The Anatomy of the Nasal Cavity of The Donkey (A Model for Electronic Learning Modules)

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Abstract:

Growing number of students, increasing costs of education, demand for quality education and limited facilities (tools are the most common education challenges for the Egyptian higher education).

To perform this work, resected heads of five donkeys (3-5 years old) were grossly studied using variable anatomical techniques and the obtained data were used for developing a theoretical and practical interactive and electronic learning (E-Learning) module focusing on the anatomy of the nasal cavity of the donkey. Media, electronic tools, computer programs and authoring apps were used as aiding tools for development of a web-based module for teaching and learning veterinary anatomy that enables students to learn anywhere and at any time.

The present work revealed that, each nostril is divided by the alar cartilage into a dorsal false nostril (leads to a blind diverticulum in the Naso-incisive notch) and a ventral, true nostril (leads to the nasal cavity proper). The nostrils and nasal cavities of the donkey were supported by group of nasal cartilages (nasal septum, alar cartilages, dorsal lateral cartilages, ventral lateral cartilages and medial accessory cartilages).

The nasal cavity as a respiratory passage extended from the nostrils rostrally to the cribriform plate caudally. It continued with the nasopharynx caudally through the posterior nares or choanae. Structurally, the nasal cavity possesses nasal conchae (dorsal, middle, ventral and ethmoidal conchae), folds (straight, alar and basal folds) and meatuses (dorsal, middle, ventral and common nasal meatuses).

The present study concluded that:

- The nasal cavities of the donkey are not completely identical to that of the horse.
- Although e-learning provides several benefits the online education has not solved the problem of practicing soft skills.

•High percentage of the students (80-90%) were satisfied with the various elements of the e-learning evaluation survey, though they agreed about the presence of technical problems regarding the internet connection and facilities.

Key words: Gross anatomy, nasal cavity, Donkey, E learning module.

Introduction:

Traditional method of teaching is based on teacher center teaching, passive learning, textbook driven learning and focus on memorization of facts; thereby not developing student' critical thinking, problem solving and decision-making skills ***(Sunal et al, 2003).***

The most common education challenges for the Egyptian higher education are, growing number of students, increasing costs of education, demand for quality education and limited facilities tools. Moreover, the effective teaching is based on helping students progress from one level to another in a more sociable interactive environment and to get the approach right to get students to be independent learners ***(Muijus and Reynolds, 2005).*** The modem constructivist learning methods basing on a learner-centered, research driven learning, problem-based learning, project-based learning, outcomes-based learning, employment-based learning, flipped learning strategy, collaborative learning and peer learning are used to get learner fully involved and focusing on what she/he know and can do and why.

In response to educating challenges, the present study introduced a lecturer and practical electronic modules for teaching the gross anatomy of the nasal cavity of the donkey as innovative methods of teaching students. These modules enable students to learn anywhere and at any time.

The main objectives of the study under investigation are:

- Establishment of e-learning modules as new trends in teaching and learning veterinary anatomical courses.
- Enhance learning in blended or mixed modes to integrate e-learning into all teaching and learning experiences.
- Create a supplemental virtual anatomy experience that was available to each student twenty-four hours a day.
- Minimizing the costs of learning especially practical sessions.
- Replacement of animal' cadavers by prepared specimens. (one of the three Rs applied in ethics of animal uses in research and education) and in turn;

reduce the risks of the formaldehyde vapor on the student' and lecturer' health during the practical sessions in the dissecting hall.

• Reducing contact hours and teaching staff that support teaching.

• Implementing the scientific search in improving learning strategies.

Material and methods:

1. Animals: Five donkeys of different ages (3 to 5 years), were euthanized (anaesthetized using i.v. injection of 1. O mg/kg bwt xylazine ***(Kalhoro et al, 1991)*** and well bled via the common carotid artery and then injected embalming mixture

2. Embalming mixture: Ordinary anatomically used embalming solution (formalin-phenol-methanol-glycerin solution as in the table1) and technique ***(Lynda, 2018)***.

Table 1: ***showing the embalming mixture components*.**

Agents	Amount/ liters
Formalin	3
Glycerin	3
Methanol	1
Phenol (1 kg)	2
Water	11
Total	20

3. Preparation: The heads of the animals were subjected to both sagittal and cross sections using electrical sawing machine.

4. Techniques: Routine gross dissection and El Nady technique were performed on both sagittal and cross-sectional specimens.

5. Data sources: 1ry. (through thoroughly dissection of both sagittal and cross sections of the head), 2ry. (through modification of some available data) and/or 3ry (notification to the sites of some available related data on the web pages).

Nomenclature was adopted according to ***Nomina Anatomica Veterinaria (2017)***

6. Electronic tools:

6-1. Programs: Paint 3D, PPT, PS.

