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MORPHOLOGICAL AND MORPHOMETRIC ANALYSIS OF EAR OSSICLES IN ADULT HUMAN CADAVERS IN RAJASTHAN POPULATION

Dr Praveen Kumar[1], Dr Monika Gupta[2], Dr. Mukesh Gupta[3], Dr. Mohhmad sharique[4], Dr. Neha Sharma[5]

[1,3]MS Anatomy 3rd Year STUDENT, Department Of Anatomy, RUHS College Of Medical Sciences Jaipur, Rajasthan,India
[2,4]ASSOCIATE PROFESSOR, department of anatomy, RUHS - CMS jaipur, Rajasthan
[5]Department of ENT, Dr. S.N. Medical College jodhpur, Rajasthan.

Corresponding Author: Dr. Neha Sharma**,** tasidiapraveen08@gmail.com

ABSTRACT

Introduction: Hearing function is a special sense present among higher animals and is one of the most important sensory inputs for sustenance of life. **Aim:** To study morphological and morphometric variation of ear ossicles in cadavers available at RUHS College of medical sciences, Jaipur. **Method:** Study conducted on 32 human cadaveric temporal bones at Department of Anatomy RUHS College of medical sciences, Jaipur. Formalin preserved human cadaveric temporal bones from the department of Anatomy, RUHS – CMS Jaipur. Cadaveric heads of both sexes and adult more than 18 years of age with intact temporal region having intact ossicular chain with no discontinuity or erosion were taken into study. **Result:** mean total length of Malleus in group LEFT and group RIGHT were 8.07±0.40 and 7.71±0.35, respectively (p=0.011). The mean Weight of Stapes the left and right sides were 2.91±0.10and 3.29±0.34 respectively, (p=.023), groups were comparable according to Width of footplate. The three ossicles are morphometrically similar in both the ears except Incus, which showed the significant difference in left and right side. **Conclusion:** Measurements of morphometry in the ear ossicles of the human cadavers can be useful for prosthetic surgical reconstruction, would be very helpful in designing the prosthesis in ossicular chain pathology.

Keywords: Ear ossicles, cadavers, malleus, incus

INTRODUCTION

Hearing function is a special sense present among higher animals and is one of the most important sensory inputs for sustenance of life. The human auricle has attracted the attention of forensic scientists since a long for its unique morphological characteristics. In modern times, these unique features can be captured by CCTV cameras, which may be extremely useful during the identification process in a criminal investigation. Unique morphological characteristics are frequently used in the identification and individualization process. The human ear was not only accessible for its morphological and morphometric variations, but also its existing bilateral, sex, and population differences.[1]

The diminutive middle ear ossicles (malleus, incus, stapes) housed in the tympanic cavity of the temporal bone play an important role in audition. Diverse hearing capabilities are also related to the morphology of the diminutive middle ear ossicles housed in the tympanic cavity.[2]

The middle ear ossicles form a semi rigid chain in the middle of the ear for conduction and amplification of sound waves from the tympanic membrane to the inner ear. Damage to ossicles by disease or trauma can lead to hearing loss. Disruption of the continuity of the ossicular chain or the fixation of even one of the ear bones, either congenitally or due to disease, can both lead to decreased hearing.[3]

Ossicular chain affected by acquired lesion of middle ear like Chronic Suppurative Otitis Media (CSOM) may lead to avascular necrosis of long process of the incus and the superstructure of stapes or there is bone resorption owing to the bone eroding property of cholesteatoma in which ossicular chain involvement is relatively early. Otolaryngologists employ advanced microsurgical reconstruction techniques in order to re-establish the audiological functions in patients who have lost them as a consequence of some disease process.

Taking into consideration the burden of this disease in developing countries like India, where neglected CSOM with its complications are quite common among the lower socioeconomic group and thus, higher is the need for various reconstructive surgeries an attempt has been made in this study to analyse and establish detailed morphometric data of ear ossicles in cadaveric temporal bones.

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Aim

To study morphological and morphometric variation of ear ossicles in cadavers available at RUHS College of medical sciences, Jaipur.

METHODS

This was a Institution based observational study conducted on 32 human cadaveric temporal bones at Department of Anatomy RUHS College of medical sciences, Jaipur. Formalin preserved human cadaveric temporal bones from the department of Anatomy, RUHS –CMS Jaipur. Cadaveric heads of both sexes and adult more than 18 years of age with intact temporal region having intact ossicular chain with no discontinuity or erosion were taken into study. Damaged/Crushed temporal bone, Temporal bones with developmental anomalies and bones with Anomalies and pathological changes were ruled out from study.

