



MORPHOMETRIC STUDY OF INCUS BY COMPUTERISED TOMOGRAPHY.

Anatomy

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ABSTRACT

INTRODUCTION : The tympanic cavity contains three small immovable bones, the malleus, incus and stapes which have a fundamental role in transmission of sound. Sclerosis, ankylosis or any disease of these ossicles cause immobilization and dislocation of the chain leading to impaired hearing. The Incus plays an important role in conveying vibrations of tympanic membrane from Malleus to Stapes. Study was conducted to determine various morphometrical parameters of Incus which can be helpful during reconstructive procedures to the Otologic surgeon for the improvement of sound conduction. **MATERIAL AND METHOD:** The prospective study was performed on 114 subjects (61 males and 53 females) in Dr. D. Y. Patil, Hospital navi, Mumbai, CT scan images of 114 subjects are studied for ossicular chain on either side, and the Incus are obtain to investigate the morphometric parameters. **RESULT:** The average of Morphometric parameters shows that the mean Total length of right Incus is 5.31 mm in male and 5.26 mm in female, where the mean Total length of left side Incus is 5.41 mm in male and 5.27 mm in female. The mean Total width of Right Incus is 4.29 mm in male and 4.28 mm in female, where the mean Total width of left Incus is 4.38 mm in male and 4.24 mm in female. The mean Length of long process of right Incus is 3.18 mm in male and 3.36 mm in female, where the mean Length of long process of right Incus is 3.22 mm in male and 3.42 mm in female. No significance difference was found when we compared these parameters of right and left side in both sexes. **CONCLUSION:** The knowledge of the morphometry of Incus will helpful in designing of implants during operations to improve hearing.

KEYWORDS

Ear ossicles, malleus, incus, stapes.

INTRODUCTION :

The high burden of deafness worldwide and in India is largely preventable and avoidable. According to the 2005 estimate of W.H.O. (World health's organization) 278 million people have disabling hearing impairment. In India, 63 million people (6.3 %) suffer from significant auditory loss. Nationwide disability surveys have estimated hearing loss to be the second most common cause of disability.

Failure of transmission of sound from the ossicular chain to the inner ear causes an air-bone gap of 40 db – 60db. Various middle ear pathologies may Fix or disassociate the chain leading to conductive deafness.

The three ear ossicles lodged in the middle ear are the malleus, incus and stapes. The ear ossicles form an articulated chain, connecting the lateral and medial walls of the tympanic cavity. The ear ossicles amplify and transmit the sound vibrations to the cochlear receptors in the inner ear. The incus or anvil is a most stable bone in the middle ear. The incus receives vibrations from the malleus, to which it is connected laterally, and transmits these to the stapes medially. It has a long and short crus extending from the body.

Osteoclerosis is a congenital or spontaneous disease characterized by abnormal bone remodeling in the inner ear. which impedes its ability to conduct sound, and it is a cause of conductive hearing loss.

In 21st century with the help of microsurgical operative techniques, it is possible to rectify these problems, reconstructive surgeries in early stages will help to restore the hearing and speech at the earliest, thereby help to overcome hearing disability and psychological trauma.

The materials used in reconstruction of ossicular chain are autografts, homografts and allografts. To achieve good postoperative results in patients who require middle ear surgery and to perform these microsurgical maneuvers, the otologic surgeons need to be fully conversant with the anatomical details of the ossicles of the middle ear.

Hence in present radiological (CT images) study an attempt is made to study morphometrical analysis of Incus.

Aims and objectives :

To study morphometric details of Incus with computed tomography.

To determine morphometrical parameters for the ossicular grafting and implants during reconstructive surgery.

MATERIALS AND METHODS:

Prospective study was conducted in Department of Anatomy and Radiology, Dr. D.Y. Patil Hospital and School of Medicine, Nerul, Navi Mumbai. 114 CT images (61 males and 53 females) are studied for ossicular chain bilaterally, and morphometry of Incus are recorded.

Inclusion criteria : Normal adults from 20 yrs to 50 yrs of age.

Exclusion criteria : Deafness.

Any past or present history of ear disease.
Complains of ear discharge.

The morphometric measurements of the stapes, are measured with GE Optima CT600 CT Scanner.

