

Comparative Morphological Studies on the Lacrimal Apparatus of One Humped Camel, Goat, And Donkey

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Abstract

The lacrimal apparatus gross anatomy studied on four camels head 4-10 years age, four goats' head 1-3 years age and four donkeys head 2-6 years age. The lacrimal gland was irregular flattened and elongated lobular in shape, pink in colour with characteristic indented borders composed by three lobes the main caudal, coma shape lateral and cranial lobes in camel, while it was flattened and oval in shape, light brown in colour possessed two distinct parts, a body and appendage-like part in goat, whatever, it was ovoid in shape, light brown in colour in donkey. The lacrimal gland was larger in size in horse and goat than that of camel in relation to body weight. The dorsal and ventral lacrimal puncta were absent and the lacrimal duct started blindly at the medial part of the upper and lower eye lids in camel, while in goat and donkey, the dorsal and ventral lacrimal puncta appeared slit like openings, they were lead to lacrimal sac. The nasolacrimal duct ran in the osseous lacrimal canal rostrally, with a slight curve at its origin. It passed the lacrimal, zygomatic and maxillary bones. It passed through the maxillary sinus, and then traversed the nasal cavity in a curved descending fashion, covered only by the nasal mucosa and a thin connective tissue membrane on the lateral surface of ventral nasal concha. The nasolacrimal duct opened at the medial wall of the nasal vestibule at the junction between the mucous membrane and skin by the nasal opening of the nasolacrimal duct that was very minute in camel and goat while it was clearly observed in donkey.

Key words: Gross anatomy, lacrimal apparatus, one humped camel, goat, donkey

INTRODUCTION

The lacrimal glands are responsible for the production of tears fluid that helps maintain corneal health. The normal tears contain major secretory source of proteins and electrolytes, the function of this dilute protein solution are to optimize the optics of the cornea, to lubricate and to protect the eye from pathogens [15].

In most species, the majority of tears are secreted from the lacrimal gland [6, 16]. The gross anatomy of lacrimal gland were described previously by [1, 3, 12, 15, 17, 20]. There is a shortage in literatures on the lacrimal gland of goat and donkey. The lacrimal gland in the camel is comparatively less developed than that of the horse or ox [4].

[1, 20] deny the existence of puncta lacrimalia in the camel.

The lacrimal apparatus system provided a passage for drainage from the eye to the nasal cavity. The nasolacrimal system of various domestic species has been previously described by [1, 2, 3, 5, 13, 18, 21, 23, 24]. The lacrimal apparatus consisted of an orbital part and a nasal cavity part. The orbital lacrimal apparatus consisted of a simple lacrimal sac, paired canaliculi with the dorsal and ventral puncta [23].

Dacryocystorhinography, the radiographic visualization of the lacrimal apparatus using radiographic contrast media has been used to study its normal anatomy [8, 23, 24, 25]. Pathological conditions of the nasolacrimal duct were stated in human [7, 9, 10, 11, 14, 24, 27] in dogs, horse, sheep, cattle, and camel respectively.

The current work based on the comparative morphological study of the lacrimal gland and lacrimal apparatus of camel, goat and donkey.

MATERIAL and METHODS

Twelve heads of adult camel, goat, and donkey were used for the study of the topographical anatomy of the lacrimal apparatus (four camels head 4-10 years age, four goats head 1-3 years age and four donkeys head 2-6 years age). The heads were dissected in a fresh state to determine the shape, diameter, and topography of the gland. The whole gland was carefully dissected out and the dimensions of the gland were made. The lacrimal ducts, lacrimal sac, nasolacrimal duct, and the nasal opening of the nasolacrimal duct were dissected, described, and photographed.

RESULT

Lacrimal gland

In one humped camel, the lacrimal gland was irregular flattened and elongated lobular in shape, pink in colour with characteristic indented borders (Fig.1/1), it was composed by three lobes the main caudal(Fig.1/3), coma shape lateral(Fig.1/4), and cranial lobes (Fig.1/2), attached together with distinct connective tissue. It was surrounded by periorbital tissue and the periosteum on the inner surface of the supraorbital process of the frontal bone, the dorsal surface of the gland was convex and contacted with the orbit, while its ventral surface was concave and laid on the caudodorsolateral surface of the eyeball from which it was separated by the periorbita. The medial border of the gland was wider than the lateral border. The gland dimensions; the caudal lobe was the largest one and was 3cm in length and 1.7-1.9cm in width, the lateral lobe was 1.7cm in length and 1.7cm width, and the cranial lobe was 1.5cm in length and 1cm width.

