

قسم التشريخ والهستولوجيا
كلية الطب البيطري - جامعة الفاتح - ليبيا
رئيس القسم : أ.د/ ابراهيم أرناؤوطوفتش

دراسات تشريحية عن التجويف الطبلي والميزاب السمعي للجمل وحيد السنام

فؤاد عثمان*، ابراهيم أرناؤوطوفتش

أجريت هذه الدراسة على اثنتان وثلاثين عينة جمعت من حيوانات مختلفة الأعمار
ومن كلا الجنسين •

أوضحت الدراسة أنه نظرا لقصر واستقامة الميزاب السمعي الخارجي يمكن فحص
التجويف الطبلي بسهولة • علما بأن طول هذا المجرى يكون حوالي 5 سم وأنه يتكون من
جزء وحشي غضروفي الطبيعة وجزء أنسي ذات طبيعة عظيمة وهو أكثر ضيقا من الجزء الأول •
كما وجد من هذه الدراسة أيضا أنه يمكن تقسيم التجويف الطبلي الى ثلاثة أجزاء
وهي الفرجه فوق الطبلية ، التجويف الطبلي الأساسي والفقاعة الطبلية • أما الفرجة
فوق الطبلية فهي تحتضن رأس المطرقة وجسم السندان على حين يحوي التجويف الطبلي
الأساسي العظيمات السمعية ، العضلات السمعية ، والفرع الطبلي من العصب الوجهي •
وان قاع هذا التجويف يأخذ شكل المصفاه نتيجة وجود عدد كبير من الفتحات الصغيره
التي تعمل على اتصاله بالفقاعة الطبلية • أما الفقاعة الطبلية فتحتوي على عدد كبير
من الخلايا الهوائية المختلفة الأشكال والاحجام وقد لوحظ أنها تقل في العدد وتكبر في
الحجم كلما ابتعدت عن التجويف الطبلي الأساسي • أما العضلة الناشرة الطبلية فهي
غير متطورة - وبدايتها تكون ضعيفة وبقية أجزائها وترية • أما العضلة الركابية فهي
متطورة وقوية نسبيا يتراوح طول القناه البلعومية الطبلية بين 4-5 سم وهي ضيقة
وبدايتها من ناحية التجويف الطبلي تكون ذات طبيعة عظمية • أما نهايتها في البلعوم
فهي غشائية وتكون قمعية الشكل والجزء الواصل بينهما يكون غضروفي • وقصر طول هذه
القناه نسبيا يدعو الى توقع الانتشار السريع لأي تلوث من البلعوم في التجويف الطبلي •

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**ANATOMICAL STUDIES ON THE TYMPANIC CAVITY AND
EXTERNAL ACOUSTIC MEATUS OF ONE HUMPED CAMEL**
(*Camelus dromedarius*)
(With 14 Figs.)

By
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SUMMARY

Thirty two specimens collected from fresh and preserved heads were used in this study. The study provided that the tympanic cavity and external acoustic meatus in one-humped camel can be easily examined by the speculum. The shortness of the meatus and the narrowing of its osseous internal part should be remembered because of the risk of injuring of the tympanic membrane.

The tympanic cavity can be divided into three parts, epitympanic recess, tympanic cavity proper and tympanic bulla. The former houses the upper part of the malleus and body of the incus. The floor of the tympanic cavity proper is sieve-like, presenting a large number of foramina which continues with the air cells of the tympanic bulla. These air cells are numerous and of variable size communicating freely with each other. The most ventral cells are larger in size and of less number than those lying directly under the floor of the tympanic cavity proper. The tensor tympani muscle is ill-developed, its fleshy origin is narrow and feeble, while the greater part of the muscle is tendinous. The stapedius muscle is well developed. The auditory tube of camel is short, 4-5 cm in length and this can clearly why the tympanic cavity of this animal is easily susceptible for infections.

INTRODUCTION

The tympanic cavity is frequently the seat of several diseases, particularly when inflammations spread from both the nasal cavity and the nasopharynx. The gross anatomy of the middle ear was studied by Getty, Foust, PRESLEY & MILLER (1956) and ELLENPORT (1975) in dogs; SISSON (1975) in horses; GANDHI (1975) in sheep, goat, ox and pigs. The authors encouraged to carry out this study as the available literature reviewed no data concerning the anatomy of the middle ear of one-humped camel.

