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FEATURES OF THE ANATOMY OF SOME BONES OF THE FACIAL PART HEADS OF A BACTRIAN CAMEL

ANNOTATION

The nasal and incisor bones of the Bactrian camel are represented by paired bones, which are located in the front of the skull and have features in the anatomical structure, unlike other agricultural animals. In a camel, the nasal bones have the appearance of two flat bones, which participate in the formation of the roof of the nasal cavity and are divided into external and internal surfaces. In comparison with cattle, the length of the nasal bone of a Bactrian camel due to the shape and location of the nostrils on the dorsal part of the nose is half as much and not covers the entire nasal cavity, as well as in dogs. The nasal part of the nasal bone in a camel is much expanded than in other animals, looks like a wing and forms two bends - internal and external. The lateral edge of the wing of the nasal bone is involved in the formation of the inner part of the lacrimal opening, which in the camel has a different size and shape. The incisive bones of the camel are topographically located in front of the maxillary bones and serve as a bone base for the nostrils, forming the entrance to the nasal cavity and form the anterior part of the bone palate and holes for the alveoli of the anterior canines, which are present in males and females. In our study, the camel was compared with a large cattle does not have an incisive-nasal suture and, accordingly, does not have a nasopharyngeal notch. An anatomical study of the bones of the facial part of the skull of the Bactrian camel was carried out according to certain methods. the facial part of the animal's skull depending on the physiological loads of the respiratory system in different age periods.

Keywords: *bactrian camel, comparative anatomy, skull morphology, craniometry, nasal bone, incisor bone.*

Introduction. The largest representative of the camel family - camelidae, is the bactrian camel - *camelus bactrianus*, belonging to the detachment with a single-humped camel to the genus of camels proper - *camelus*. The Bactrian camel differs from the one-humped camel by the presence of two humps in a larger size and the presence of a greater live weight, both types of camels are closely related, which give fertile viable crosses.

The Republic of Kazakhstan is the birthplace of this unique breed of camels, the Kazakh Bactrian, which is rightfully considered the national treasure of the whole people. [1,2,3].

Camel breeding in the southern and western regions of the Republic of Kazakhstan, where basically more than half of the land area is represented by a zone of sands and deserts, this livestock sector is of production interest to local farmers in order to obtain valuable food for the population, such as meat and «shubat» [4,5,6]. In this regard, the breeding of camels in the above natural and climatic conditions of this region is one of the cost-effective and additional reserves in solving the

food program of the agricultural complex of the Republic of Kazakhstan [7]. In fulfilling the tasks set by the country's livestock food program, a large role is given to the development of veterinary sciences, that is, in the development of scientifically based methods for the treatment and diagnosis of diseases of an infectious and non-infectious nature in camel breeding. [8,9]. The adaptation of the camel to the extreme environment contributed to the emergence of a number of structural and functional features in the structure of some body systems.

In vertebrates, the formation of the skeleton of the head (skull) in the past was associated with the complication of the general organization of the way of life. The shape and size of the facial skeleton of the head directly depends on the degree of development of the masticatory apparatus of animals. The size of the skeleton of the head and the development of individual bones of the skull are also affected by the age of the animal, its species and breed. [10-12].

The lacrimal, nasal and incisive bones of the Bactrian camel, like those of other farm animals, are represented by paired bones, which are located in the front of the skull. [13-18].

The purpose of our anatomical study was to study the morphological features of some bones of the facial part of the skull (lacrimal, nasal and incisor) of the Bactrian camel in the postnatal period of the animal's life.

Material and research methods. The material for the craniometric study of the zygomatic bone in a Bactrian camel in a comparative aspect was 10 preparations from six to ten years old taken from adult animals. The anatomical study was carried out according to certain methods, that is, the bones of the skull cleaned from soft tissues were subjected to processing by maceration and cooking in dishes over low heat. The bones are boiled for 1-3 hours in a decoction of an aqueous decoction of vegetable raw materials (1: 4), containing (in percent by weight) the following components in crushed form: saline herb - 25.0, shoots and roots of soapwort - 25.0, rhizomes calamus - 25.0, linden leaves - 25.0. Then the bones are removed from the hot or warm broth, rinsed with water and dried [19].

For morphometric study of some bones of the facial part of the skull (nasal and incisal), linear measurements of interosseous sutures and other linear measurements between anatomical formations were determined using a compass and a metal millimeter ruler and a caliper. Latin names of anatomical formations are given according to the international veterinary anatomical nomenclature [20].