6-2. Software or E-Learning Authoring App:

Camtasia recording, Camtasia studio for screen recorder and video editor for Windows PC **(TechSmith Camtasia 2019)**

Articulate Studio, which make turning PowerPoint presentations into e-learning courses a snap

6-3. Learning Management System (LMS): Moodle - Open-source learning platform Moodle.org

6-4. Strategies (Learner centered learning, Collaborative learning, flipped learning and peer learning).

6-5. Media: Web site (vetmed-academy.com).

6-6-1. E-learning survey:

The survey questionnaire was designed, revised and reported by a specialist and offered to 50 students from the second year (as they studied the anatomy of the respiratory system by the traditional teaching) and then exposed to learning by the method under investigation via Vetmed-academy.com. (as a model of blended learning)

The data were tabulated, statistically analyzed and biographed.

Results:

The nasal cavity of the donkey is the portion of the respiratory system extending from the nares (nostrils) to choanae and includes the nares (nostrils), the nasal passages (nasal cavities).

1. The Nares (Nostrils):

The nares (external nostrils) form the initial part of the air passage (the entrance to the nasal cavity). Each nostril is bounded by a mobile lateral and immovable medial wing (*Alae nasi*) that meat dorsally and ventrally forming the dorsal and ventral commissures respectively (fig.1/B). When undilated the nostril appeared, comma shaped. It is supported medially by the rostral end of the nasal septum. Each nostril is divided by the alar fold into a dorsal, "false nostril" and a ventral "true nostril". The dorsal nostril leads to a blind diverticulum (fig. 1A/1) in the naso-incisive notch, however the ventral nostril-nasal vestibule (fig. 1A/2)- leads to the nasal cavity proper. On the floor of the nasal vestibule close to the point between the nasal mucosa and the skin covering the nostril, the nasolacrimal duct openings are located nearby the nasal septum (fig. 1A/4).

The nostrils and nasal cavities of the donkey are supported by group of nasal cartilages (nasal septum, alar cartilages, dorsal lateral cartilages, ventral lateral cartilages and medial accessory cartilages).

1-1. *Septum nasi* -The nasal septum (fig. 2/1): The nasal septum is somewhat quadrilateral in outlines, being slightly thicker peripherally than centrally. It divides the nasal cavity into two symmetrical halves (right and left). It attached dorsally along the nasal and frontal sutures. Ventrally, it concealed within the groove of the vomer bone and the palatine process of the incisive bone. Caudally, the nasal septum blended with the ethmoidal bone. Anteriorly, it continued between the nostrils as naris septum.

1-2. *Cartilago alaris*- The alar cartilages (fig.2/2): The alar cartilage is represented by two comma shaped cartilages, placed

transversally back to back. They support the nostrils dorsally, medially and ventrally keeping them open. The dorsal part of the alar cartilages is represented by a prolonged flattened plate-like quadrilateral *Lamina* (fig.2/2a), while the Medio-ventral part forms the narrow *Cornu* (fig.2/2b).

1-3. *Cartilago nasi lateralis dorsalis* -The dorsal lateral nasal cartilages (fig.2/3): Are thin narrow plates extended for a short distance on either side of the dorsal border of the nasal septum. The dorsal lateral cartilages don't support any part of the lateral wall of the nostril.

1-4. *Cartilago nasi lateralis ventralis* -The ventral lateral nasal cartilages*:* Are thin flattened and extend for a short distance from the anterior part of ventral border of cartilaginous nasal septum into the palatine fissure.

1-5. *Cartilago nasi medialis accessorius* -The medial accessory nasal cartilages (fig.2/4): The "S" shaped medial accessory nasal cartilages were detected within the alar fold. Each of them is attached to the corresponding ventral nasal concha.

2. *Cavum nasi* - Nasal passage (nasal cavity)

The nasal cavity is a respiratory passage lies between the nostrils rostrally and the cribriform plate caudally. It continues with the nasopharynx caudally through the posterior nares or *Choanae*. It consists of paired symmetrical halves (right and left) separated by a septum and lined by highly `vascular mucosa- *Tunica mucosa nasi* (fig. 3/1).

The nasal cavities are supported dorsally by the nasal bones and the anterior portion of the frontal bones. Ventrally, they supported by the palatine processes of the incisive and maxillary bones as well as the palatine bone. Bilaterally the nasal cavities are supported by incisive, maxillary, lacrimal, palatine and ethmoidal bones.

The medial wall of the nasal cavity comprised the boney parts of the nasal septum (perpendicular plate of ethmoidal bone and vomer bone) in addition to the cartilaginous nasal septum (fig. 3).

The narrow rostral portion of the nasal cavity is the *Vestibulum nasi*, the middle portion is the largest part and contains the nasal conchae while the small caudal part of the nasal cavity possesses the much more numerous ethmoidal conchae.

From the interior of the lateral wall of the nasal cavities, scroll-like thin boney plates (turbinate bones) covered with highly vascular nasal mucosa project into the nasal cavity forming nasal conchae. According to their topographic orientation, the nasal conchae include dorsal,

middle and ventral nasal conchae in addition to caudally located ethmoidal conchae.