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MATERIAL and METHODS

Thirty two specimens collected from fresh and preserved heads were used in this study. Cross, oblique and longitudinal sections of temporal bones were prepared. The tympanic membrane as well as the contents of tympanic cavity were studied. The use of dental machine and Dozar magnifier were of great help in this study. The terminology used in the present work was that adopted by *Nomina Anatomica Veterinaria* (1975).

RESULTS

The external acoustic meatus is about 5cm long, circular in cross section and consists of two structurely different parts, cartilaginous (*Meatus acusticus externus cartilagineus*) and osseous. The lateral cartilaginous part is 1.5-2cm long, while the osseous one forms the rest of the meatus and is formed by the tympanic elements of the temporal bone except for the dorsal wall which is formed by the squamous part of the same bone (Figs. 2/6, 9/1, 11/4, 13/8).

The tympanic cavity (*Cavum tympani*) of the camel is large, irregular and laterally compressed space within the temporal bone. The cavity is lined by mucous membrane which covers its contents. The cavity can be divided into three divisions, tympanic cavity proper, epitympanic recess and tympanic bulla, which communicate freely with each other.

The tympanic cavity proper (Figs. 9/5, 11/5, 13/6) is bounded laterally by the tympanic membrane (*Paries membranaceus*) which closes the medial end of the external acoustic meatus, thus forms the septum between the external and middle parts of the ear. The membrane (Figs. 2/12, 3/3, 5/10) is circular in outline and slopes ventro-medially at an angle of about 20 degrees with the ventral wall of the external acoustic meatus. The circumferent thick border (*Anulus fibrocartilagineus*) is lodged into the thin bony ring (*Anulus tympanicus*). The central part of the membrane is pulled inward (*Promentia mallearis*) by the well - defined handle of the malleus producing large concavity on the outer surface of the membrane. The *Umbo membranæ tympani* forms the deepest central depressed point on this surface. The membrane can be divided into *Pars flaccida* and *Pars tensa*. The latter is firmly attached to the handle of the malleus. The handle of the malleus can be seen when the membrane is viewed for from the external acoustic meatus as a light streak (*Stria mallearis*).

The medial wall (*Paries labyrinthicus*) separates the tympanic cavity from the internal ear and presents a number of special features. The *Promontorium* (Figs. 5/2, 7/6, 11/8, 14/5) is well-developed bony prominence that encloses the cochlea. The cochlear window (*Fenestra cochleæ*) is circular in outline and closed by the second tympanic membrane (*Membrana tympani secundaria*) which separates the tympanic cavity from the *scala tympani* of the cochlea (Figs. 7/3, 11/7, 14/4). The vestibular window (*Fenestra vestibuli*) is an oval small foramen which lies more rostral and dorsal than the cochlear one (Figs. 11/6, 14/6). It is occupied by the base of the stapes (*Basis stapedis*) and is located dorso-lateral to the *promontorium* and just medial to the *Pars flaccida* of the tympanic membrane.

The rostral, carotid or tubal wall (*Paries caroticus*), is occupied mainly by the internal ostium of the auditory tube (Figs. 1/1, 2/1, 6/8, 7/8, 8/10, 9/10). Above the tube and incompletely separated from it by a plate of bone is canaliculus for the greater petrosal nerve (Figs. 6/7, 7/7). The nerve leaves the geniculate ganglion and courses rostrally and ventrally on the

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lateral aspect of the promontorium to attain the dorsal wall of the auditory tube passing underneath the trigeminal ganglion. The auditory tube (*Tuba auditiva*) is short, 4-5 cm in length. Its bony part (*Pars ossea tubae auditivae*), incomplete ventrally and is formed by the tympanic part of the temporal bone. The cartilagenous part is formed by medial and lateral plates. The pharyngeal opening of the auditory tube (*Ostium pharyngeum tubae auditivae*) is slit like opening leading into the very narrow canal. Its lumen is little larger than a capillary space.

The caudal or mastoid wall (*Paries mastoideus*) presents a large number of mastoid air cells (Figs. 1/7, 2/7, 8/2, 9/2, 10/3, 11/3, 12/7, 13/7, 14/2). The cells are smaller and more numerous in the medial than in the lateral part. The facial canal is surrounded by these cells (Figs. 10/10, 11/10), and the *Apertura tympanica canaliculi chordae tympani* is ill defined. The tegmental wall or roof (*Paries tegmentalis*) has two parts, lateral and medial. The lateral part is formed by the epitympanic recess, while the medial part by the facial canal (*Pars cupularis*). In this part the canal is more or less incomplete ventrally and here the nerve is covered by the mucous membrane of the tympanum. The epitympanic recess (*Recessus epitympanicus*) houses the upper part of the malleus and body of the incus (Figs. 1/11, 2/11, 3/1). The recess appears in the form of small concave elliptical depression in dorsal portion of tympanic cavity (Figs. 8/6, 9/6, 12/5, 13/5).