Research results. The nasal bone - osnasale (Fig. 1-1a, 1b) is represented in the Bactrian camel, a paired bone, which is involved in the formation of the roof of the nasal cavity. On the nasal bones, the outer and inner surfaces are distinguished.

The lateral process of the nasal bone in the camel in 90% of cases ends at the junction of the incisor and maxillary bones (at the incisor-maxillary suture), in dogs this process goes like the lower part of the nasopharyngeal suture. And only in 10% of the studied material (preparation No. 7) did the Bactrian camel have a 1.2 cm long naso-incisor suture, like in all animals.

In the Bactrian camel, the nasal bone borders caudally with the frontal bone by the frontonasal suture.

The back of the nasal bone of the camel is widened, like that of a horse, and looks like a wing. The total length of the frontonasal suture - suturafrontonasalis (Fig. 1-3a) in adult animals averaged 5.2 ± 0.10 cm, including the length of the suture to the inward bend, on average for the group, was 3.5 ± 0.08 cm.

The rest of the nasofrontal suture sharply bends, more often in two moments at different angles, first at 45° laterally, then after 1.2 cm the bend changes direction at 35° medially, forming a narrow frontal process between the opening and the nasal bone. The nasal bone of the Bactrian camel in the region of the lacrimal opening forms its inner part, which has a different shape and size. Thus, in 10% of the studied material (preparation No. 7) in a Bactrian camel, the lacrimal opening has the shape of a flattened oval (Fig. 2 - 4).

The medial process - processus medialis, (Fig. 1-2b) of the nasal bone in the Bactrian camel is barely noticeable and is presented in the form of a small growth. In 10% of the studied material of the Bactrian camel (preparation No. 7), the medial process of the nasal bone is well developed and has the same length as the lateral one. The nasal bone laterally borders on the maxillary bone through the nasomaxillary suture - sutura nasomaxillaris, (Fig. 2 - 5a, 5b) the total length of the suture in adult animals was on average 8.2 ± 0.08 cm, which at first, after 0.5-1.5 cm after the lacrimal opening, sharply turns at 70° perpendicular to the internasal suture.