In goat, the lacrimal gland was flattened and oval in shape, light brown in colour (Fig.2/1). The gland possessed two distinct features a body (Fig.2/2), and appendage-like part (Fig.1/3); this was the continuation of the body. It was surrounded by the periorbital tissue and the periosteum on the inner surface of the supraorbital process of the frontal bone. The gland was situated greatly under the frontal bone and it overlapped the rectus dorsalis muscle. The gland body dimension was 2.5-2.8cm in length and 2cm in width, while the appendage was 1cm in length and 0.7cm in width.

In donkey, the lacrimal gland was ovoid in shape, light brown in colour (Fig.3/1). The gland was partially covered with fat. It was situated on the dorsolateral aspect of the eyeball covered by the supraorbital and zygomatic process of frontal bone. The gland dimension was 3.2cm

in length and 2cm in width.

The excretory ducts of the lacrimal gland

The gland possessed three excretory ducts in camel, two ducts in goat and donkey emerged from the ventral surface of the gland, ran parallel to each other, penetrated the periorbita and opened at the fornix of the upper eyelid conjunctiva in all studied animals.

The lacrimal apparatus system

The lacrimal apparatus system provided a passage from the eye to the nasal cavity. The system for each eye in all species under study consisted of dorsal and ventral lacrimal opening (puncta), paired canaliculi, lacrimal sac and the nasolacrimal duct.

The dorsal and ventral lacrimal puncta were absent and the lacrimal duct started blindly at the medial part of the upper and lower eye lids in camel, while in goat and donkey, the dorsal and ventral lacrimal puncta appeared slit like openings 0.05 cm in diameter and 0.5 cm away from the medial angle of the eye. The dorsal and ventral canaliculi converged to lacrimal sac.

The lacrimal sac

The lacrimal sac was the enlarged funnel shaped beginning of the nasolacrimal duct; it was situated in the lacrimal fossa of lacrimal bone outside the periorbita in all animals under study (Fig.4/2, Fig.5/2, and Fig.6/2).

The nasolacrimal duct

The nasolacrimal duct extended from the lacrimal sac to the nostril in the wall of the nasal cavity, the proximal part of the lacrimal duct ran within the osseous lacrimal canal. In camel (Fig.4/3), it was measured 20cm and 0.2cm, in goat (Fig.5/3), it was measured 7.5cm and 0.2cm, while in donkey (Fig.6/3), and it was measured 16cm and 0.4cm in length and diameter respectively.

The nasolacrimal duct ran in the osseous lacrimal canal rostrally, with a slight curve at its origin. It passed the lacrimal, zygomatic and maxillary bones. It passed through the maxillary sinus, and then traversed the nasal

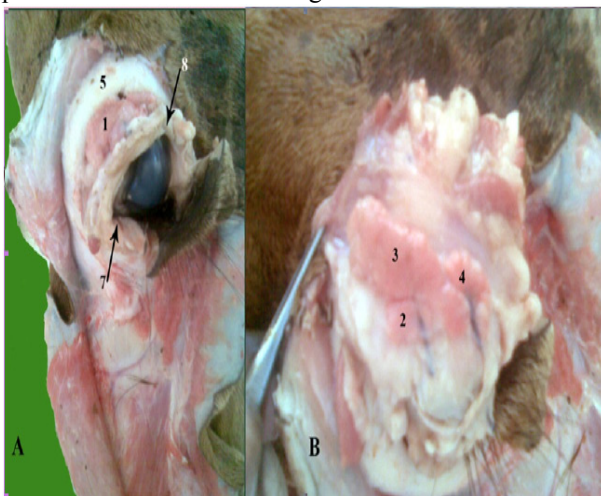


Figure 1. The lacrimal gland of one humped camel. A. Showing the position of the gland. B. Showing the shape and lobulation of the gland. 1. The lacrimal gland. 2. The cranial lobe.

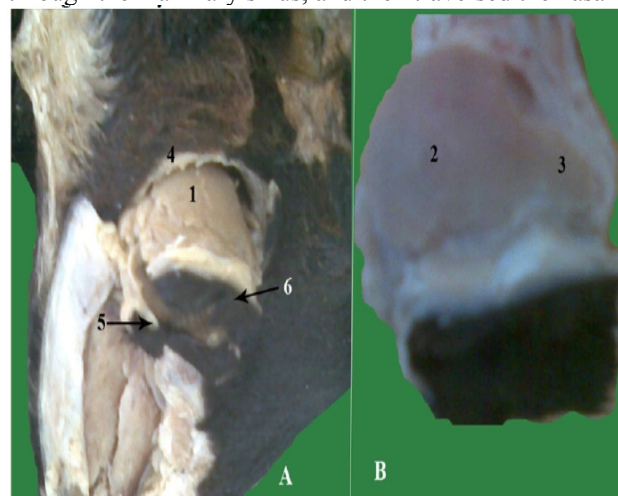


Figure 2. The lacrimal gland of goat. A. Showing the position of the gland. B. Showing the shape and lobulation of the gland. 1. The lacrimal gland. 2. The body of the gland. 3. The appendage-like part of the gland. 4. The supraorbital process. 5. The medial angle of the eye. 6. The lateral angle of the eye.