The floor or juglar wall (*Paries jugularis*) is sieve - like concavity presenting numerous small pores (*foramina*) which continues with the cells of the tympanic bulla (Figs. 2/13, 5/10, 7/9, 12/9, 13/9).

The tympanic bulla is the most ventral portion of the tympanic cavity. The interior of the bulla shows a series of small and numerous intercommunicating cavities or air cells (Figs. 4/9, 5/9, 6/2, 7/2, 12/1, 13/1). The tympanic air cells communicate freely with the floor of tympanic cavity proper through numerous small *foramina* and lined by mucous membrane which is continuous with that of the tympanic cavity. The most ventral cells are larger in size and of less number. The cells which lie directly ventral to the tympanic cavity proper communicate with those around the external acoustic meatus and facial canal.

The tympanic mucosa is continuous with that of the pharynx, through the auditory tube. It invests the auditory ossicles, the muscles and nerves. The membrane forms the inner layer of the tympanic membrane and lines the air cells of the tympanic bulla.

The auditory ossicles have been studied in a special work done by ARNAUTOVIC and OSMAN (1985).

The auditory muscles are two in number, tensor tympani and stapedius muscles. The tensor tympani muscle (*M. tensor tympani*), is ill developed and its fleshy origin is narrow and feeble, arising from the most dorsal part of the rostral wall of the tympanic cavity (Figs. 2/4, 5/11). The greater part of the muscle seems to be tendinous. It extends caudo-ventrally and outward to be inserted to the muscular process of the malleus. The stapedius muscle (*M. stapedius*) is well developed, arising from small bony projection from the facial canal. It is tendinous and runs rostrally to be fixed to the muscular process of stapes (Figs. 7/4).

The chorda tympani nerve (Figs. 1/10, 4/5, 5/5) is derived from the facial nerve near the stylomastoid foramen. It has a recurrent course, running rostrally and dorsally to enter the tympanic cavity through the *Apertura tympanica canaliculi chordae tympani*. It traverses the tympanic cavity from the caudal to the rostral wall between the handle of the malleus and long branch of the incus. The nerve then passes laterally to the end of the tensor tympani

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muscle, again entering the bone through the anterior canaliculus (Fig. 13/4), after leaving the latter, courses ventrally and rostrally to join the lingual nerve.

DISCUSSION

The tympanic cavity and external acoustic meatus in camel can be examined easily by the speculum. The shortness of the meatus should be remembered when a speculum is used for the risk of injuring of the tympanic membrane. The malleus attaches internally to the membrane and appears as a brown yellow streak.

The present work showed that the cavity is irregular and laterally space, compressed what is in accordance with the observations of GANDHI (1975) in ox. Moreover, the epitympanic recess as revealed by this study contains the upper part of malleus and body of the incus, what is similar to that of the horse (SISSON, 1975), sheep and goat (GANDHI, 1975), but not in the ox as mentioned by the last author, who stated that part of the body of the incus and the head of the malleus are located in the epitympanic recess. In this connection, GETTY, *et al.* (1956) and ELLENPORT (1975) in dog reported that the epitympanic recess is entirely occupied by the head of the malleus and incus.

The present work revealed that the tympanic bulla of camel has a large number of air cells which are smaller and more numerous dorsally, while they become larger in the ventral part of bulla. This observations are in agreement with the findings of GANDHI (1975) in the pig. In addition, the same author mentioned that tympanic bulla of ox is well developed and has elliptical opening facing dorsally, through which it communicates with the tympanic cavity proper. However, a sieve - like plate of bone is demonstrated in the present study with numerous small openings that allow free communication between the air cells in the tympanic bulla and the tympanic cavity proper.

The auditory tube of camel is short, 4-5 cm in length, while in the horse 10-12 cm (SISSON, 1975). This fact can clearly why the tympanic cavity of camel is more susceptible for infection.

The origin and shape of tensor tympani muscle presented in this work is similar to what is reported by SISSON (1975) in horse. However, GANDHI (1975) observed that this muscle in sheep, goat and ox is well - developed and arises from the fossa which lies rostral to the vestibular window.

