than the right but this difference was statistically not significant (p=0.2). There were significant differences found between the right and left auricle – face indices (p=0.03) and Male students was higher values for right and left auricle size, right and left auricle otapostasis as

well as face height than female students, these all differences were statistically not significant, there were also differences in the values for auricle – face indices with higher value for females students than male students and this difference was not significant **(Table 2)**. Male student was the widest range of left auricle height, face height and both auricle otapostasis was equal as compare to female was left auricle height, left auricle otapostasis, this all recorded values were in female students **(Table 3)**. All Male students were observed to higher values for the left auricle height and left auricle face index, left auricle otapostasis. We found the differences were not statistically significant **(Table 4)**. All Female students were observed (Table 5) to higher values for the left auricle height and left auricle face index and these differences were found statistically significant. When analysis for otapostasis of the auricle, we found all the students 25.81% was an otapostasis, left auricle otapostasis while 25.09% was right auricle otapostasis **(Table 6).** All male students, 28.48% was otapostasis auricle while 23.63% of female students was otapostasis auricle; we found, there were more females with small auricles (< 15 mm) compared to male**s (Table 7)**.We observed, left auricle otapostasis was more common among male students (28.48%) as compared to female students (24.67%). The percentage of males with otapostasis right and left auricle was equal while among the female students frequency of prominence of the left auricle was more than that of the right **(Table 8)**.
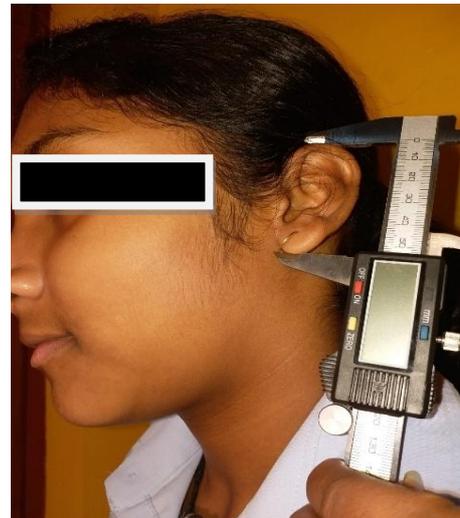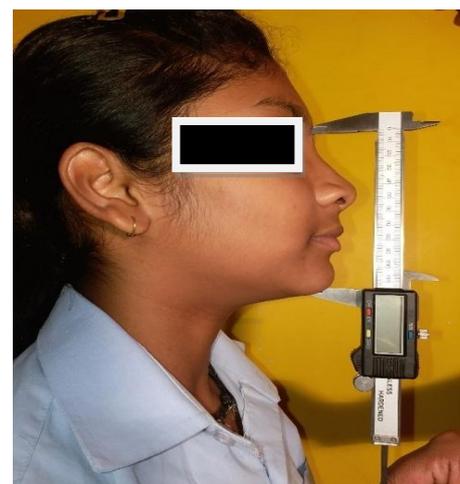

Figure: 1

Figure: 2

Figure: 3

Figure: 4

Table 1: Auricle measurements (male and female)

	Right auricle (mm)	Left auricle(mm)	P - value
Auricle height	48.95 +5.75	48.98 +5.77	df = 549 t = 1.908 **p = 0**
Auricle otapostasis	18.86 +4.09	18.87 +4.10	df =549 t = 1.206 p = 0.2
Auricle face index	45.68 +4.87	45.72 +4.86	df = 549 t = 2.105 **p = 0.03**

This table show mean face height was 125.79 mm (SD = 443.8)

Table 2: Student's gender comparison of both auricle

	Male student (mm) n =164	Female student (mm) n = 386	p – value
Right auricle height	49.49+5.833	48.72 +5.75	df = 304 t = 1.425 p = 0.15
Left auricle height	49.49 +5.82	48.77 +5.75	df = 304 t = 1.344 p = 0.18
Right auricle otapostasis	19.01+3.97	18.80 + 4.15	df = 320 t = 0.567 p = 0.57
Left auricle otapostasis	19.02 + 3.97	18.81+4.16	df = 320 t = 0.585 p = 0.55

