

Review Anatomical Features Ossicular Cattle and Pigs, with Special Reference to Morfometric Characteristics Bule Tympani

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Abstract – There are relatively few studies especially in our region, who have studied the ossicles in domestic animals. In the existing literature, textbooks, morphology, anatomy and zoology, anatomy atlases and technical papers there are a variety of information about the existence of certain ossicles. The literature states that there are three auditory ossicles: Maleus, Incus and Stapes. The fourth auditory ossicles - Os lenticulare, often lacking in the papers and books of the respective authors.

At our university, we have established a laboratory for anatomical research, and the first task was to on a number of samples determines the existence or absence of lenticular axis in cattle and pigs. For this purpose we have to slaughter line separated by 30 processed head of cattle and pigs, which we later processed in our laboratory.

Native examination and after cooking isolated temporal bone and isolating the ossicles, clearly we have established the existence of four auditory ossicles - Os lenticular.

We have performed a morphometric analysis Bule tympani, measure the length and width of pigs and cattle, statistically processed and presented.

Keywords – Auditory Ossicles, Pigs, Cattle, Bula Tympani.

I. INTRODUCTION

Anatomy is the science that to research material size, shape color, position and relationship of individual organs or organ systems in the body of animals. He describes them in a certain order the organ systems which is why it is called systematic or descriptive anatomy. This we not want to go into further division of the anatomy but we want to emphasize that this study we wanted to the students who are in the first year of study, research awaken spirit and teach them how to come up with scientific results and facts, as they are analyzed and how the results are compared with previously published. How to perform some analysis and how statistically processed. In the end, as the results obtained form conclusions and to shape a single scientific research.

Since there are few works especially in our region who have studied the ossicles in domestic animals we wanted a practical example of using our own laboratory show students how to come up with scientific truth and accurate data.

In the existing literature textbooks, morphology anatomy and zoology atlases and technical papers there

are a variety of information about the existence of certain ossicles. The literature states that there are three auditory ossicles : Maleus Incus and Stapes. The fourth auditory ossicles - Os lenticular often lack the papers and books of the respective authors.

In this paper we want to activate as many students to actively participate in the experiment, every one of them feel the importance of teamwork and to develop their research potential. After the theoretical preparation that comprised both the analysis of available information obtained in lectures textbook practice illustration reviewing anatomical atlases and works with the internet we decided to check all this information in one experimental rda in his laboratory.

We wanted to show the students that the anatomy of an exact science it's all subject to verification that little remained unexplored and that our approach to this problem was the need to introduce the student to research and work with them resolve some uncertainties caused by the data in certain books and papers.

II. LITERATURE SURVEY

In the literature review we have listed information related to the middle ear. In addition to these data are identified and literature data related to external ear because the auditory ossicles connected to the eardrum which is part of the outer ear canal. Stirrup is attached to the oval hole of the inner ear and the power and this section briefly describe.

Extraction of the middle ear from the whole organ of hearing and balance serves to emphasize the importance of this part in the transmission of sound creating a pulse or microphone potentials in auditory nerve fibers and the transmission of sensory impressions to the brain.

Auditory ossicles (ossicula tympani ossicula auditus) grade range which extends from the lateral to the medial wall of the middle ear. On the lateral to the medial side of the flow in this order : glanders Inus os lenticular stapes. The first is attached to the inner side of the eardrum and the last - stapes to the vestibular window. (Septimus Sison (1962).

The middle ear is an air- filled space the tympanic cavity lined by mucosus membrane and contained within

the temporal bone. In most domestic animals the middle ear features a ventrally expanded cavity the tympanic bulla visible on the ventral surface of the skull. The middle ear is closed to the external acoustic canal by the tympanic membrane and intact communicates with the nasopharynx via the auditory tube (formerly eustachian tube). In the horse the auditory tube is expanded to form the large air-filled guttural pouch dorsocaudal to the nasopharynx. The connection between the middle ear and the pharynx is normally closed except briefly during swallowing. The opening of the auditory tube brought about by swallowing or yawning permits equalization of air pressures between middle and external ears. Three auditory ossicles span the middle ears from the tympanic membrane to the vestibular (oval) window. From superficial to deep they are the malleus (hammer) incus (anvil) and stapes (stirrup). (Rowen Frandson D. et al 2009).