The stapedius muscle of camel which arises from bony projection of the facial canal bears great similarity with that of the dog (GETTY, *et al.* 1956 and ELLENPORT, 1975). However, this muscle in the horse as reported by SISSON (1975) arises from the mastoid wall of the tympanic cavity.

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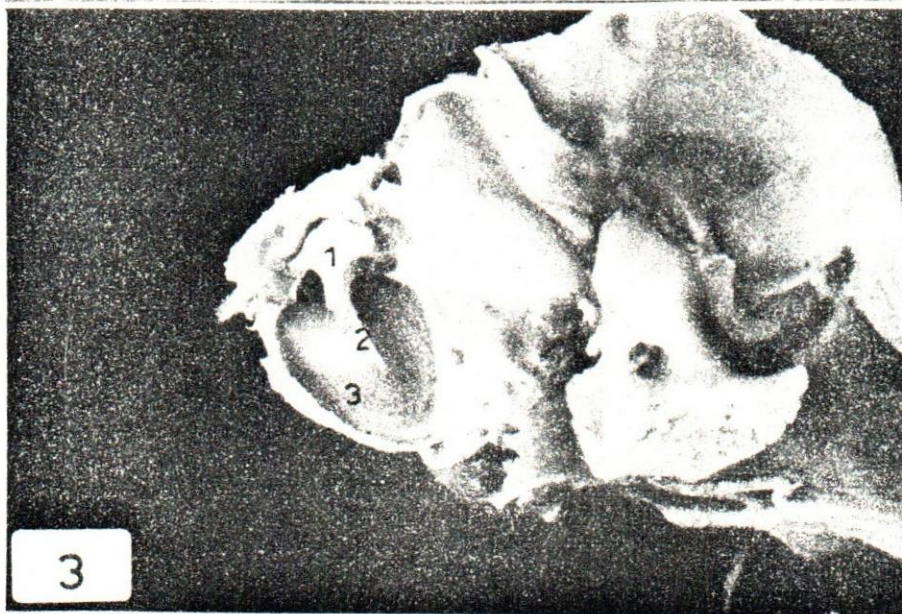
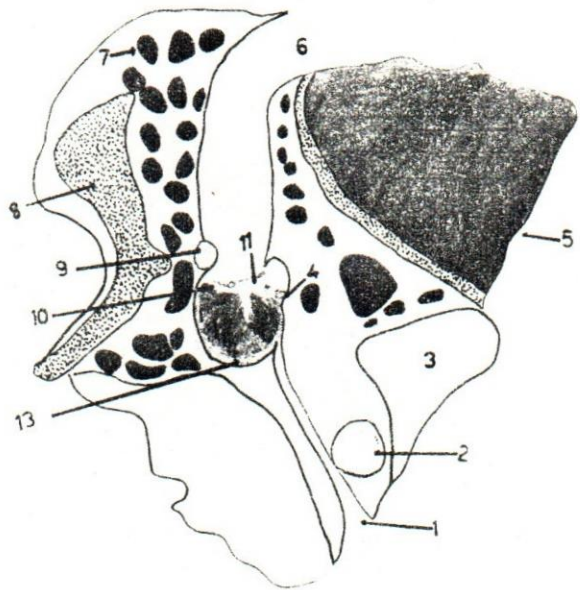
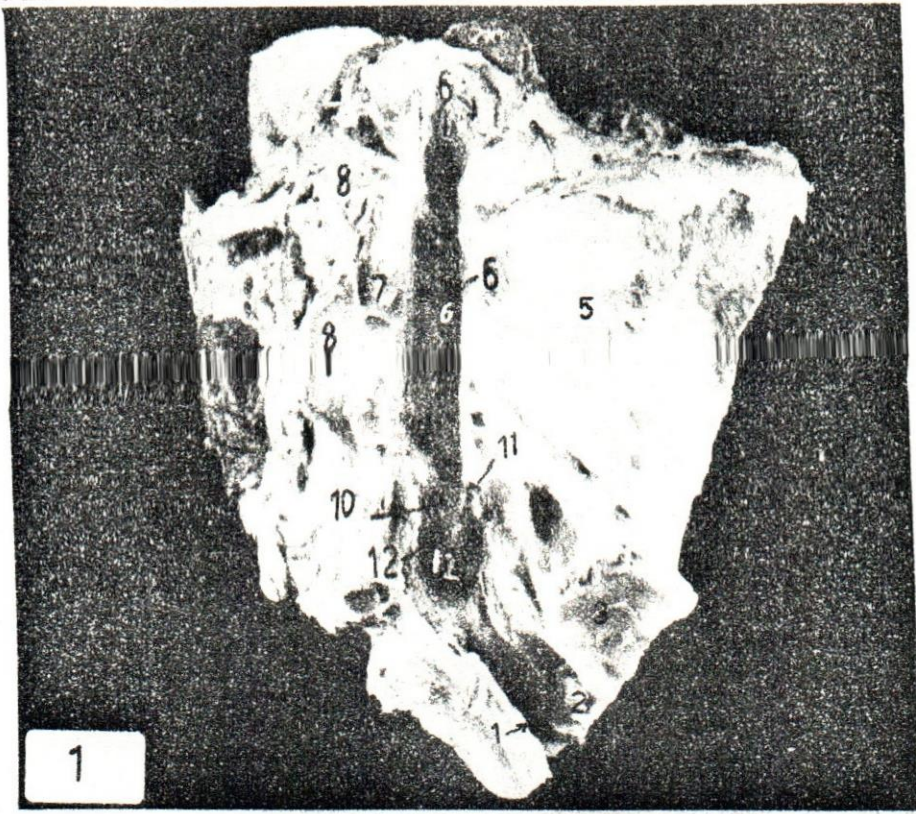
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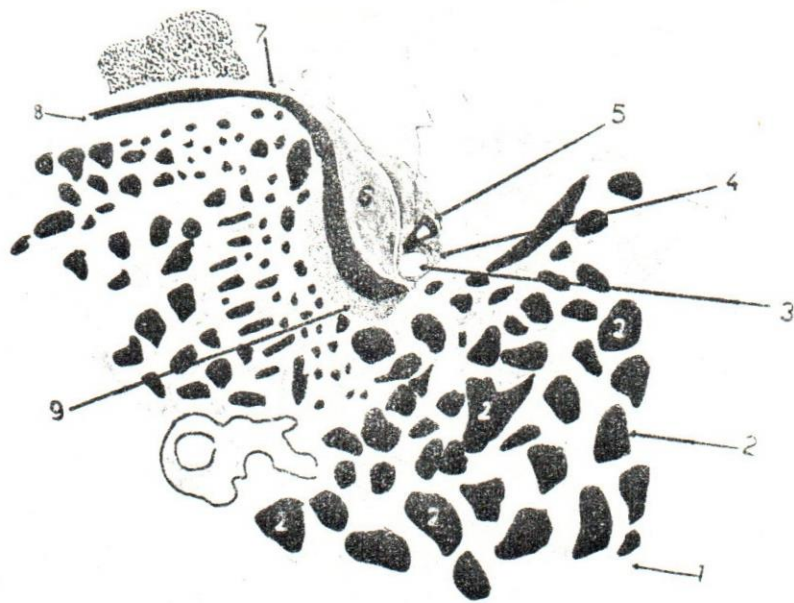
LEGENDS OF FIGURES

