

MORPHOLOGICAL VARIATIONS IN HUMAN FETAL EAR OSSICLES -A STUDY

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ABSTRACT

Aim: To study the morphological variation, if any, of the ear ossicles in the human fetuses and use of the study in medical applications. **Materials and Methods:** This study was performed on 100 sets of middle ear ossicles, each set consisting of Malleus, Incus and Stapes, which were taken from 50 fetal cadavers on either side. **Observations:** All the three ossicles showed variations in their morphology and more so in the stapes. **Discussion:** There are few studies in the literature on individual differences in these ossicles and these studies were on either adult or different species. **Conclusion:** the ear ossicles of the destitute human fetuses can be used as homografts to replace eroded adult middle ear ossicles.

KEY WORDS: CRUS BREVES; INCUS; MALLEUS; MANUBRIUM; STAPES.

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INTRODUCTION

The three little bones of the human body, tucked in our tympanic cavity, just on the inner side of the eardrum, are named malleus, incus and stapes, each about the size of a small fresh water pearl and jointly the basis of one of evolution's greatest inventions, the mammalian middle ear. The ossicular chain and middle ear muscles ontogenically belonged to the masticatory system and serve the hearing system [1]. Interestingly, in other ancestral species (reptile fossils), the jaw was fixed with the ossicles, which constrain acoustic signals [2]. This scenario is not currently applicable to humans; however, the close relationship of the temporomandibular joint (TMJ) and the middle ear make them neighbours (embryological, anatomically and physiologically speaking), although performing

different tasks[3]. extensive studies have been carried out on their morphology [4,5,6,7] anomalies [9,10,11] embryology [12], function and structure[13,14,15] as well as the surgical reconstruction[16,17]. Most of these previous studies were on adult ossicles. In this present work, the aim is to study the morphological variation, if any, of the ear ossicles in the human fetuses and use of the study in medical application.

MATERIALS AND METHODS

This study was performed on 100 sets of middle ear ossicles, each set consisting of Malleus, Incus and Stapes, which were taken from 50 fetal cadavers left and right sides of both sexes, obtained from local government, and private hospitals. All the brains are severed at the level

of medulla oblongata and have been used for project study. The fetuses in which the brains are dissected out have been used for the present study of ear ossicles. The ossicles have been obtained from tympanic cavity after opening tegmen tympani, which is the roof of middle ear and is possible only after removal of brain.

OBSERVATIONS

Morphological data has been recorded by observing the ear ossicles under a dissecting microscope of 10x magnification .

Malleus: the variations occurred in the lateral process and handle of malleus. Normal lateral process of malleus is observed (fig.1a). The lateral process of malleus presented different appearance, that is long and thin (fig. 1b); lateral process was thick and broad in four mallei (2%) (fig.1c), it was absent in two sets of ossicles of same fetal cadaver, that is 1% (fig.1d). six mallei (3%) had no neck between head (caput) and manubrium and these mallei had large and long lateral processes (fig. 1b). The length of the eight(4%) manubrium mallei was variable and some of the processes were quite short (fig.1e).

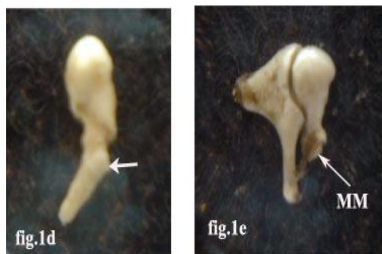
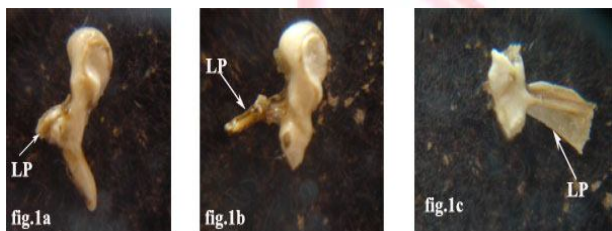


fig.1a: Showing normal projection of lateral process(LP).
fig.1b: Showing long and thin LP.

fig.1d: Showing absence of LP.

fig.1e: Showing short manubrium mallei (MM).

Incus: The incus presented less morphological variations compared with other ossicles. The long process was bent towards the long process of incus in the fetus of 16 wks gestation(fig.2a). As the gestational age increased, the long process became straight. The long processes of incus of two ear ossicles(1%) are high curved(fig.2b) , instead of being a straight process which is normal(fig.2c). Two long processes (1%) of incus showed a slight curve(fig.2d).