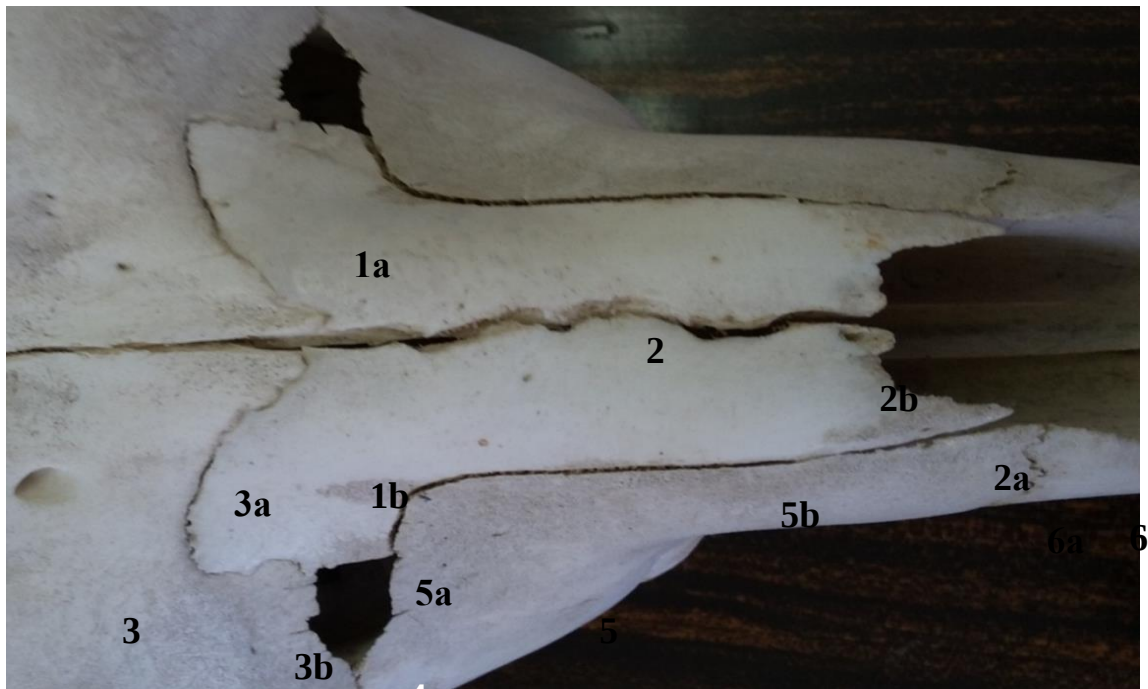


Figure 1 – The outer surface of the nasal bone of the Bactrian camel (preparation No.10):
1a - left nasal bone, 1b - right nasal bone, 2 - internasal suture, 2a - lateral process, 2b - medial process,

3 - frontal bone, 3a - nasofrontal suture (outer bend), 3b - nasofrontal suture (internal bend), 4 - lacrimal opening, 5 - maxillary bone, 5a - nasopharyngeal suture (internal bend), 5b - nasopharyngeal suture (external bend),
6 - incisive bone, 6a - incisive-maxillary suture

Then, after 1.5-1.8 cm, it again turns outward and runs parallel to the internasal suture to the incisive-maxillary suture - suturamaxilloincisiva (Fig. 2 - 6a). Medially, the nasal bone borders on a well-defined internasal suture - sutura internasalis, (Fig. 2 - 2) with the bone of the same name, which is a continuation of the frontal suture.



Figure 2 – The outer surface of the nasal bone of the Bactrian camel (preparation No.7):
1a - left nasal bone, 1b - right nasal bone, 2 - internasal suture, 2a - lateral process, 2b - medial process,
3 - frontal bone, 3a - frontonasal suture (external bend), 3b - frontonasal suture (internal bend), 4 -

lacrimal opening, 5 - maxillary bone, 5a - nasopharyngeal suture (internal bend), 5b - nasopharyngeal suture (external bend), 6 - incisor bone, 6a - incisor-maxillary suture, 6b - nasal incisor suture.

The total length of the internasal suture is equal in adult animals - 7.6 ± 0.05 cm, respectively. The inner surface - *facies interna*, the nasal bone of the Bactrian camel, forms a short ceiling (upper wall) of the nasal cavity. On the inner surface of the lateral part of the nasal bones, the camel has ethmoid ridges that serve to attach the dorsal nasal conchas. On the inner surface, the left and right nasal bones also medially border each other with a well-defined internasal suture. The internasal suture in the Bactrian camel is visually very well expressed, it is a continuation of the interfrontal suture, which runs between the nasal bones of the same name.

The external curvature of the nasopharyngeal suture in the Bactrian camel topographically runs parallel to the internasal suture between the maxillary and nasal bones, the length of the suture varies with the width of the nasal bone of the animal.

The internal bend of the naso-maxillary suture in the Bactrian camel is, as it were, the internal bend of the wing of the nasal bone and is located visually perpendicular to the external bend above the said suture.

The internal bend of the frontonasal suture in the Bactrian camel is the nasal (posterior) border of the nasal bone and is located perpendicular to exactly 45° to the interfrontal suture at the point of transition of the latter to the internasal suture. The external bend of the frontonasal suture in the Bactrian camel is located parallel to the internasal suture and the external bend of the nasopharyngeal suture, and also participates in the formation of the inner edge of the lacrimal opening.

The incisor bone - *os incisivum*, is represented (Fig. 2,3 - 1) in a camel by a paired lamellar bone, like in all agricultural and ruminant animals.