Table 3 Gender comparison of both uricle

	Male student (mm)	Female student (mm)
Right auricle height	32 -60	33 – 58
Left auricle height	32 – 61	33 – 59
Right auricle otapostasis	10 – 27	10 – 28
Left auricle otapostasis	10 – 27	10 – 29
Face height	92 – 120	94 – 119

Table 4: Compare, Male's right and left auricle value

	Right auricle (mm)	Left auricle (mm)	P – value
Auricle height	49.44 +5.87	49.45+5.86	df = 163 t = 0.05 p = 0.95
Auricle otapostasis	19.00 +3.98	19.02 +3.98	df = 163 t = 1.29 p = 0.21
Auricle face index	45.51+3.71	45.56 +3.67	df = 163 t = 1.340 p = 0.18

Table 5: Compare, Female's right and left auricle value

	Right auricle (mm)	Left auricle (mm)	P - value
Auricle height	48.95 +5.75	48.98+5.77	df = 549 t = 1.908 **p = 0.00**
Auricle otapostasis	18.86 +4.04	18.87+4.10	df = 549 t = 1.206 p = 0.2
Auricle face index	45.68 +4.87	45.72 + 4.86	df = 549 t = 2.105 **p =0.03**

Table 6 Auricle otapostasis (both sexes)

	Right auricle – frequency (%)	Left auricle – frequency (%)
Small auricle	58 (10.54)	58 (10.54)
Normal auricle	354 (64.36)	350 (63.63)
Otapostasis auricle	138 (25.09)	142 (25.81)

Small auricle <15 mm, normal auricle 15 – 21mm, otapostasis > 21mm.

Table 7 Compare, right auricle otapostasis by both sex

	Male student (%)	Female student (%)	Total (%)
Small auricle	18 (10.90)	40 (10.38)	58 (10.54)
Normal auricle	100 (60.60)	254 (65.97)	354 (64.36)
Otapostasis auricle	47 (28.48)	91 (23.63)	138 (25.09)

Table- 8 Compare, left auricle otapostasis by both sex

	Male student (%)	Female student (%)	Total (%)
Small auricle	18 (10.90)	40 (10.38)	58 (10.54)
Normal auricle	100 (60.60)	250 (64.93)	350 (63.63)
Otapostasis auricle	47 (28.48)	95 (24.67)	142 (25.81)

Discussion

According to De Carlo D et al and Ekanem AU et al, the external auricle occupies a unique position among the structures of the face and is an important region in aesthetic composition of the auricle which transmits information about age and gender of individual[7,8]. The external auricle's parameters, shape and proportion to the face are vital in aesthetic surgery as this information helps guide a plastic surgeon in correcting auricle defects. It is important to recognize that there is no standard ear morphology and variation across ethnic groups has been noted[9,10]. Any auricular defect in the form of disproportionate size, abnormal elongation of the auricular lobe, or a missing part is corrected by surgery[11]. Surgeons require information about normal auricular dimensions, the auricles' bilateral position on the face and specific data relating to general conformation.

The present study provides the mean values of the different morph metric measurement from the right and left external ears data for 550 normal children of both sexes aged 9 – 15 years in tribal belt of Chhattisgarh. Deopa et al[12] reported mean right LH of 16.7 mm and left LH of 16.8 mm. The measurement found in the study of Bozkir et al[13] was 18.2mm in right ear and 17.9 in left ear. A recent paper from Nigeria studied the parameters of ear height, lobule height and lobule width from

the adult population[8]. W. Muteweye et al[14] was found the right and left ear height for males were 58.10(SD 4.87) and 58.08 (SD 4.75) and 55.93 (SD 4.91) and 55.81(SD 4.84) for females. Skaria[15] studied ear morphometry of three different races (i.e. the Indian, Caucasians and Afro-Caribbean's adults and found that Indians from the subcontinent had the largest auricle length followed by the Caucasians and Afro-Caribbean's was the smallest auricle. In present study, the mean right auricle height was 48.95 $\pm$5.75 and the mean left auricle height was 48.98 $\pm$5.77. auricle height was very important in the evaluation of congenital deformity anomalies like the small auricle present in Down syndrome, Alpert syndrome and Treacher– Collins syndrome.