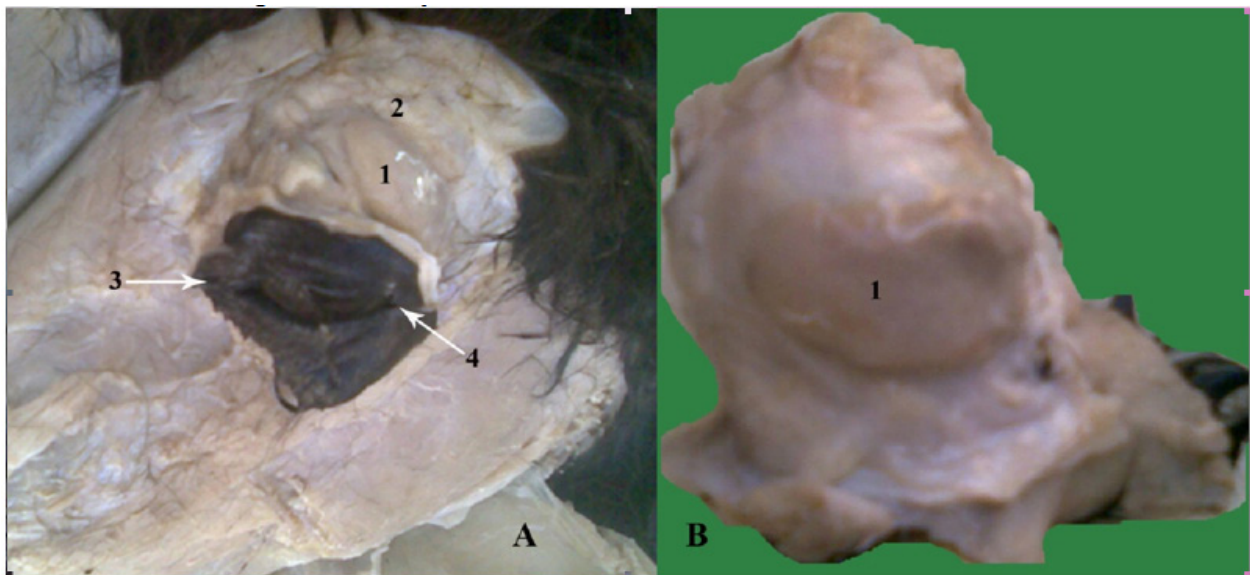


Figure 3. The lacrimal gland of donkey. A. Showing the position of the gland. B. Showing the shape of the gland. 1. The lacrimal gland. 2. The supraorbital process. 3. The medial angle of the eye. 4. The lateral angle of the eye.

cavity in a curved descending fashion, covered only by the nasal mucosa and a thin connective tissue membrane on the lateral surface of ventral nasal concha. The nasolacrimal duct opened at the medial wall of the nasal vestibule at the junction between the mucous membrane and skin by the nasal opening of the nasolacrimal duct that was very minute opening measured about 0.1cm in camel (Fig.4/4), goat, and about 0.3cm in donkey (Fig.6/5). The opening located away from the nostril by about 5cm in camel, 2cm in goat, and 4cm in donkey.

DISCUSSION

The lacrimal gland was varied in shape between species. Thus in the camel the gland was irregular flattened and elongated lobular in shape, pink in colour with characteristic indented borders, it was composed

by three lobes the main caudal, coma shape lateral and cranial lobes attached together with distinct connective tissue, these findings agree with those of [1, 12, 15] in camel. While in other studied animals, in goat the lacrimal gland was flattened and oval in shape, light brown in colour. The gland possessed two distinct features, a body and appendage-like part, these results is in a line with that denoted by [3 15] in cattle and goat. In donkey, it was ovoid in shape, triangular in pig, and bipartite in ox [22]. In man, the lacrimal gland is bipartite, the two parts being connected with each other by the aponeurosis of the levator palpebrae superioris [19, 26].