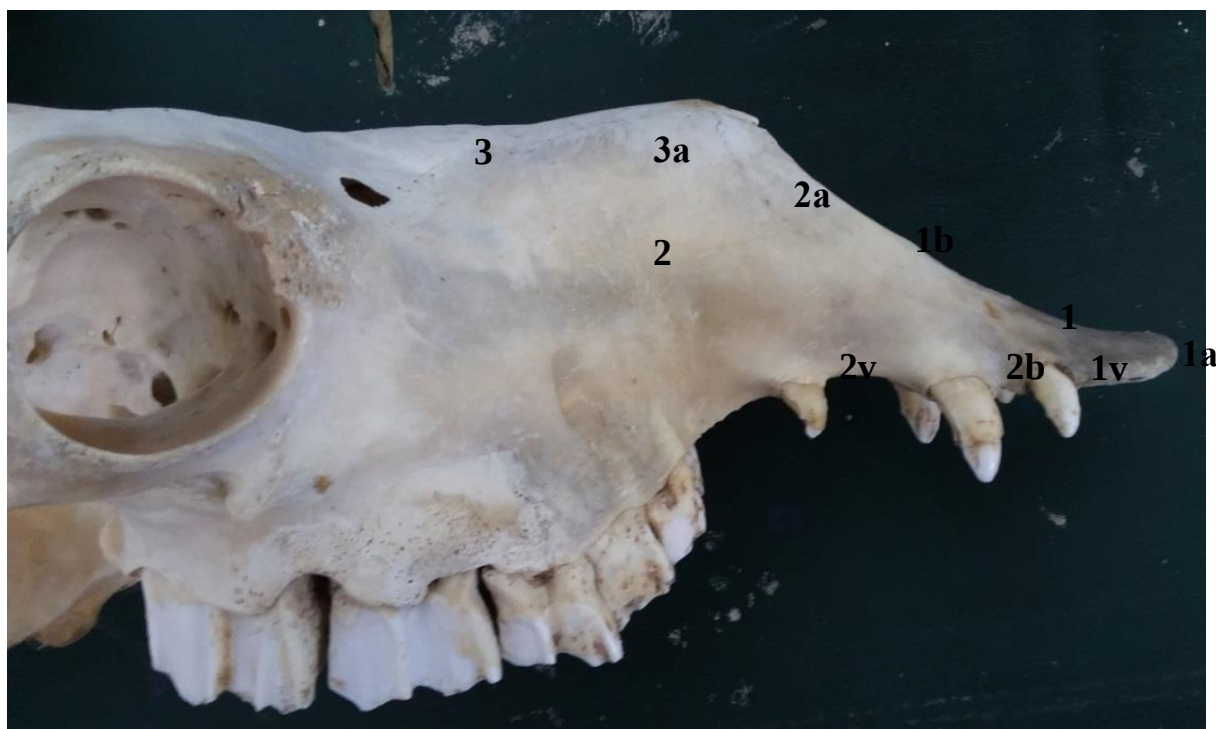


Figure 3 – Lateral surface of the front part of the skull of a Bactrian camel (preparation No.7):
 1 - incisor bone, 1a - body of the incisor bone, 1b - nasal process of the incisor bone, 1c - alveolar hole for the anterior canine, 2 - maxillary bone 2a - incisive-maxillary suture, 2b - alveolar hole for the middle canine,
 2c - alveolar hole for the posterior canine, 3 - nasal bone, 3a - nasopharyngeal suture

Topographically, the incisor bone of the camel is located in front of the maxillary bone and serves as a bone base for the nostrils, forming the entrance to the nasal cavity - aperturanasiossea, forms the anterior part of the bone palate and holes for the alveoli of the anterior canines (Fig. 3 – 1v).

Camels have the latter, both males and females have three canines, middle and posterior canines (Fig. 2 - 2b, 2v) are located on the alveolar margin - margoalveolaris, of the maxillary bone on each side.

In a camel, the incisor bone -corpus ossis incisivi, (Fig. 2,3 - 1a) has a lamellar shape and an oblique position, while in cattle it is located perpendicularly. On the sides towards the maxillary bone in the camel, lamellar nasal processes extend more laterally - processus nasalis, (Fig. 3-1b) which form the side walls of the nasal cavity. The width between the nasal processes at the level of the middle canines in adult camels on average for the group was 5.8 ± 0.02 cm, the distance between the processes at the level of separation of the processes from the body of the incisor was 2.3 ± 0.05 cm.

In comparison with cattle, in our study, the camel does not have an incisor-nasal suture and, accordingly, there is no nasopharyngeal notch, that is, the length of the nasal bone due to the peculiarity of the shape and the location of the nostrils on the dorsal part of the nose is half as much and does not completely cover the nasal cavity.

From the lower part of the body of the incisor bone, closer to the midline, in the caudal direction, there is a shorter lanceolate paired palatine process - processus palatinus, (Fig. 3 – 1v) which with a sharp end approaches the median part of the palatine process of the maxillary bone, participates in the formation of the nasal floor and the roof of the oral cavities, the length of the process in adult animals was on average - 4.2 ± 0.03 cm.