- Fig. (1):** Middle ear of camel (Left side) after removal of petreous part of temporal bone and opening of the external acustic meatus (dorso-medial view).
- Fig. (2):** Schematic presentation of fig. (1):
1- Auditory tube, 2- Fifth cranial nerve, 3- Cranial cavity, 4- Tensor tympani muscle, 5- Temporal fossa, 6- External acustic meatus, 7- Mastoid air cells, 8- Mandibular process (sectioned), 9- Facial nerve, 10- Chorda tympani nerve, 11- Malleus, 12- Tympanic membrane, 13- Floor of tympanic cavity proper.
- Fig. (3):** Longitudinal section through the middle ear of camel, left side (the tympanic membrane viewed from internal).
1- Incus, 2- Handle of malleus, 3- Tympanic membrane.
- Fig. (4):** Longitudinal oblique section through the middle ear of camel, left side (viewed from internal).
- Fig. (5):** Schematic presentation of fig. (4).
1- Mastoid bone, 2- Promontorium, 3- Epitympanic recess, 4- Malleus, 5- Chorda tympani nerve, 6- Mandibular process (sectioned), 7- Occypital condyle, 8- Tympanic bulla, 9- Tympanic air cells, 10- Tympanic membrane, 11- Tensor tympani muscle.
- Fig. (6):** Longitudinal oblique section through the middle ear of camel showing the medial wall of tympanic cavity.
- Fig. (7):** Schematic presentation of fig. (6).
1- Tympanic bulla, 2- Tympanic air cells, 3- Cochlear window, 4- Stapedius muscle, 5- Stapes, 6- Promontorium, 7- Greater petrosal nerve, 8- Auditory tube, 9- Floor of tympanic cavity proper.
- Fig. (8):** Saggital section through the right temporal bone of camel.
- Fig. (9):** Schematic presentation of fig. (8).
1- External acustic meatus, 2- Mastoid air cells, 3- Temporal fossa, 4- Condylar vein, 5- Tympanic cavity proper, 6- Epitympanic recess, 7- Greater petrosal nerve, 8- Cranial cavity, 9- Fifth cranial nerve, 10- Auditory tube, 11- Tympanic bulla, 12- Tympanic air cells.
- Fig. (10):** Right temporal bone of camel after removal of tympanic bulla to show the dorsal wall of tympanic cavity (Viewed from ventral).