The calvarias was removed with the help of hand saw and the brain was taken out. Just below the bone, the duramater was stripped off. To extract the bone out, the tegmen tympani was removed with the help of hammer and chisel. Now, the roof of middle ear is exposed. All the morphological parameters were compared on the basis of side of origin – between right and left side ear ossicles. Data was calculated and analysed by Epi info software of CDC.

RESULT

The mean total length of Malleus in group LEFT and group RIGHT were 8.07±0.40 and 7.71±0.35, respectively (p=0.011).

The mean length of the manubrium in the left and right was 4.6s2±0.28 and 4.35±0.50, respectively (p=0.066).

The mean length of head and neck of malleus on the left and right sides was 4.78 ±0.52 and 4.56± 0.52, respectively (p= 0.239).

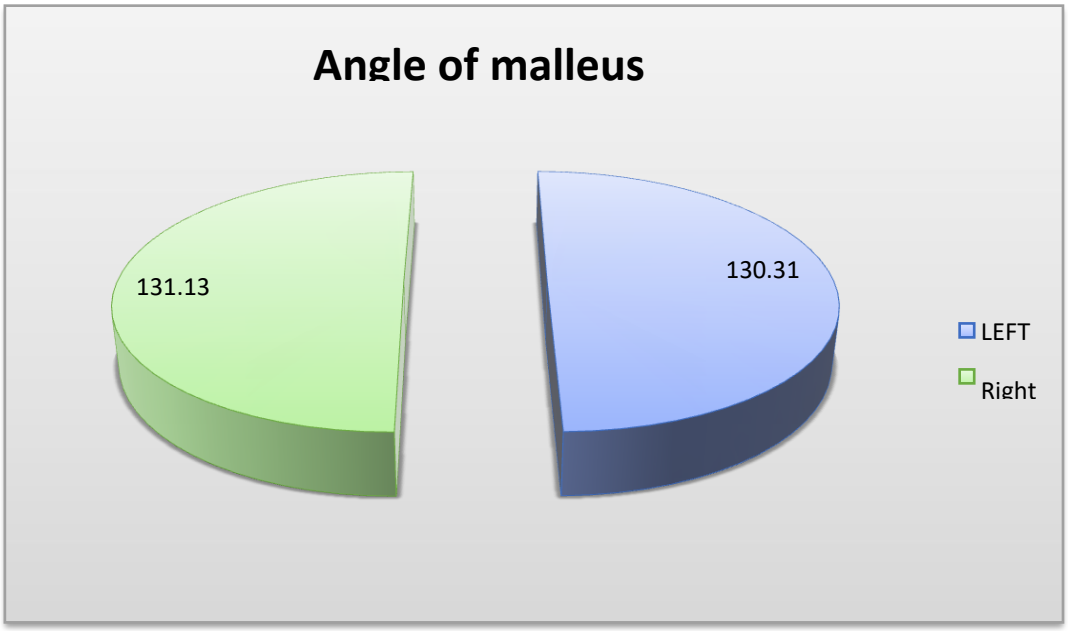
Table 1 Length of Ossicles

Length of Ossicle	Left			Right			P value
	Mean ± SD	Minimum	Maximum	Mean ± SD	Minimum	Maximum	
Total Length of Malleus	8.07 ± 0.40	7.30	8.60	7.71 ± 0.35	6.94	8.50	0.011S
Length of manubrium	4.62± 0.28	4.20	5.20	4.35± 0.50	3.50	4.91	0.066 NS
Length of Head and Neck	4.78 ± 0.52	4.30	5.76	4.56 ± 0.52	3.80	5.63	0.239NS

The mean weights on the left and right sides were 17.65±1.56 and 15.43±1.56, respectively, (p<0.1).
The mean angle (MlA) on the left and right sides **of Malleus** were 130.31±17.91and 131.13±17.78, respectively, (p=0.89).

Graph 1 Comparison of Angle of Malleus(MIA)in degree

The mean Total Width of head of Malleus in the left and right sides were 6.21±0.59 and 5.98±0.97, respectively, (p=0.418). i.e., sides were comparable according to width.