In the middle plane of the Bactrian camel, between the body of the incisor bone and lateral to the palatine process, there is a rather narrow, short, sharp scalpel-shaped fissure between the incisors - fissure interincisivi, on each side of the skull, the average length was 2.8 ± 0.03 cm, and the width was 0.8 ± 0.05 cm.

The width between the bodies of the incisor bones in the Bactrian camel is the anterior border of the incisor bone, and unlike other animals, it has a lamellar shape and an oblique position.

Conclusion. Thus, based on the anatomical and morphometric study of the comparative anatomy of some bones of the facial part of the skull (lacrimal, nasal and incisal) in the Bactrian camel with other agricultural and domestic animals, the following distinctive conclusions can be drawn:

1. The length of the nasal bone of the Bactrian camel, in comparison with cattle, due to the peculiarity of the shape and the location of the nostrils on the dorsal part of the nose, is half as much and does not completely cover the nasal cavity, as well as in dogs (carnivores).

2. The posterior part or aboral process of the nasal bone in the camel is expanded, and, like in the horse, it looks like a well-defined wing, the outer edges of which are involved in the formation of the lacrimal openings.

3. Unlike other ruminants, the Bactrian camel has a lacrimal opening, mainly in the form of an oval, which does not close with age, formed by the lateral edge of the wing of the nasal bone and the divergence of the fronto-maxillary suture at an acute angle, in ruminants it is presented in the form of a lacrimal or nasolacrimal fissure, while other animals are absent.

4. The body of the incisor bone in the Bactrian camel, like in ruminants, has a lamellar shape, but its oblique location is a distinctive feature. Aborally towards the maxillary bone, on the sides of the incisor bone, more laterally convex lamellar powerful nasal processes extend, which participate in the formation of the side walls of the nasal cavity.

5. The incisor bone of the Bactrian camel is topographically located in front of the maxillary bone and forms the anterior part of the bone palate and holes for the alveoli of the anterior canines, which are available in both males and females with three canines, middle and posterior canines are located on the alveolar margin of the maxillary bone with each sides.

6. In the Bactrian camel, in comparison with other animals, the incisor bone does not border on the nasal bone, accordingly, it does not have an incisive-nasal suture, and a nasopharyngeal notch, but has a nasopharyngeal suture, and a nasopharyngeal notch, which is expressed at an acute angle of 20° between the lateral process of the nasal bone and continuation of the nasopharyngeal suture.

REFERENCES

1 Genetics of the productive profile of camels of different genotypes of the Kazakh population/ D.A.Baymukanov, A. Baymukanov, O. Alikhanov, D.A. Doshanov, K.Zh. Ihsan, D.S. Sarsenbay// Bulletin of the National Academy of Sciences of the Republic of Kazakhstan.- 2018. - No. 371.- pp. 144-161.

2 Comparative assessment of meat efficiency indicators at thoroughbred Kazakh bactrians and their hybrids in conditions of «hanskayaorda» LLP/ K. Bozymov, F. Zakirova, I. Zhubantayev, A. Dnekeshev // Proceedings 4th Conference of ISOCARD «Silk Road Camel: The Camelids, Main Stakes For Sustainable Development». June 8-12, 2015 Almaty//Veterinary medicine.- 2015.-№ 2 (42).- P.399-401.

3 Baymukanov D.A. Camel breeding: a textbook / D.A. Baymukanov, Yu.A. Yuldashbayev, D.A. Doshanov . - M.: COURSE, SIC INFRA, 2016. - 184 p.

4 Zakirova F.B. Nutritional and medicinal properties of shubat/ F.B. Zakirova// Science and education: Scientific journal of Zhangir Khan West Kazakhstan Agrarian-Technical University.-2019. - №2(55). - P.43-47.

5 Zakirova F.B. corsets for assessing the meat productivity of Kazakh Bactrian camels/ Zakirova F.B., Zhubantayev I.N., Dnekeshev A.K.// improving the level of competition of the national economy within the EAEU: materials of the international scientific and practical conference. 17 march, 2017 . - Uralsk,2017. - Part II, pp. 27-28.

6 Zakirova F.B. The study of medicinal and nutritional properties of shubat/ F.B. Zakirova, M.S. Seitov// Science and education: scientific. - practice. the journal of the Zhangir Khan ZKATU.– 2019. - №3 (56) . - Pp.100-106.