Textbook Zoology by (Poleksic V, 2003) Pages 304-311 reads as follows :

Middle ear.

The middle ear is the tympanic cavity (cavum tympani) voids in the tympanic part of the temporal bone. In timpanalno sockets are located three auditory ossicles: hammer (malleus) anvil (incus) and the stirrup (stapes). Auditory ossicles are connected with each other and with the eardrum and the oval window. When it comes to the auditory ossicles it should be noted that the three auditory bones are just in the middle ear of mammals. In other vertebrate middle ear is only one rod auditory ossicles (columella), which corresponds to the comparative anatomy of mammals stapes. Glanders is evolutionarily generated from articular and incus bones of the square. These two bones form the joint of the lower jaw to the skull in reptiles and birds. In mammals, the lower jaw to the skull directly zglobljava during evolution wrist bones have moved into the service of the hearing instrument giving auditory ossicles malleus and incus. The eardrum and ossicles system. For the eardrum pričvršćena the handle of the hammer (malleus). Glanders is a tiny ligaments attached to the incus (anvil) so that with every move of glanders and also runs the incus. Other krajinkusa associated zglobomsa heads stapes (stirrup) a base of stapes lies opposite end of the membrane labyrinth screw hole in the oval window. (Guyton A. C. Hall J. E. 2008).

Middle - ear auris media make cavum tympani tuba and auditory ossicles auditiva. Cavum tympani limits medial pars Petros and on the other side pars stone tympanic bone. Laterally located eardrum dorsomedial fenestra vestibuli ventroaboralno fenestrae cochleae a ventrooralno ostium tympanicum tubae auditivae. Auditory ossicles (ossicula auditus) are located in the cavum tympani. One vibration transfer air from the eardrum through the cavum tympani to the inner ear. On the eardrum sits malleus (attached to the eardrum) and then in a series of findings incus Central auditory ossicles (lenticular axis) and the stapes. (Šijački N. et al 1997.).

Auditory ossicles are the three tiny bones (malleus incus and stapes) in timpaničnoj cavity. They form a chain that extends from the eardrum to the oval window (fenestra

ovalis) which opens into the inner ear. Through them, the vibrations of the eardrum are transferred to the perilymph the fluid of the labyrinth. (Swenson J. M., 1975). The middle ear - Auris media. By the middle ear mean in the cavum tympani which are located auditory bones muscles and the pharynx is associated with the auditive tube.

Cavum tympani limits medial pars Petros and on the other side pars stone tympanic bone. Laterally located eardrum dorsomedial fenestra vestibuli fenestra cochleae ventrolateral and ventro - oral ostium tympanicum tubae auditivae.

Auditory ossicles - ossicula auditus are located in the cavum tympani and serve to transmit the vibrations of the air from the eardrum through cavum tympani to the inner ear. On the eardrum fit and attached to the collagen fibers malleus (hammer). Then, in a series of findings incus (anvil) os lenticular (mean auditory ossicles) and stapes (stirrup).. These auditory ossicles have epiphysis and fully developed during fetal life. (Pantic V. 1981).

The middle ear is an air- filled cavity in the temporal bone and is connected to the nasopharynx by the auditory (eustachian) tube. Three tiny bones -the malleus incus and stapes - collectively called the ossicles are connected to each other and are located in the middle ear. (Cunnigham G. J. Klein G. B. 2007).

In Nomini Anatomic on page 156 reads as follows : Middle - ear AURIS MEDIA consists of Cavum tympani tympanic membrane Ossicula auditus Tunica mucosa cavi tympani and Tuba auditiva.