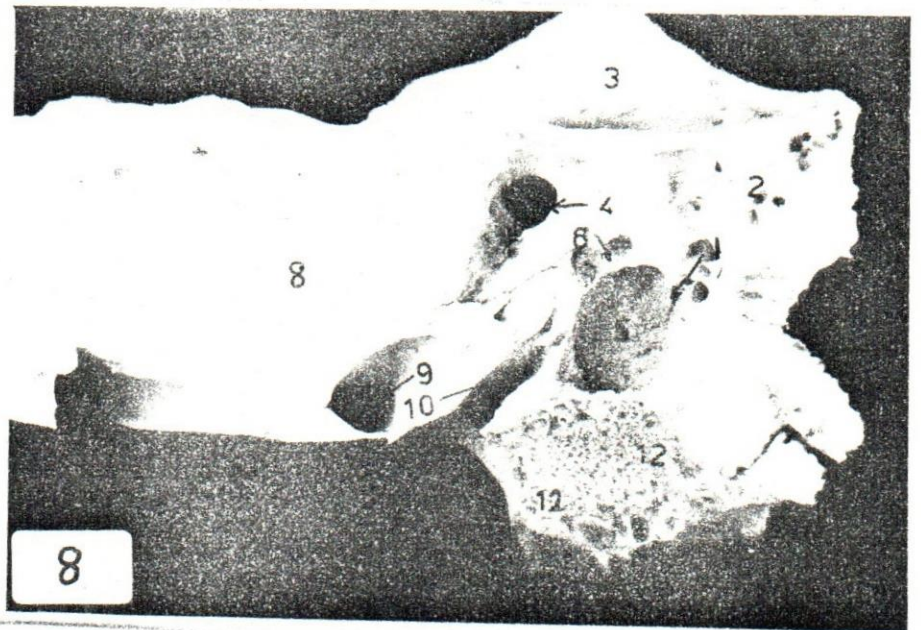
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- Fig. (11):** Schematic presentation of fig. (10).
1- Condylod fossa, 2- Zygomatic process, 3- Mastoid air cells, 4- External acoustic meatus, 5- Tympanic cavity proper, 6- Vestibular window, 7- Cochlear window, 8- Promontorium, 9- Auditory tube (osseus part), 10- Facial canal, 11- Petro-tympanic fissure.
- Fig. (12):** Oblique saggital section through the left temporal bone of camel, medial view.
- Fig. (13):** Schematic presentation of fig. (12).
1- Tympanic air cells, 2- Auditory tube, 3- Oval foramen, 4- Foramen for chorda tympani nerve, 5- Epitympanic recess, 6- Tympanic cavity proper, 7- Mastoid air cells, 8- External acoustic meatus, 9- Floor of tympanic cavity proper, 10- Tympanic bulla.
- Fig. (14):** Left tympanic cavity after removal of tympanic bulla, ventromedial view.
1- External acoustic meatus, 2- Mastoid air cells, 3- Facial canal, 4- Cochlear window, 5- Promontorium, 6- Vestibular window.