7 The study of meat productivity indicators in bactrian camels in Khan's Horde LLP/ F.B. Zakirova, I.N. Zhubantayev, A.K. Dnekeshev, M.S. Seitov, A.N. Zhubantayeva// Mat. XVIII inter-scientific conference of young scientists "Human capital – the basis of modernization" in the light of the President's Message Of the Republic of Kazakhstan to the People of Kazakhstan dated January 10, 2018 "New development opportunities in the context of the Fourth Industrial Revolution" on March 17.- Uralsk, 2018.- p.15.

8 Changes in morpho-biochemical parameters of blood of bactrian camels in various reproductive periods / A.K. Dnekeshev, F.B. Zakirova, I.N. Zhubantayev, M.S. Seitov//Izvestia OGAU.- 2018.-№1(69).- Pp.140-142

9 Changes in healing of postoperative wounds by different castration methods of male camel// A.K. Dnekeshev, M.G. Kakishev, G.H. Dzhubanysheva, Z.U. Abuova// Science and education: Scientific journal of Zhangir Khan West Kazakhstan Agrarian-Technical University.– 2017. – №1(46). P.72-76.

10 Minyuk L.A., Comparative analysis of the morphology of the pterygoid fossa of humans and some domestic animals/ L.A. Minyuk, T.V. Burakova, E.N. Burakova// Bulletin of the medical Institute "REAVIZ".- 2018. - No. 1. - pp.37-40.

11 Telenkov V.N. Comparative anatomy of bones of the skeleton of the head of Siberian roe deer and domestic sheep/ V.N. Telenkov, M.V. Markova, E.V. Badanova // Collection of scientific papers of the All-Russian Research Institute of Sheep and Goat Breeding.- 2015.-Vol.1. - No. 8.- pp.532-535.

12 Dnekeshev A.K. Anatomy, projections and morphometry of the subglacial nerve of a camel-bactrian in the age aspect/ A.K. Dnekeshev, M.S. Seitov, T.Y. Parshina// Izvestia OGAU .- 2019. - №4(78). – Pp.184-187.

13 Dnekeshev A.K. Morphometry of the nasal bone of a bactrian camel in the age aspect/ A.K. Dnekeshev// Agrarian Scientific Journal (SSAU named after N.I. Vavilov). – 2019. - No. 12.– p.42-46.

14 Dnekeshev A.K. Morphometric changes of the incisor bone in the age aspect of the bactrian camel/ A.K. Dnekeshev// Science and education: scientific. - practice. the journal of the Zhangir Khan ZKATU.– 2019. - №4 (57). – Pp.123-129.

15 Dnekeshev A.K. Comparative anatomy of the nasal bone of a bactrian camel/ A.K. Dnekeshev, M.S. Seitov // Izvestiya OGAU .-2020.-№5 (85).– Pp.149-152.

16 Dnekeshev A.K. Dynamics of growth and development of the incisor bone of a bactrian camel in the postnatal period/ A.K. Dnekeshev // Mat. X International scientific and practical conference "Agrarian science and education at the present stage of development: experience, problems and ways to solve them".Ulyanovsk, 2020.- pp.271 -277 .

17 Dnekeshev A.K. Change in the nasal bone growth in the postnatal period of a bactrian camel/ A.K. Dnekeshev M.G. Kakishev // Вестник ЗКУ.– 2022. - № 1 .– С.188-193.

18 Dnekeshev A.K. Growth rate of the subglacial nerve in the age aspect of the bactrian camel/ A.K. Dnekeshev, F.B. Zakirova, E.U. Baitlesov// Agrarian Scientific Journal (SSAU named after N.I. Vavilov). – 2022. - No. 1.– pp.55-59.

19 Patent No. 29922 Republic of Kazakhstan, IPC A 01 N 1/00. A method of degreasing and releasing natural bones from soft tissues for the manufacture of educational preparations / N.E. Tarasovskaya; applicant and patent holder Pavlodar GPI. - No. SU 1152556; application 13.06.14 ; publ. 15.06.15, Bul. No. 6.

20 Zelenevsky N.V. International veterinary anatomical nomenclature in Latin and Russian. Nomina anatomica veterinaria: textbook for universities / N.V. Zelenevsky; per. and rus.terminology of N.V. Zelenevsky. - St. Petersburg, 2013. - 400 p.