Cavum tympani consists of Paries tegmentalis Paries jugular Paries labyrinthicus (Fenestra vestibuli Promontorium Sinus tympani Fenestra cochleae tympanic membrane canaliculi chordae tympani) Paries caroticus Paries membranaceus.

Ossicula auditus consists of the following parts : Stapes make Caput stapedis rostrale Crus Crus caudale Basis stapedis. Incus consists of Corpus incudis Crus longum processus lenticularis lenticular axis Crus breve. Malleus consists of manubrium mallei caput mallei Collum mallei processus lateralis processus rostral processus muscularis. Practicum in exercise anatomy of domestic animals by Atanas Nitovskog in 2009 states: Os temporale - temporal bone consists of: Petros Pars Pars tympanic endotympanica Pars Pars squamosa. Auditory ossicles (ossiculae auditivae) are located in Cavum tympani. najbliži eardrum is a hammer (Malleus) which is attached to the eardrum. On the hammer builds anvil (incus). On the incus lenticular OS builds that are connected with the stirrup (stapes).

In the book, the nervous system and sense of domestic mammals Prof. Dr. Vladeta Simic (1969) the middle ear (Auris Media) states the following:

Middle ear is located in the bone cavity bubnog work auditory bones (cavum tympani pars timpanicae osis Petros). Inside the tympanic cavity are resonating auditory ossicles each special form (ossicula tympani still auditus) of these bones is one shaped as a hammer (malleus) the other as an anvil (incus) and the third as the stirrup (stapes). Between the anvil and the stirrup is quite small lentoid ossicles (lenticular axis).

Thirty halved pig heads were obtained from the butcher and each middle ear was dissected. Using a digital light microscope several anatomical magnitudes were determined for 24 specimens namely the planar projected area of the tympanic membrane (TM) in relation to the stapes footplate as well as the dimensions and weight of the ossicles in order to determine the effective lever ratios. Using normal and micro computed tomography (CT), six porcine temporal bones were scanned and the geometric data obtained were transferred into a finite element model (FEM) simulation of the porcine middle ear. The transfer function was determined and compared to those from humans determined by measurements and simulations respectively. Hence the suitability of the domestic pig (*Sus scrofa domestica*) as a new animal model for research on the middle ear (ME) that would match The human in size was investigated. (Hoffstetter M at all. 2011).

The transmission of sound waves across the tympanic cavity is mediated by the three auditory ossicles known, in lateromedial sequence as malleus incus and stapes. The handle of the malleus is embedded in the tympanic membrane so that the head of the malleus protrudes above the membrane by a few millimeters. The head articulates with the body of the incus and the latter articulates with the head of the stapes by means of its long crus. The base of the stapes sits in the vestibular window in the medial wall of the tympanic cavity (Mohammadpour A. 2011).

III. MATERIALS AND METHODS

In our work we chose in our laboratory processed 30 skulls of cattle and pigs in a nearby slaughterhouse we get processed (removed skin fascia and muscles of the head) which we subjected to further treatment which consisted of separating the temporal bone on both sides of the skull. Five skulls we examined native examination without heat treatment and photographed some areas. After reviewing all of the native patterns of temporal bone are subjected to heat treatment - cooking. After cooking and drying we have selected the auditory ossicles and compared the size of the picture. Photos are an integral part of the display ossicles.

After the heat treatment we performed measurements Bule tympani as a method for students to get used morphometric analysis and further statistical processing. The treatment results were used descriptive statistical parameters : arithmetic mean and standard deviation (SD). Testing the statistical significance of differences between mean values was performed by Student's t -test. For calculating the Pearson correlation was used the linear correlation coefficient. The criterion for statistical significance was $p < 0.05$.