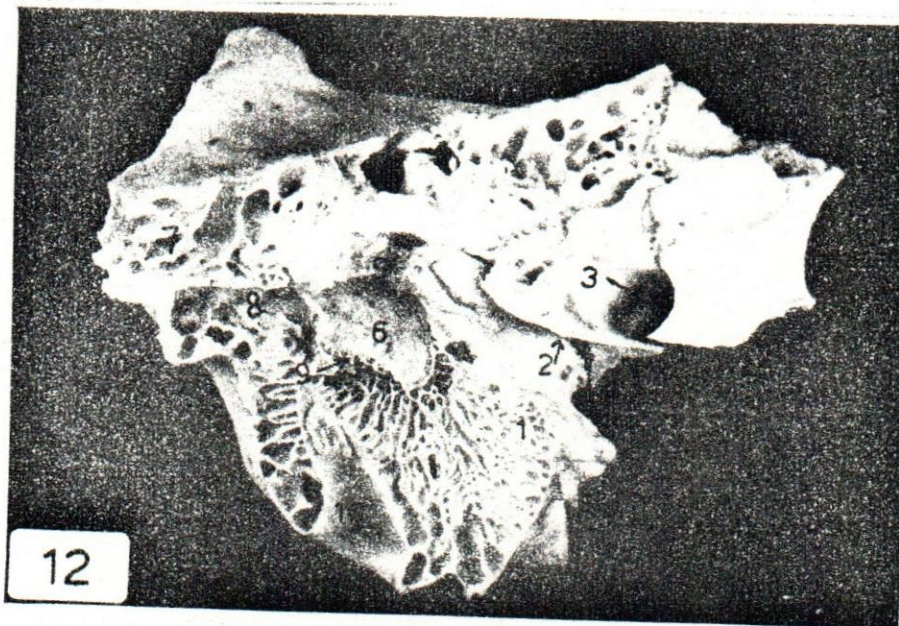
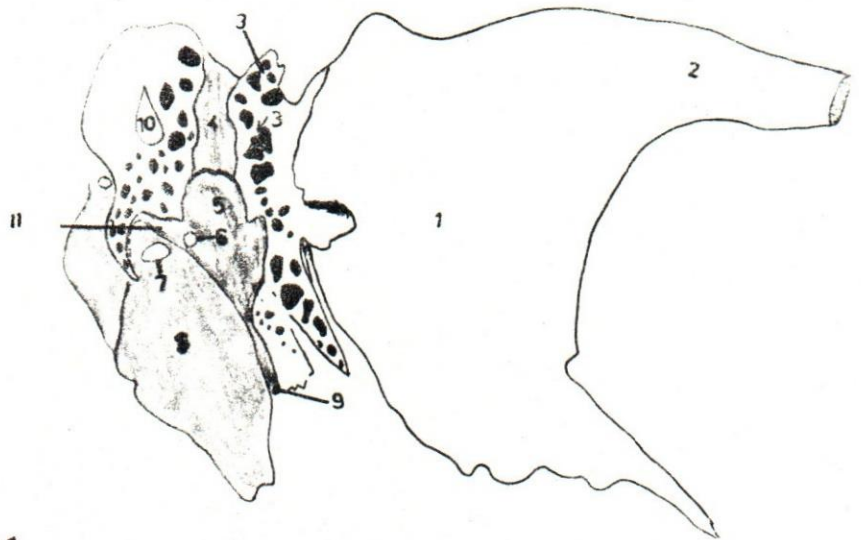
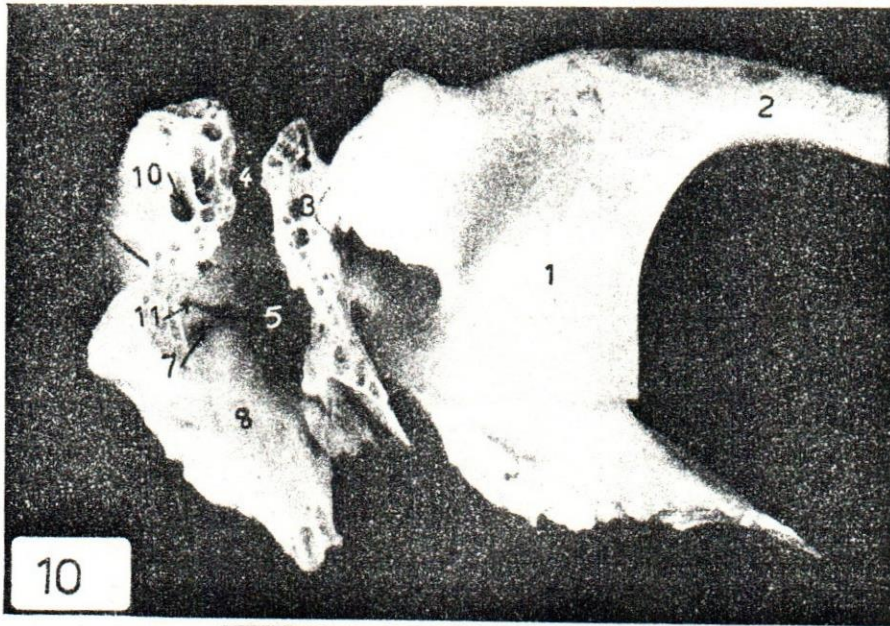
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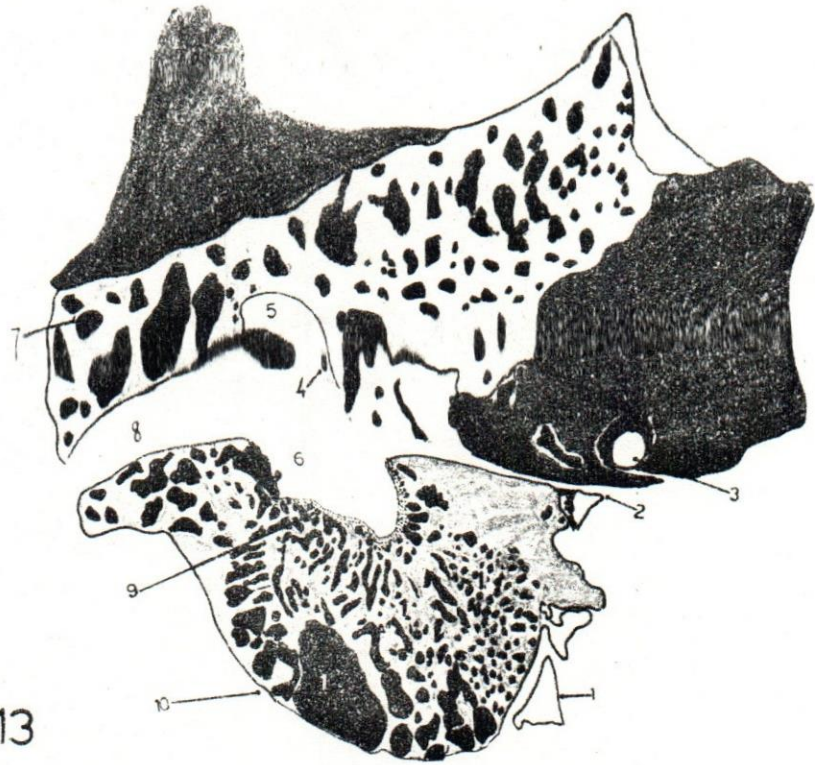