2-1. *Concha nasalis dorsalis*- The dorsal nasal concha (fig. 4/1) is the largest among the nasal conchae. It extends the furthest into the nasal cavity from the nasal fundus caudally to the nasal vestibule anteriorly and prolonged forward by the straight nasal fold (fig. 4/a). It divided by the dorsal conchal septum into a rostral and caudal parts. Caudally, it forms a dorsal conchal sinus that communicate with the frontal sinus forming Concho-frontal sinus, while anteriorly it forms a conchal recess.

2-2. *Concha nasalis media* -The middle nasal concha (fig. 4/3) is located in the nasal fundus being extended from the ethmoidal bone to about the level of the choanae. It enclosed the middle conchal sinus.

2-3. *Concha nasalis ventralis*- The ventral nasal concha (fig. 4/2) appeared shorter than the dorsal one being extended from about the level of the caudal limit of the choanae caudally till the level of canine tooth rostrally. It prolonged forward as dorsal alar and ventral basal folds (fig. 4/b & c). The ventral nasal concha is divided by the ventral conchal septum into a rostral and caudal parts. The caudal part forms the ventral conchal sinus, while anteriorly it forms a conchal recess.

2-4. *Conchae ethmoidales* - The ethmoidal conchae (fig. 4/4) are represented by (5-6) much smaller conchae extending forward from the ethmoidal bone to about to level of the choanae.

2-5. Nasal meatuses:

The conchae are partially subdividing the nasal cavity leaving three meatuses; dorsal *(Meatus nasi dorsalis)*, middle *(Meatus nasi medius)* and ventral *(Meatus nasi ventralis)* nasal meatuses which are communicated medially forming narrow paramedian passage - common nasal meatus (*Meatus nasi communis*) between the nasal septum and the nasal conchae. In addition, the passages between the ethmoidal conchae form ethmoidal meatuses (*Meatus ethmoidales*)

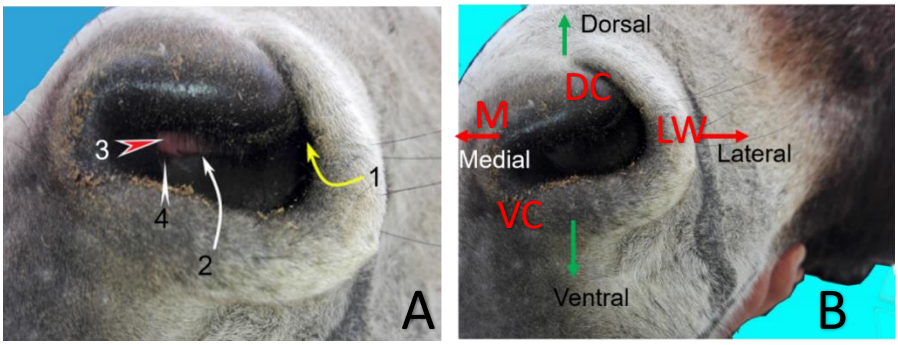

Fig. 1: Photographs of the nares (nostrils) of the donkey (left side) showing:
DC Dorsal commissure. VC Ventral commissure.
LW Lateral wing. MW Medial wing.
1: Entrance to the nasal diverticulum.
2: Entrance to the nasal vestibule
3: Septum nasi
4: Nasal orifice of nasolacrimal duct

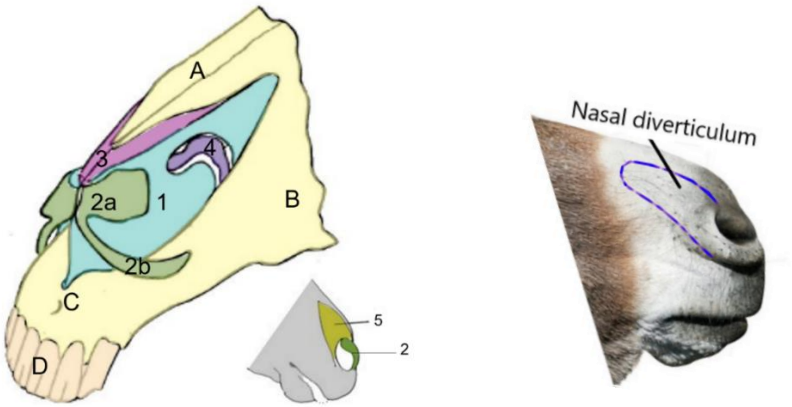

Fig.2: Diagrammatic illustration showing the orientation of the nasal cartilages of the donkey. ***(Modified after Mickiewicz Studios, 2017).***
A: Os nasale; B: Maxilla; C: Os incisivum; D: Incisors
1: Septum nasi; 2: Cartilago alaris; 2a: Lamina of the alar cartilage; 2b: Cornu of the alar cartilage; 3: Cartilago nasi lateralis dorsalis; 4: Cartilago nasalis accessoria medialis; 5: Diverticulum nasi.