For statistical analysis of the results was used a software program SPSS Statistics 18

Table 1: The values of the observed variables in relation to a group of animals observed

Variable	Group of individuals	Number	Means	SD	p
Width of bule tympani	Cows	30	18.58	3.3	<0.05
	Pigs	30	21.03	1.9	
Length of bule tympani	Cows	30	38.67	5.8	<0.05
	Pigs	30	25.97	3.6	
Height of bule tympani	Cows	30	45.73	5.7	<0.05
	Pigs	30	33.33	2.6	

Width of bulla tympani was significantly higher in pigs than in the group of cows ($t = -3505$, $df = 58$, $p < 0.05$) Length of tympanic bulla was significantly higher in cows than in the group of pigs ($t = 10.124$, $df = 58$, $p < 0.05$) Height of tympanic bulla was significantly higher in cows than in the group of pigs ($t = 10.919$, $df = 58$, $p < 0.05$) Here is a used T test for independent samples in order to compare whether there are differences in the values of the variables (width, length, height bt) in two groups of animals (cows and pigs)

IV. DISCUSSION AND ANALYSIS OF PAPER

These results are consistent with published data showing that in the middle ear livestock present in addition Incusa glanders and stapes and fourth auditory ossicles Os lenticular ((Septimus Sison 1962 ; Pantic V 1981 ; Šijački N 1971 ; Nitovski A, 2009 Simic V, 1969).

Other authors particularly common areas which are researched by the sense of hearing domestic animals according postojnje three auditory ossicles malleus and

stapes Incusa (Swenson JM 1975) ; (Rowen Frandson D. et al 2009) ; (Hoffstetter M at all. 2011) ; (Guyton A. C. Hall J. E. 2008) ; (Mohammadpour A. 2011) :

As anatomists we must abide by data from Nomine Anatomica Veterinaria (2003) in which the side of the 156 states the following : Middle - ear AURIS MEDIA consists of Cavum tympani tympanic membrane Ossicula auditus Tunica mucosa cavi tympani and Tuba auditiva. Cavum tympani consists of Paries tegmentalis Paries jugular Paries labyrinthicus (Fenestra vestibuli Promontorium Sinus tympani Fenestra cochleae tympanic membrane canaliculi chordae tympani) Paries caroticus Paries membranaceus.

Ossicula auditus consists of the following parts : Stapes make Caput stapedis rostrale Crus Crus caudale Basis stapedis. Incus consists of Corpus incudis Crus longum processus lenticularis lenticular axis Crus breve. Malleus consists of manubrium mallei caput mallei Collum mallei processus lateralis processus rostral processus muscularis. Septimus Sison (edition of 1962) in 1920 clearly confirmed the existence of a fourth axis lenticular auditory

ossicles. His photographs we took a photo for comparison with our we filmed the experiment and displayed in the work.

V. CONCLUSION

A review of thirty skulls of cattle and pigs separating the temporal bone and the creation of new middle ear we found the existence of a fourth axis lenticular auditory ossicles.

Auditory ossicles have selected photographed and so display.

We have measured the length and width of the Bull Tympani cattle and pigs the results we statistically processed and thus complete mormometrijsku analysis bulla tympani cattle and pigs.