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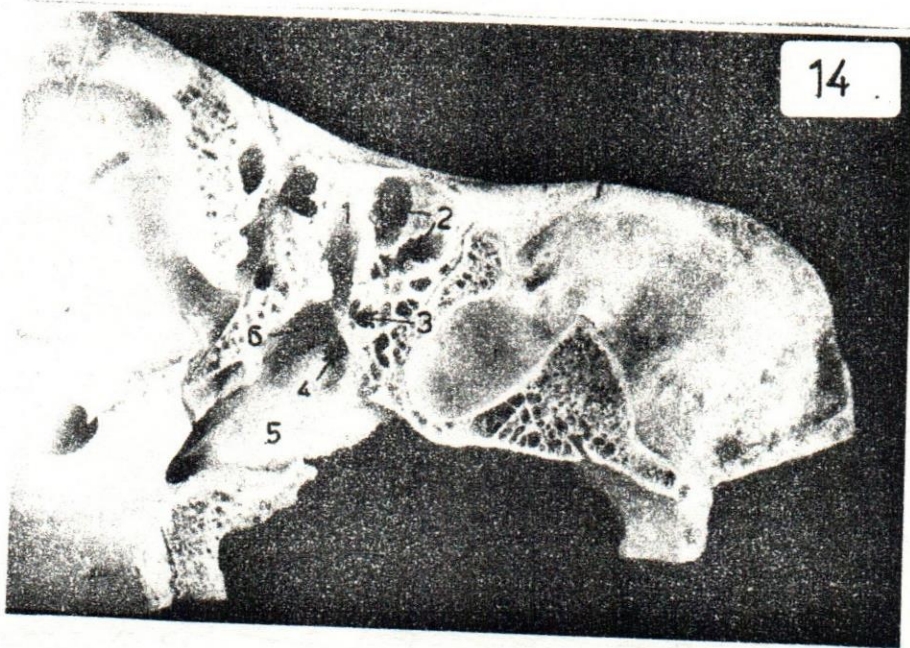


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