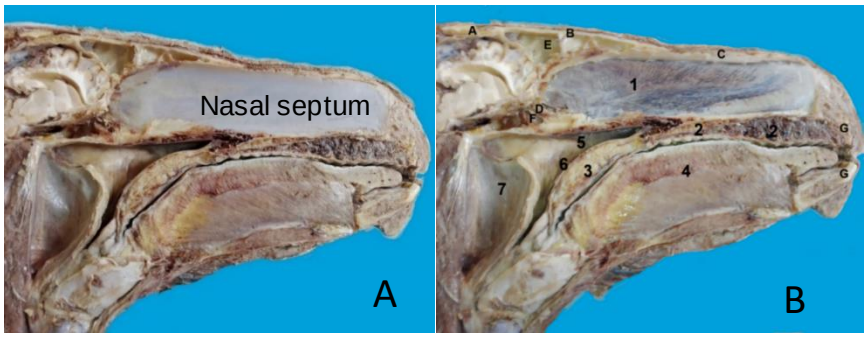

Fig.3: Photographs of a sagittal section of the head of a donkey showing the upper air way of the respiratory system (A) with intact

nasal septum, (B) Resected nasal septum and exposure of septal mucosa.
AOs parietale, B Os frontale, C Os nasale, D Os sphenoid, E Sinus frontalis, F Sinus sphenoidalis, G Incisors.
1 Highly vascular mucosal covering of the nasal septum, 2 Hard palate; 3 Soft palate, 4 Corpus linguae 5 Pars nasalis pharyngis, 6 Ostium pharyngeum tubae auditivae, 7 Guttural pouches.
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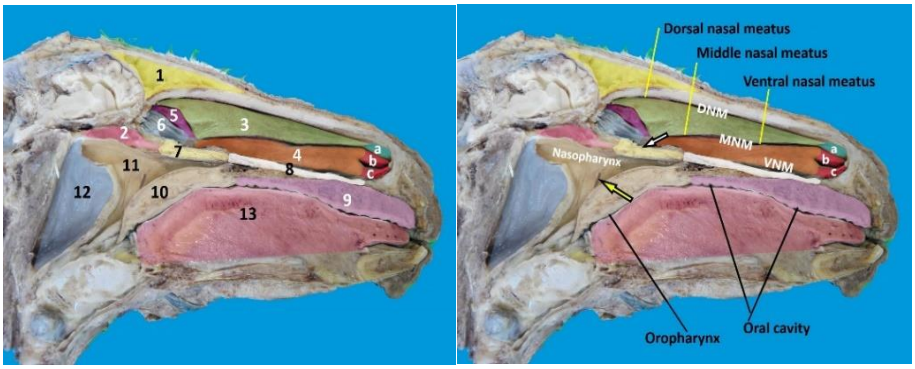


Fig.4: Photograph of a sagittal section of the head of a donkey showing the upper airway of the respiratory system after resecting the nasal septum and its mucosal covering.
1: Sinus frontalis, 2: Sinus sphenoidalis, 3: Concha nasalis dorsalis (a- Straight fold)
4: Concha nasalis ventralis (b- Alar fold, c- Basal fold), 5: Concha nasalis media
6: Conchae ethmoidales, 7: Vomer bone, 8: Palatine bone, 9: Hard palate, 10: Soft palate
11: Pars nasalis pharyngis, 12: Guttural pouch, 13: corpus linguae
Whit arrow ⬅ ▪ ➤ Choanae (Nasopharyngeal passage)
Yellow arrow ⟶ Ostium pharyngeum tubae auditivae

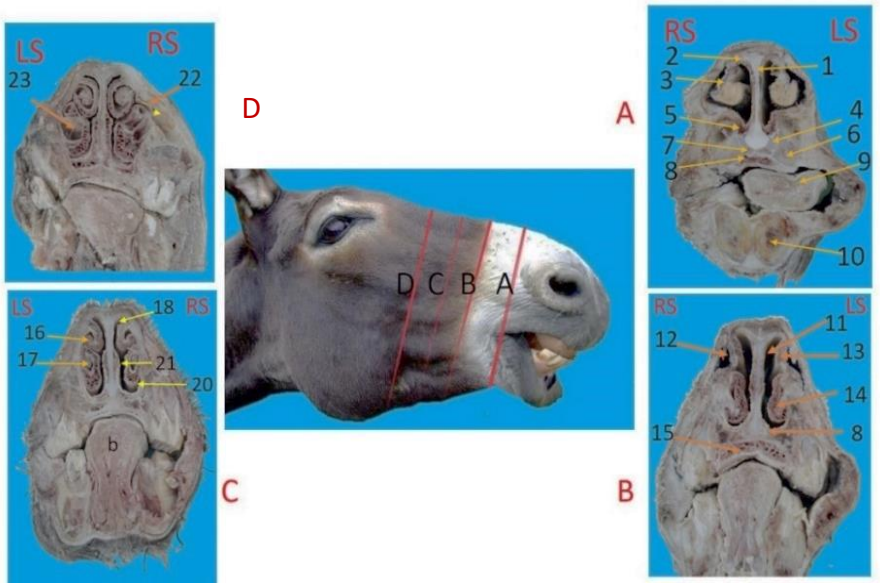


Fig.5: Photographs of cross sections of the head of a donkey at different levels, showing the nasal air way.