Gender variations in auricle parameters present so many cases, some research authors was noted that the means height of the male auricle was higher than that of female auricle in various populations and age groups[9,14,16,17,18]. Similarly, present study also found that male students had higher values for right and left auricle size, right and left auricle otapostasis than female students.

In present research, face height was found higher values in male students than in female students. We know an individual was an aesthetically fine appearance, the height of face and auricle should be proportionate, someone with a relatively small

face height and relatively longer auricle, individual can appear as if he or she was otapostasis auricle. According to C.Barut's[17] face height was found to be significantly higher in male than in female and Farkas[18] was found that the face height of males was higher than that of female but his research did not mention any statistic. W. Muteweye[14] was found that face height was higher in male than females and the difference was statistically significant.

W.Muteweye[14] was found the right auricle – face index was 46.26(SD 3.97) and the left was 46.20(SD 3.89), the difference between the auricle face indices among the sexes were not significant and C.Barut's[17] was suggested that for an attractive facial expression, the auricle – face index should be 50% in male and 50% in females. They found the right auricle – face index was 50.70(SD 3.00), in males and 49.59 (SD 3.23) in female whereas the left auricle –face index was 50.52(SD 3.11) in male and 49.64 (SD 2.87) in females. The present research, we found higher values in left auricle face index in both male 45.56 $\pm$3.67 and female students 45.72 $\pm$ 4.86.

P.Kelley[2] was noted that the auricle was an infinitely complex structure with great variation between individuals and C.Barut's[17] was observed that variations also exist between the two sides of the same individual. The structural differences in the human auricle create unique shapes and morphology similar to the unique fingerprint of each human being.

M.G.Bozkir[13] studied in turkey, auricles of 341 young adults and found that female auricles were slightly more otapostasis than men's measured at the level of the tragus. P. Kelley[2] found there in the European 5% of the children at the age of 6 years was prominent ears and R.Purkait[9] studied in Indian men, the prominent ear was observed in 11.4% of right and 10.2% of left auricles. W.Muteweye[14] was found 7.69% of male subjects had otapostasis auricle (right and left sided) and female subjects 6.17% had right sided otapostasis, while 5.56% had left sided otapostasis. According to Bo. Wang[19] found in Chinese age ranged from 18-75 years, the otapostasis auricle ranged from 3.7 to 4.1% among the male subjects and 3.3 – 4.1% among the female subjects, they observed tragal measurements were generally higher than supra – auricular levels, they using 3 dimensional computer tomography measurements projections at the tragal level were up to 50% higher than at the supra – auricular level. The present research we found total of 25.81% was otapostasis left auricle while 25.09% of the study students was an otapostasis right auricle and in male students, 28.48% was otapostasis auricle while 23.63% of female students was otapostasis auricle. We found more females with small auricle (< 15 mm) compared to male, left auricle otapostasis was more common among female (24.67%) as compared to male students. The percentage of males with otapostasis right and left auricle was equal while among the female students frequency of otapostasis of the left auricle was more than that of the right.

In the tribal belt Chhattisgarh, level of tag children with otapostasis auricle was much unknown. This current research helps to evaluate the prevalence of otapostasis auricle.

Conclusion

The otapostasis auricle was a very common deformity causes serious psycho-social problems. The current knowledge of auricle parameters was very vital. Otapostasis auricle problem in the current research in students occurred with a slightly higher frequency (25.81%) when compared to Zimbabwean children (6.89), and to Caucasian children (5%). This research was still keen useful in future studies comparing populations with different social and ethnic surrounds to interpret the knowledge of, different size of the auricle. This current research useful in the diagnosis, evaluation of congenital malformation, deformity as well as in the planning of auricle treatment, auricle reconstructive plastic surgeries and hearing instruments industry.

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