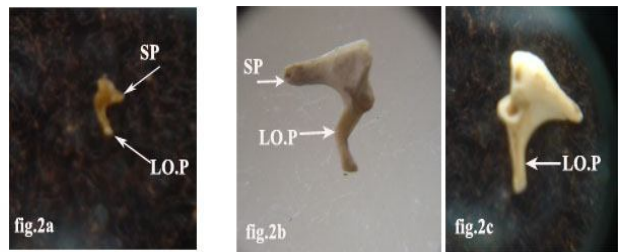


fig.2a: Showing long process (L.O.P) of incus bent close to short process(SP).
fig.2b: Showing high curved long process.
fig.2c: Showing straight long process.
fig.2d: Showing slight curved long process.

Stapes: maximum morphological variations have been observed in stapes of fetuses. The variations of stapes are in the neck and the hole or foramen. Circular foramen of stapes with long neck (fig.3a), circular hole with small pointed head (fig.3b), semicircular foramen without neck (fig.3c), oval foramen(fig.3d), with neck(fig.3e), arched foramen with a very long neck(fig.3f), foramen covered with membrane(fig.3g), tunnel shape hole(fig.3h),triangular foramen (fig.3i), deviated head and bony spicule diving the foramen(fig.3j).

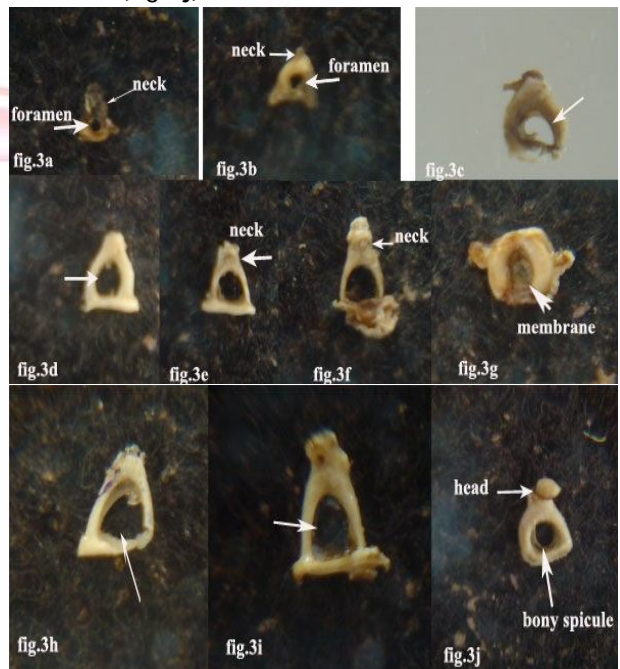


fig.3a: Showing circular foramen of stapes with long neck. **fig.3b:** Showing circular hole with small pointed head. **fig.3c:** Showing semicircular foramen without neck. **fig.3d:** Showing oval foramen. **fig.3e:** Showing neck. **fig.3f:** Showing arched foramen with a very long neck. **fig.3g:** Showing foramen covered with membrane. **fig.3h:** Showing tunnel shape hole. **fig.3i:** Showing triangular foramen.**fig.3j:** Showing deviated head and bony spicule diving the foramen.

DISCUSSION

There are few studies in the literature on individual differences in these ossicles and these studies were on either adult or different species. It is reported in the literature that the free ends of manubrium mallei curve slightly forward at a rate of 53-70% [5,6]. Manubrium mallei curve slightly forward at a rate 50% in the newborns [18]. In the present study a curve in the manubrium mallei was not seen. Incus is the most stable ossicle in variation [7]. However, a notch of about 41-42% was reported on the crus breve(short process) [4] and as 42% [18]. But in the present study there was no variation in the short process. The long process of incus showed variation from a slight curve to a high curve in 2% of the observations.

Variations are present in the stapes without the hole (foramen obturatum) and also in the shape of the foramen [18]. In the present study there is one stapes without a foramen but covered by a membrane and there is also variation in the shape of the foramen. Stapes is the most variable bone in the present study which is in agreement with the study of above authors and the incus is the stable ossicle comparatively with the other ear ossicles in view of morphological variations.

CONCLUSION

Congenital malformations of middle ear ossicles can cause hearing problems. Wehrs RE 1999 [16] reported that congenital absence of the long process of the incus caused bilateral conductive hearing loss. The middle ear ossicles obtained from newborn, which are approximately of the same size as adults, might be observed in ossicle banks for future use in ossiculoplasty. In addition, these ossicles can be used as homografts to replace eroded adult middle ear ossicles(Erdogan Unur 2002 [18]).

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