A. At a level just caudal to the canine tooth,
B. At the level of the 2nd. cheek tooth.
C. At the level of the 4th. cheek tooth.
D. At the level of the last (6th.) cheek tooth.

1. Septum nasi, 2. Cartilago nasi lateralis dorsalis, 3. Cartilago alaris, 4. Cartilago nasi lateralis ventralis, 5. Nasolacrimal duct, 6 Processus nasalis of incisive bone, 7. Processus palatinus of incisive bone, 8. Organum vomeronasale, 9. linguae, 10. Mandibula, 11. Vestibulum nasi, 12. Diverticulum nasi, 13. Concha nasalis dorsalis, 14. Concha nasalis ventralis ,15. Hard palate, 16. Bulla conchalis dorsalis, 17. Bulla conchalis ventralis, 18. Meatus nasi dorsalis, 19. Meatus nasi medius, 20. Meatus nasi ventralis, 21. Meatus nasi communis, 22. Nasomaxillary communication, 23. Concho-maxillary sinus.

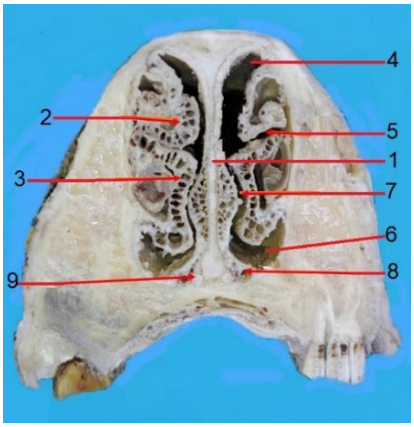


Fig.6 Photograph of cross section of the nose of a donkey at the level of 5th. cheek tooth.
1. Septum nasi, 2. Concha nasalis dorsalis, 3. Concha nasalis ventralis.
4. Meatus nasi dorsalis, 5. Meatus nasi medius, 6. Meatus nasi ventralis.
7. Meatus nasi communis, 8. Nasolacrimal duct, 9. Organum vomeronasale

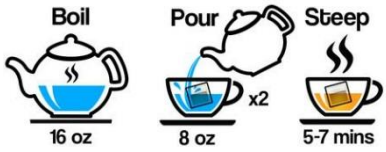
Learning Module (Please join our web site), http://vetmed-academy.com

Title
Gross Anatomy of the Nasal Cavity of the Donkey

Welcome
Welcome to the anatomy of the nasal cavity of the donkey. This module will deal with Nares (nostril), nasal cartilages, nasal conchae and nasal meatuses).
Each of these items looks in detail at aspect of Gross Anatomy and is interspersed with exercises (Formative assessments) for monitoring progress and providing feedback. At the end, a test (Summative assessment) will measures overall performance and understanding.

Instructions
- Throughout the course, you must follow the practical labs in the dissecting hall.
- Revised the well-prepared specimens in the Department' museum.
- The Department' notes, web sites and library texts are important for advancement of your performance.
- Make contacts with the course consultant and don't hesitate to

ask him/her when it is needed either face to face or by any mean of other available contacts.



Learning Objectives

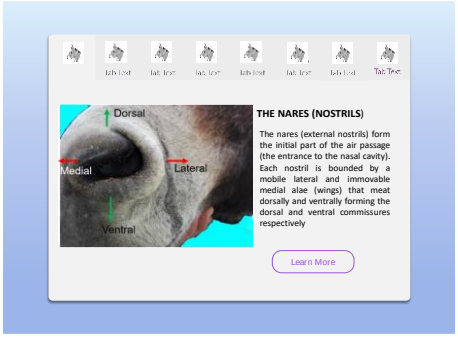
Upon completion of this module the learner will be able to:

- Recognize the components of the nasal cavity.
- Describe the gross morphology of the nasal vestibule.
- Differentiate the various nasal cartilages.
- Discuss the gross morphology of the nasal conchae.
- Analyze the nasal meatuses and their communication with the paranasal sinuses.
- Appreciate the clinical significance of the nasal diverticulum.

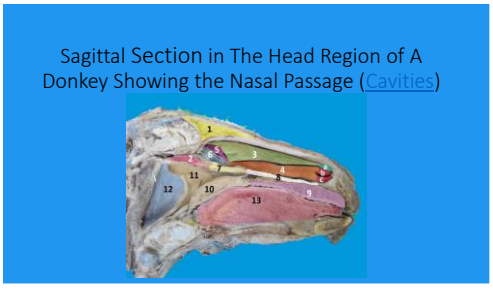
Contents

The content of the module will be offered in form of:

1. Text and graphs.
2. Interactive power point



THE NARES (NOSTRILS).pptx



Nasal cavity ppt.