It is interesting to note that for so big an animal the gland is so small in size. This has already been commented by [4, 12] whose state that the lacrimal gland of the camel is less well-developed than that of either the ox or horse. The lacrimal gland of the camel measured about 3cm in length and 1.7-1.9 cm in width of the caudal lobe, the lateral lobe was 1.7cm in length and 1.7cm width, and the cranial lobe was 1.5cm in length and 1cm width, these findings were similar to that stated by [1, 12] whose reported that the dimensions of gland in camel is 40 mm for length and 20 mm for width. Moreover, [4] stated that the lacrimal gland of the camel is 45 mm in length and 24 mm in width.

In the current work, the position of the lacrimal gland of the camel is similar to that reported in the same species by [1, 4, 12, 13].

The position of the lacrimal gland is similar in camel, goat and donkey, similar results [3, 13, 15, 22]. The lacrimal gland is situated on the dorsolateral aspect of the eyeball, covered by the zygomatic process of the frontal bone. In both goat and the donkey, the gland is partially covered with fat [22].

The present study reveals that the gland possessed 3



Figure 4. The lacrimal apparatus system of one humped camel. 1. The lacrimal canaliculi. 2. The lacrimal sac. 3. The nasolacrimal duct. 4. Arrow refers to the opening of nasolacrimal duct. 5. Ventral nasal concha.



Figure 5. The lacrimal apparatus system of goat. 1. The lacrimal canaliculi. 2. The lacrimal sac. 3. The nasolacrimal duct. 4. Ventral nasal concha.

excretory ducts in camel, 2 in goat and donkey emerged from the ventral surface of the gland, the number of excretory ducts of the lacrimal gland is 2-4 denoted by [1, 4]. However, [4, 28] claimed that the number of excretory ducts of the lacrimal gland of the camel is two. In other studied animals, there were two ducts in goat and donkey as that recorded by [3, 13, 22].

In goat and donkey, the two lacrimal ducts starts by a small one upper and one lower opening, the punctum lacrimale, situated close to the medial angle of the respective eyelid. While the puncta of the camel are absent and that the lacrimal ducts start blindly. The dorsal and ventral canaliculi converged to lacrimal sac, the lacrimal sac was the enlarged funnel shaped beginning of the nasolacrimal duct; it was situated in the lacrimal fossa of lacrimal bone outside the periorbita in all animals under study, similar to that recorded by [1, 3, 12, 13, 15, 22].

The nasolacrimal duct extended from the lacrimal sac to the nostril in the wall of the nasal cavity, the proximal part of the lacrimal duct ran within the osseous lacrimal canal. The ducts open into the medial wall of the nasal vestibule at the junction of the mucous membrane and the cutaneous epithelium. The opening is difficult to detect in

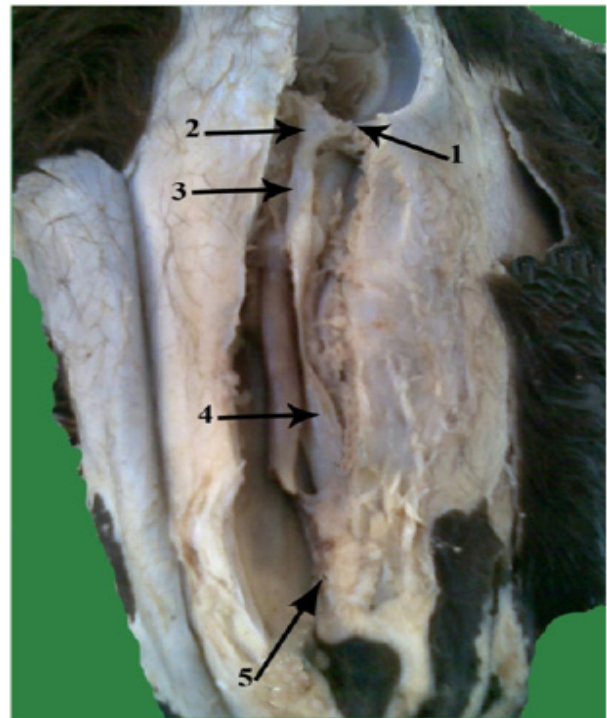


Figure 6. The lacrimal apparatus system of donkey. 1. The lacrimal canaliculi. 2. The lacrimal sac. 3. The nasolacrimal duct. 4. Ventral nasal concha. 5. Arrow refers to the opening of nasolacrimal duct.

camel and goat while in donkey it was observed clearly. The nasolacrimal duct of the camel is not functional and, therefore, no lacrimal fluid is carried to the nasal cavity, this in agreement with that stated by [12, 15].

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