Total Length of Incus: Maximal distance between the superior edge of the body and the end of the long process.

Total Width of Incus: Maximal distance between the superior edge of the body and the end of the short process.
Length of long Process of Incus

Statistical Analysis :- Mean and Standard Deviation are worked out to assess the average dimensions of the Stapes. P-value is the probability rate at 0.05 level of significance for the corresponding degree of freedom.

P < 0.05 is significant
P > 0.05 is not significant.

All the statistical calculations were performed using the software SPSS.

RESULTS :

- The morphometric data of Right and Left side Incus are recorded.
- The mean and standard deviation are worked out.
- The p-value is highly significant in the right and left side of stapes, and It is significant in the male and female data.

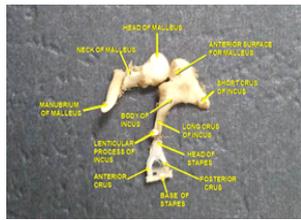


Figure 1 : Ear ossicles



Figure 2: GE Optima CT600 CT Scanner

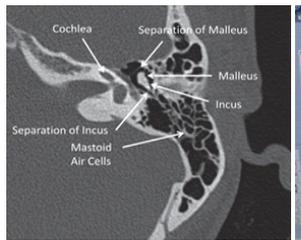


Figure 3 : CT Image of Three Ear Ossicles



Figure 4 : CT Image of Total Length of Incus

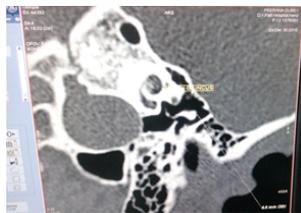


Figure 5 : CT Image of Total Width of incus



Figure 6 : CT Image of Length of Long process

Table 1. Morphometric data of Incus (Male)

	Male (n- 61)				P Value
	Right (mm)		Left (mm)		
	Mean	S.D.	Mean	S.D.	
Total Length (mm)	5.31	5.41	0.56	0.55	0.02
Total Width (mm)	4.29	4.38	0.29	0.34	0.01
Length of Long Process (mm)	3.18	3.22	0.43	0.47	0.02

Table no. 2. Morphometric data of Incus (Female)

	Female (n – 53)				P Value
	Right (mm)		Left (mm)		
	Mean	S.D.	Mean	S.D.	
Total Length (mm)	5.26	5.27	0.56	0.54	0.02
Total Width (mm)	4.28	4.24	0.28	0.29	0.01
Length of Long Process (mm)	3.36	3.42	0.56	0.58	0.00

DISCUSSION :

Ossicles, tiny small ear bones play an important role in the process of hearing. A lot of work has been done previously on ear ossicles of adult and new born cadavers, and all these studies shows different morphometrical variations.

Table 3 : Comparison with previous studies. (values in mm)

Authors	Unar, Ulgar & Ekinki	Masall 1968	Latha p. et.al.	Padmini et. al. 2014	Jyoti K.C. 2011	Present study Male	Present study Female
Total Length (mm)	6.5	6.4	5.7	5.13	6.3	5.31	5.26
Total Width (mm)	4.9	4.8	4.0	3.47	4.4	4.29	4.28
Length of Long Process (mm)	4.2	-----	2.97	4.5	3.68	3.18	3.36

- Mean of Total Length of Incus is 5.31 mm for male and 5.26 mm for female.

- These values are Supported by the Latha p. et.al, & Padmini et.al, but comparatively less than Unar, Ulgar, Ekinki and Masall et.al.

Mean of Total Width of Incus is 4.29 mm for male, and 4.28 for female.

- It is nearer to the values of Jyoti K.C. & Latha P. et.al.
- Mean of Length of Long Process is 3.18 mm for male and 3.36 mm for female.
- These values are less than Unar, Ulgar, Ekinki., But also supported by Jyothi K.C.

CONCLUSION :

- The advanced surgical procedures for treating conducting hearing loss and surgeries to recover the function of middle ear ossicles are complete with ossicular bone replacement.
- Morphometric data of Incus will help the prosthesis maker in the formation of various implants and grafts required to treat various diseases.
- In the present scenario, with the advent of microsurgical operative techniques, it is possible to rectify many middle ear problems, such as to restore speech and hearing at the earliest, thereby help to overcome disability and psychological trauma.

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