3-video clips. (self-learning)

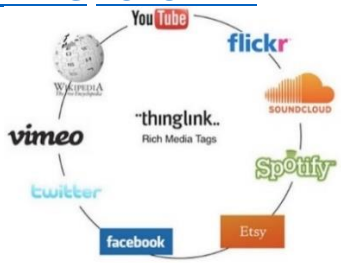
PRACTICE ACTIVITIES

Dissection

In the dissecting hall

Under the supervision of your consultant, and with the aid of your practical notes, dissect the nose of the donkey and make a sagittal section through the head region and discuss the nasal cavity components with your peers.

WEB-BASED LEARNING TUTORIAL



Please visit the Department Museum

Knowledge checks & assessments

Formative assessment of nasal cavity

Summative assessment of the nasal cavity

Summary of the module

The nares (external nostrils) form the initial part of the air passage. When undilated the nostril appeared, comma shaped. Each nostril is divided by the alar cartilage into a dorsal, "false nostril" and a ventral "true nostril". The dorsal nostril leads to a blind diverticulum in the Naso-incisive notch however the ventral nostril-nasal vestibule leads to the nasal cavity proper. On the floor of the nasal vestibule close to the point between the nasal mucosa and the skin covering the nostril, the nasolacrimal duct openings are located nearby the nasal septum. The nostrils and nasal cavities of the donkey are supported by group of nasal cartilages (nasal septum, alar cartilages, dorsal lateral cartilages, ventral lateral cartilages and medial accessory cartilages).

The nasal cavity is a respiratory passage lies between the nostrils rostrally and the cribriform plate caudally. It continues with the nasopharynx caudally through the posterior nares or choanae. It consists of paired symmetrical halves (right and left) separated by a septum and lined by highly vascular mucosa. Structurally, it possesses nasal conchae (dorsal, middle, ventral and ethmoidal conchae), folds (straight, alar and basal folds) and meatuses (dorsal, middle, ventral and common nasal meatuses).

Contact Information and Resources

Consultants to contact:

Name: Prof. Dr. Saber Abuzeid	**Name**: Fatma Abdallah
Tel: 01222323751	**Tel**: >>>>>>>>>>>>
Email: saber7453@yahoo.com	**Email**: fatma2014@yahoo.com
Time available face to face: Monday (10 am – 1pm)	**Time available face to face**: Tuesday (9- 12)

Resources:

Author' Self-Research studies (1ry. Data)
Modified data from previous studies (2ry. Data)
Pieces of data from previous studies (3ry. Data)
Web sites' links

E-learning survey

The survey questionnaire was designed, revised and reported by a specialist and offered to 50 students from the second year (as they studied the anatomy of the respiratory system by the traditional teaching) and then exposed to learning by the method under investigation via Vetmed-academy.com. (as a model of blended learning)

- The data conculcated that high percentage of the students (80-90%) were satisfied with the various elements of the e-learning evaluation survey, though they agreed about the presence of technical problems regarding the internet connection and facilities.

Discussion

The present work, and in accordance with ***Eshra (2011)*** showed that the shape of nostril of donkey appears comma shape when undilated. Otherwise, the horse's nostril is crescentic shape that helps it to become wider during racing.

Division of the nostril of the equines including donkey ***(Hare, 1975 and Hamoda, 2000)***, by the alar fold into false and true nostrils is of great significance in preventing fine food particles from passing to the succeeding air passages during labial food prehension.

Like in the horse as reported by ***Pohlmeyer and Wissdorf (1975)*** and ***Nickel et al. (1979),*** the present work revealed that the rostral aperture of the naso-lacrimal ducts of the donkey are located at the muco-cutaneous junction on the floor of the nasal vestibule slight medially nearby the nasal septum and not on the lateral to dorsolateral aspect of the nostril, near the mucocutaneous junction. of the nostril as reported by ***Said et al. (1977), Matthews and Taylor (2009)*** and ***Burnham (2002)*** in the donkey.

. The dorsal lateral cartilage in the donkey, like that of the horse ***(Nickel et al., 1979)***, does not project very far laterally, and the narrow ventral lateral cartilage covers only the palatine suture. A further difference in the formation of the nasal cartilages in the donkey, like in horse, is the presence of alar cartilages which are absent in buffalo and camel as mentioned by ***Metwally et al. (2018).***

In the donkey as mentioned here, and in the horse as revealed by ***Nickel et al. (1979)*** the alar cartilages are consisted of a lamina dorsally and a comu ventrally and support the nostrils dorsally, medially, and ventrally. The present work and that of ***Metwally et al. (2018)*** in the donkey and ***El-Hagri (1967), Hare (1975), Nickel et al. (1979)*** and ***Dyce et al. (2018),*** in the horse, agreed about the absence of the lateral accessory cartilages

resulting in keep the lateral wall of nostril free movable, a case that play a considerable role in the nose breathing in such species. In the donkey, like in the horse (***Nickel et al., 1979)*** the medial accessory cartilage is large S-shaped and lies inside the alar fold**.**