ТҮЙІН

Бактриан түйесінің мұрын және кескіш сүйектері бас сүйегінің алдыңғы бөлігінде орналасқан және басқа ауылшаруашылық жануарларына қарағанда анатомиялық құрылымында жұптасқан сүйектерімен ерекшеленеді. Түйедегі мұрын сүйектері екі жалпақ сүйекке ұқсайды, олар мұрын қуысының төбесін қалыптастыруға қатысады және сыртқы және ішкі беттерге бөлінеді. Ірі қара малымен салыстырғанда, бактриан түйесінің мұрын сүйегінің ұзындығы мұрынның пішіні мен мұрын айнасының дорсальді бөлігінде орналасу ерекшелігіне байланысты екі есе кіші және мұрын қуысын толығымен жабылуын қамтамасыз етпейді, сондай-ақ иттерде де осындай сипатта. Түйедегі мұрын сүйегінің мұрын айнасы бөлігі басқа жануарларға қарағанда едәуір кеңейеді, канат тәрізді және екі иілісті құрайды – ішкі және сыртқы. Мұрын сүйегі қанатының бүйір шеті мұрын бөліндісі ағатын бөлігінің ішкі бетін қалыптастыруға қатысады, бұл түйеде әртүрлі өлшем мен пішінге ие. Түйедегі кескіш сүйектері топографиялық тұрғыда жоғарғы жақ сүйегінің алдында орналасқан және мұрын қуысына кіретін мұрын айнасы үшін сүйек негізі ретінде қызмет етеді және сүйекті таңдайының алдыңғы бөлігін және еркек және ұрғашы жануарлардың алдыңғы азуының альвеолаларына ойық ретінде қызмет атқарады. Біздің зерттеуімізде түйе ірі қара малымен салыстырғанда кескіш мұрын тігісі және сәйкесінше мұрын-кескіш кесіндісі жоқ. Бактриан түйесінің бас сүйегінің алдыңғы бөлігінің сүйектерін анатомиялық зерттеу белгілі әдістерге сәйкес жүргізілді. Постнатальды кезеңдегі бактриан түйесінің мұрын сүйегінің өсу және даму динамикасы бойынша зерттеу нәтижелері әртүрлі жас кезеңдеріндегі тыныс алу жүйесінің физиологиялық жүктемелеріне байланысты анатомиялық түзілімдер мен жануарлардың бас сүйегінің алдыңғы бөлігі сүйектерінің сызықтық өлшемдерінің өзгеруіне сәйкес келеді.

РЕЗЮМЕ

Носовые и резцовые кости у верблюда-бактриана представлены, парными костями, которые расположены в лицевой части черепа и имеют особенности в анатомическом строении в отличие от других сельскохозяйственных животных. У верблюда носовые кости имеют вид двух плоских костей, которые участвуют в образовании крыши носовой полости и делятся на наружные и внутренние поверхности. В сравнении с крупным рогатым скотом длина носовой кости верблюда-бактриана из-за особенности формы и расположение ноздрей на дорсальной части носа вдвое меньше и не прикрывает полностью носовую полость, так же как и у собак. Назальная часть носовой кости у верблюда сильно расширена, чем у других животных, имеет вид крыла и образует два изгиба – внутренний и наружный. Латеральный край крыла носовой кости участвует в образовании внутренней части слезного отверстия, которая у верблюда имеет разный размер и форму. Резцовые кости у верблюда топографически располагаются впереди верхнечелюстных костей и служат костной основой для ноздрей образуя вход в носовую полость и формируют переднюю часть костного неба и луночки для альвеол передних клыков, которые имеются у самцов, и у самок. В нашем исследовании верблюд в сравнении с крупным рогатым скотом не имеет резцовоносового шва и соответственно не имеет носорезцовой вырезки. Анатомическое изучение костей лицевой части черепа верблюда-бактриана проводилось согласно определенным методикам. Результаты исследования по динамике скорости роста и развития носовой кости верблюда-бактриана в постнатальном периоде

соответствуют изменениям линейных промеров анатомических образований и костей лицевой части черепа животного в зависимости от физиологических нагрузок дыхательной системы в разные возрастные периоды.

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**МОРФОЛОГИЧЕСКИЕ ПОКАЗАТЕЛИ КРОВИ ИНФИЦИРОВАННЫХ
ВИРУСОМ ЛЕЙКОЗА КРУПНОГО РОГАТОГО СКОТА
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