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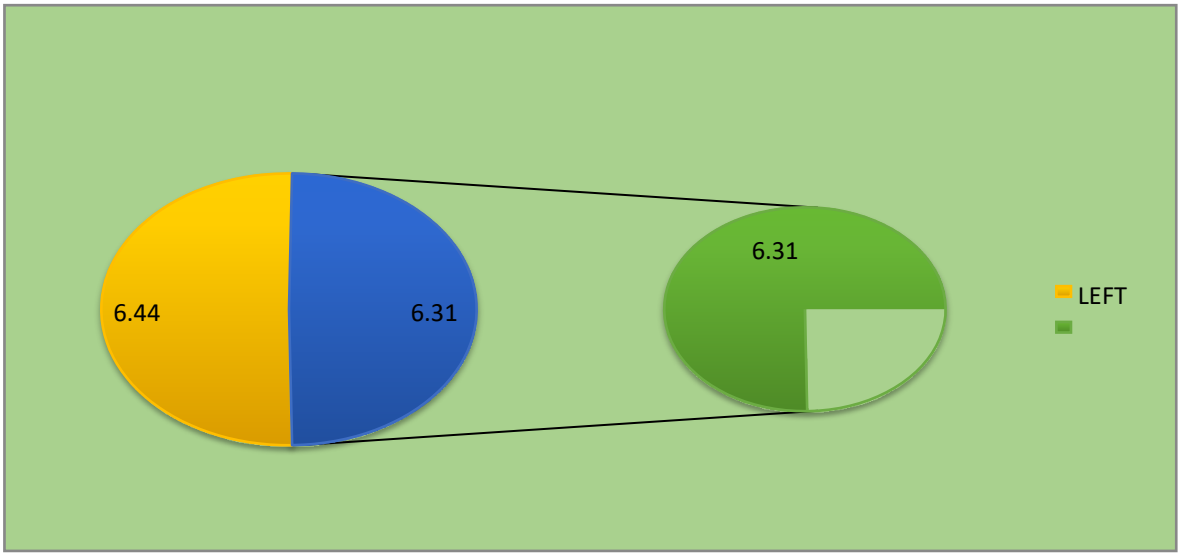
The mean total length of the left and right sides were 6.44±0.53 and 6.31±0.71, respectively, (p=0.557).
The mean **of Malleus** Index: length of manubrium x 100/ total length in the left and right sides were 0.57±0.04 and 0.57±0.07, respectively (P=0.69NS)

Graph 2 Comparison of Total length of Incus



The mean Total Width of the left and right sides were 4.91±0.54 and4.60±1.17, respectively, (p=0.35).
The mean Weight of the left and right sides were 25.06±2.03 and 25.02±2.52,respectively, (p=0.96). i.e., groups were comparable according to weight.

Table 2 Comparison of Stapes according to side

SIDE	LEFT			Right			Total			P Value
Stapes	Mean±SD	Mini mum	Maxi mum	Mean±SD	Mini mum	Maxi mum	Mean±SD	Mini mum	Maxi mum	
Height	3.25±0.09	3.18	3.41	3.25±0.11	3.12	3.46	3.25±0.10	3.15	3.44	0.977NS
Length of Footplate	2.80±0.23	2.51	3.12	2.70±0.34	2.04	3.14	2.74±0.29	2.07	3.13	0.530NS
Width of Footplate	1.43±0.42	1.18	2.29	1.28±0.55	0.36	2.40	1.34±0.49	0.77	2.35	0.584NS
Weight	2.91±0.10	2.76	3.02	3.29±0.34	2.82	3.74	3.12±0.32	2.79	3.38	0.023S

The mean total height in Left and Right side were 3.25±0.09 and 3.25±0.11, respectively, (P<0.977). The mean length of the footplate on the left and right sides was 2.80±0.23and 2.70±0.34, respectively, with a P value of LS 0.530 NS, i.e., groups were comparable according to the length of the footplate. The mean Width of footplate the left and right sides were 1.43±0.42and 1.28±0.55, respectively, with a P value of LS 0.584NS S. i.e., groups were comparable according to Width of footplate. The mean Weight of the left and right sides were 2.91±0.10 and 3.29±0.34 respectively, (P=0.023).

DISCUSSION

In the present study, the mean total length of Malleus in groups LEFT and RIGHT was 8.07± 0.40 mm and 7.71 ± 0.35mm, respectively, with a P value of LS 0.011 Significant Which is almost similar to other studies. **Mudhol R S et al (2022)**[4]observed that the mean length of the manubrium is7.18 mm.

In the current study, the mean length of the manubrium in the left and right was 4.62 0.28 and 4.35 0.50, respectively, with a P value of LS 0.066 NS. **According to Irugu et al. (2018)**[5]**,** the average length of the manubrium is 4.17 mm.

In this study, the mean length of the head and neck of the malleus on the left and right sides was 4.78± 0.52 and 4.56± 0.52, respectively, with a P value of LS 0.239NS, which were similar in the study conducted by **Mogra** (2014)[6].