In The donkey, as in other domestic animals, the nasal cavity, as a part of upper respiratory airway, connects the nostrils rostrally with the nasopharynx caudally through the posterior nares (choanae). Moreover, the nasal cavity is separated from the oral cavity by the hard and soft palates. In the donkey, like that in the horse, the long soft palate and the close apposition of epiglottis to it classified both animals as obligatory nose breather ***(Reznik, 1990).*** Moreover, the heavy vascular pattern of the nasal mucosa, as revealed here in the donkey, and ***Eshra (2011)*** makes its function not only as a part of air passage to the respiratory portion, but also, acts as conditioning system by its venous plexuses (warming) and humidification by mucous secreting cells.

The present work agreed with the findings of ***Matthews and Taylor (2009)*** in that the nasal passage is narrower than that in the horse and the middle nasal meatus communicates with the maxillary sinus via this nasomaxillary opening.

Fores et al. (2001) and ***Burnham (2002)*** reported one additional difference, that the donkey typically has a narrower ventral meatus than a horse or pony of equivalent size and age. The nasal and ethmoidal conchae of the donkey, like other domestic animals ***(El-Hagri, 1967; Hare, 1975*** and ***Nickel et al., 1979),*** are thin osseous scrolls originating with a basal lamella and roll up on themselves forming scrolls that covered on both sides with highly vascular mucosa forming the nasal and ethmoidal conchae. The present finding simulate that mentioned by ***Metwally et al. (2018)*** in the donkey, and ***Nickel et al. (1979)*** in the horse, in that both dorsal and ventral nasal conchae, the spiral lamellae enclose air-filled sinuses (caudally) and recesses rostrally which communicate extensively with the nasal meatuses. In this connection, in the carnivores, the middle portion of the concha is coiled, enclosing a recess, while the rostral and short caudal portions consist only of the basal lamella and have the appearance of a shelf or a longitudinal swelling respectively. However, in ruminants, the caudal two-thirds of the dorsal concha is coiled and encloses the dorsal conchal sinus; the rostral third is plate like and consists only of the

basal lamella ***(El-Hagri, 1967 and Hare, 1975)).***

Moreover, and in the contrary with those mentioned by ***Metwally et al. (2018)*** in the donkey, and ***El-Hagri (1967), Hare (1975), Nickel et al. (1979)*** and ***Dyce et al. (2018)*** in other domestic animals, the present study showed that the ventral nasal concha is being shorter than the dorsal one, as it arises caudally from the conchal crest of the maxilla about the level of the nasal choanae, and not from the ethmoidal plate like the dorsal and middle conchae. Such orientation leads us to say that the middle nasal concha, in the donkey, lies between the dorsal nasal concha and the ethmoidal conchae.

El-Hagri (1967), Hare (1975), Nickel et al. (1979) and ***Dyce et al. (2018)*** consider the caudal ends of the dorsal and middle nasal conchae as parts of the ethmoid labyrinth scrolls (ethmoidal conchae) and known them as endoturbinates I and II respectively, a results which could be also applied to the donkey.

As in other domestic animals, the dorsal and ventral nasal conchae split the nasal cavity into dorsal, middle and ventral nasal meatuses. Moreover, and on the contrary with those in the donkey and horse, the middle nasal meatus in carnivores and ruminants, is split caudally by the middle nasal concha into dorsal and ventral channels as mentioned by ***Hare (1975), Nickel et al. (1979)*** and ***Dyce et al. (2018).***

The present study agreed with many others, that online education (e-learning) is unquestionable and the heterogeneity of students' individual skills and capability, self-dependent and self-organized learning is indispensable for permanent internalization of knowledge. ***D'Albenzio and Alessandrini (2010)*** described e-learning as a powerful and valuable extension of traditional educational initiatives. ***Alison (2016)*** exceeded that e-learning courses provide a flexible and versatile learning system that enables individual learners and organizations alike to tailor their training to fit with their specific circumstances. Moreover, ***Gupta et al. (2017)*** declared that e-learning has become quite popular and appreciated among students all over the world.

Burbles (2004) demonstrated that the chief disadvantage of the virtual classroom concerns the lack of face-to-face interaction, the inability to build up a team spirit and to practice soft skills like profiling, originality, rhetorical skills and communication, one of the most important elements of a learning experience. In this connection,

the instructions of the e-learning modules recorded in the present study indicate that the combination of both e-learning and personal contact with instructors, would be therefore an optimal option, which we must be implemented at our institute.

No matter what student-based e-learning looks like, it will generally fall into one of two categories: information-based or performance-based.