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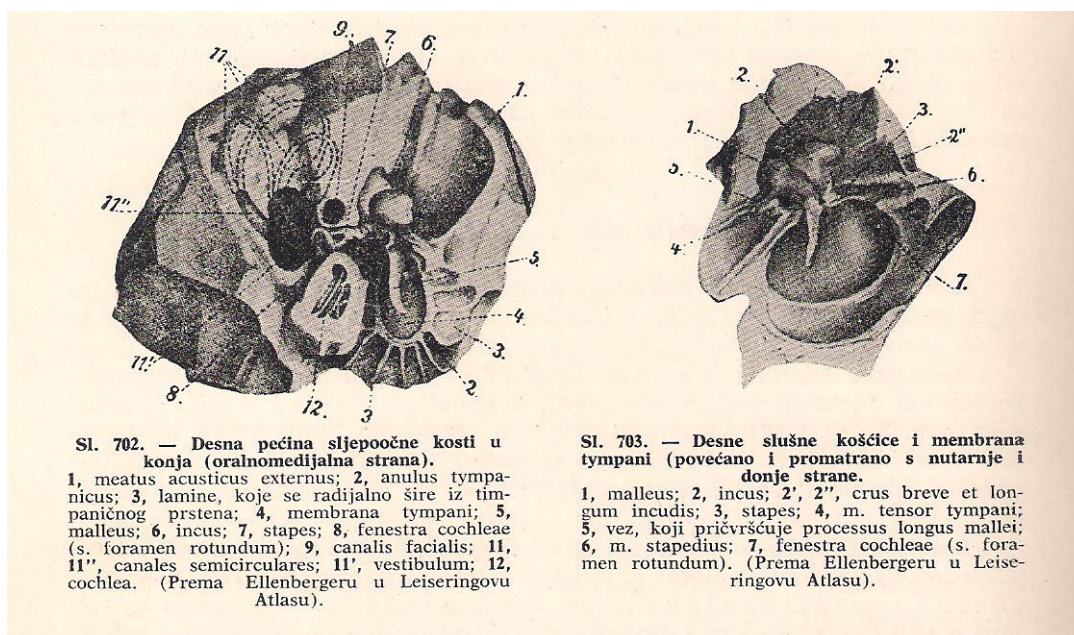


Fig.702. Right oral medial temporal bones in horses (S.Sisson)

Fig.703. The right auditory ossicles and tympanic membrane (increased and viewed from the inside and bottom) (S.Sisson)

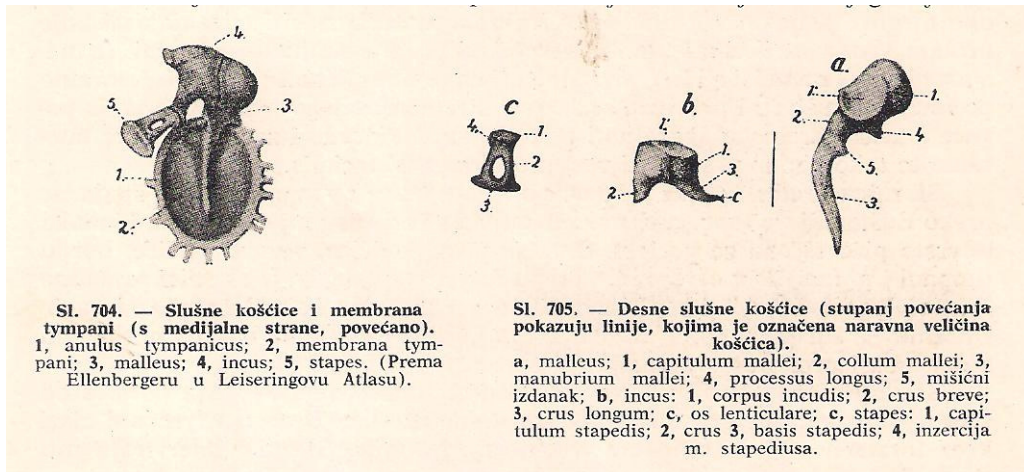
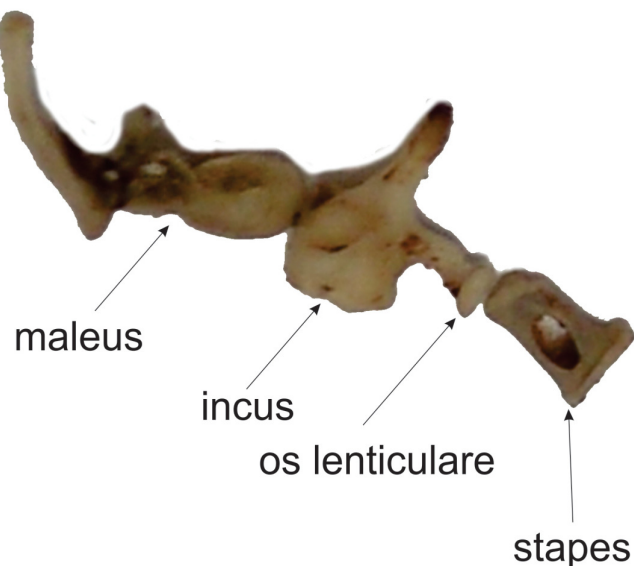