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In this study, the mean weights on the left and right sides were 17.65±1.56 and 15.43± 1.56, respectively, with a P value of LS 0.1 NS. The weight in our study was slightly low compared to other studies.
In the present study, the mean angle(MlA) on the left and right sides of Malleus was 130.31 ±17.91 and 131.13 ± 17.78, respectively, with a P value of LS 0.89NS. **Irugu et al. (2018)**[5] observed that the mean angle was 128.76°.

In this study, the mean total width of the head **of Malleus** on the left and right sides was 6.21 ±0.59 and 5.98 ±0.97, respectively, with a P value of LS 0.418NS S.

In the present study, the mean total lengths on the left and right sides were 6.44±0.53 mm and 6.31±0.71mm, respectively, with a P value of LS 0.557 NS. **Mudhol R S et al**. (2022)[4] also reported the same.

In the present study, the mean total width on the left and right sides was 4.91 ±0.54 mm and 4.60 ±1.17mm, respectively, with a P value of LS 0.35 NS. The width of the incus is smaller compared to other studies. **Iruguetal.** (2018)[5] also observed the same.

In this study, we observed that the mean weight of incus on the left and right sides was found to be 25.06±2.03 mg and 25.02±2.52 mg, respectively, with a P value of LS 0.967NS.i.e., groups were comparable according to weight, which was almost equal to That reported by **Jyoti and Shama et al**. (2015)[7] in India (23.8mg).

In this study, we observed that the comparison of total height of Stapes according to side**.** The mean total height in Left and Right side were 3.25±0.09 mm and 3.25±0.11mm, respectively, with p value of LS 0.977 NS. **Kumar DV et al** 2018[5] also reported the same.
In this study, we observed the comparison of lengths of stapes footplates according to side. The mean length of the footplate on the left and right sides was 2.80±0.23mm and 2.70±0.34mm, respectively, with a P value of LS 0.530 NS, i.e., groups were comparable according to the length of the footplate. Similar was observed in other study. **Asthana S et al**in2016[8] observed the same.
In the present study, a Comparison of width of footplate of Stapes according to side was done. The mean Width of footplate the left and right sides were 1.43±0.42 mm and 1.28±0.55 mm, respectively, with a P value of LS 0.584NS S. i.e., groups were comparable according to width of foot plate. **Asthana S et al** 2016[8] observed the same. In the present study, Comparison of weight of Stapes according to side was done**.** The mean Weight on the left and right sides was 2.91±0.10 mg and 3.29±0.34 mg respectively, with a P value of 0.023S. **Asthana S et al** in2016[8] observed the same.

Conclusion

This study analyses the precise measurements of morphometry in the ear ossicles of the human cadavers can be useful for prosthetic surgical reconstruction, would be very helpful in designing the prosthesis in ossicular chain pathology.With a rapid rise in demand for ossiculoplasty in our country, this study assesses the possible morphology and anthropometric variation that can exist in Indian cadavers with an intention to add upto the present understanding of middle ear dynamics. With considerable inter- and intra-regional variations in the morphology and anthropometry, we also expect that the effort of this study will motivate several others to carry out temporal bone dissections.

REFERENCES

1. Rani D, Krishan K, Sahani R, Baryah N, Kanchan T. Variability in human external ear anthropometry- Anthropological and forensic applications. Clin Ter. 2022;172(6):531-541.
2. Gleeson MJ. Scott-erown‟s otorhinolaryngology: head and neck surgery .7th ed. oxford university press; 2008: 78-84.
3. Ludman H, Wright T. diseases the ear. 6th ed., Jaypee Brothers; 2006:14-34.
4. Mudhol R S, Narahari S, Havaldar RR. Morphological and Anthropometrical Features of Human Ear Ossicles: A 1-Year Cadaveric Observational Study. J Anat Soc India 2022;71:88-92.
5. Kumar DV, Chaitanya K, Singh V, Reddy DS. A morphometric study of human middle ear ossicles in cadaveric temporal bones of Indian population and a comparative analysis. J Anat Soc India 2018;67:12-17
6. Mogra K, Gupta S, Chauhan S et al. Morphological and morphometrical variations of malleus in human cadavers. International J. of Healthcare and Biomedical Research. 2014 ;2(3): 186-192.
7. Jyothi K C, Shama Sundar N M, Anupama K et al. Morphological and Morphometrical analysis of human Incus. International Journal of Current Research. 2015;7(5):1-5.
8. Asthana S , Sandhya Mehra , Aarushi Jain and Kalpna Makheja Osteometric Analysis Of Ear Ossicles In Population Of Rajasthan. Int. J. Adv. Res.2016 4(9), 1633-1639