Information-based courses are designed to increase awareness or certify understanding, not change behavior. On the other hand, performance-based courses seek to change behavior, such as applying a new skill. These kinds of courses can drive measurable results that make a real impact.

Seels and Richey (1994) demonstrated that Educational technologists try to analyze, design, develop, implement, and evaluate process and tools to enhance learning. Moreover, ***Kurbel, Karl (2001)*** declared that, in practice, a "virtual education course" refers to any instructional course in which all, or at least a significant portion, is delivered by the internet. "Virtual" is used in that broader way to describe a course that is not taught in a classroom face-to-face but through a substitute mode that can conceptually be associated "virtually" with classroom teaching, which means that people do not have to go to the physical classroom to learn. Accordingly, virtual education refers to a form of distance learning in which course content is delivered by various methods such as course management applications, multimedia resources, and video conferencing. ***Bransford et al (2000)*** Added that virtual education and simulated learning opportunities, such as games or dissections, offer opportunities for students to connect classroom content to authentic situations.

Malinowski (2003) stated that "designing an interactive educational tool requires content expertise, skills in multimedia authoring, knowledge of current distribution technologies and the ability to design for learning". The same elements were applied in preparation the learning modules in the present work.

According to ***Towards Maturity (2010),*** one of the reasons for the failure of an eLearning initiative in an organization is lack of in-built e-assessment, usage measurement, record keeping, evaluation recording, and links to competency measurement or business evaluation. Despite this statement, the present study accompanies each learning module with groups of formative and summative e-assessment. In this connection, ***JISC (2010)***

concluded Benefits of Using Technology for Assessments to managers and learning professionals as follows:
Ability to design interactive assessments resulting in greater learner engagement. Use of multimedia, simulations and games can make the assessments interesting. • Flexibility in terms of location and timing for the assessments. Assessments can be included after every module or within the module to test the understanding of a particular learning objective. • Increase of efficiency and reduction of workload for learning experts. • Feedback can be instant and effective. Improves learners' ability to self-assess their understanding on the subject matter and facilitate better learning. • Data stored in the LMS can help evaluate the effectiveness of the curriculum and learning outcomes. Helps in training evaluation and future designing of courses.

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الملخص العربي

تشريح تجويف الأنف للحمار (نموذج لوحدات التعلم الإلكتروني)

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يعتبر تزايد عدد الطلاب، وزيادة تكاليف التعليم، والطلب على التعليم الجيد والمرافق المحدودة الأدوات هي التحديات التعليمية الأكثر شيوعا للتعليم العالي المصري. وبما اننا يجب ان نقوم بتطوير أنظمتنا التعليمية لتلبيه احتياجاتنا المستقبلية، فمن الأفضل غض الطرف عن تعريفات الانظمه التعليمية التقليدية والتركيز علي أنظمة التعلم الحديثة.

واستجابه لهذه التحديات ، قدمت الدراسة الحالية نماذج نظرية وعملية للتعلم الالكتروني علي التشريح العياني لدهليز وتجويف الأنف كنموذج لتدريس وتعلم التشريح البيطري بما يُمكن الطلاب من التعلم في اي مكان وفي اي وقت.

وللقيام بهذا العمل، تمت دراسة رؤساء خمسة حمير (3-5 سنوات) باستخدام تقنيات تشريحية مختلفة، واستخدمت البيانات التي تم الحصول عليها في إعداد وحدة تعليمية تفاعلية وإلكترونية نظرية وعملية (التعلم الإلكتروني).

اشتملت الوحدات الألكترونية التعليمية على: عنوان الوحدة , والترحيب , والتعليمات ، وأهداف التعلم ، والمحتوي (النص والرسوم التوضيحية ، والنماذج التفاعلية للعروض التقديمية المزودة بالصوتيات ، والفيديوكليب ، وما إلى ذلك من تقنيات تشريحيه مختلفه) ، أنشطة الممارسة والتقييم ، ومعلومات الاتصال والموارد).

وخلصت الدراسة إلى ان: الصفات التشريجية للممرات التنفسية العلوية للحمار ليست مطابقه تماما لمثيلاتها في الحصان حيث وجد العديد من الاختلافات التشريحية بين الحمار والحصان في مناطق تجاويف الأنف والبلعوم والحنجرة.

إلى جانب ذلك وبالرغم من ان التعلم الالكتروني يوفر العديد من الفوائد (يقلل من التكلفة الاجماليه ، ويقلل من وقت التعلم ، ويضمن التعليم المستمر بلا حدود مكانية أو زمنية، إلا أن التعليم عبر الإنترنت لم يحل مشكله ممارسه المهارات العملية.

ومن خلال الدراسة الاستقصائية لتقييم التعلم الكتروني ، تبين وجود نسبه عاليه من الطلاب (80-90%) راضين عن العناصر المختلفة للنظام المعروض وان كانوا قد اتفقوا علي وجود مشاكل تقنيه فيما يتعلق بالاتصال بالإنترنت من داخل الكلية.