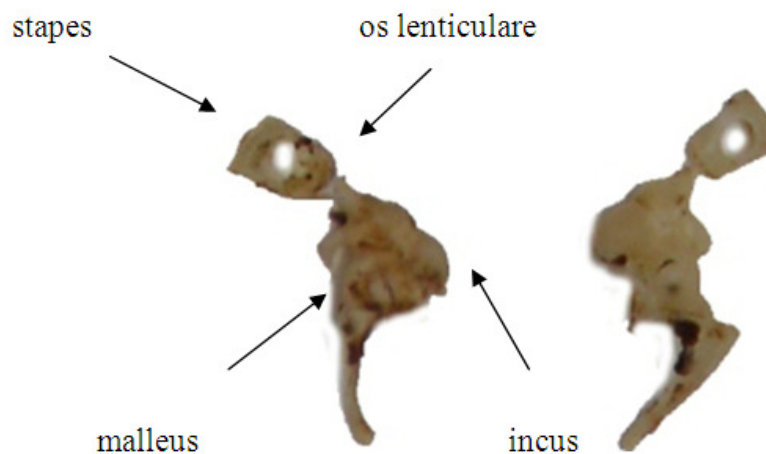
Fig.704. Auditory ossicles and tympanic membrane (the medial side, enlarged) (S.Sisson)

Fig.705. The right auditory ossicles (S.Sisson)

OSSA AUDITIVA BOVIS (original image)



OSSA AUDITIVA SUIS (original image)



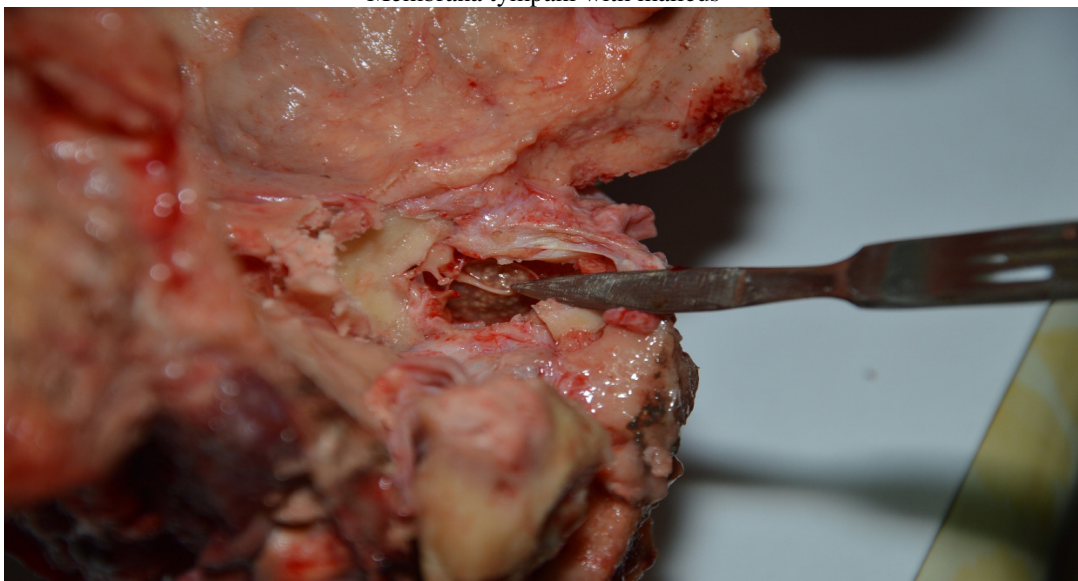
Bulla tympani bovis (original image)



Eardrum cattle with part of the inner ear after heat treatment (original image)



Membrana tympani with malleus



Ossa auditiva of auris media

