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COMPUTED TOMOGRAPHIC IMAGING OF EYE OF THE DROMEDARY CAMEL

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ABSTRACT

Three cadaver heads of adult camels were scanned by 16 slice CT scan machine. The CT imaging findings of ocular components were recorded. The eyeball appeared as hypoattenuating structure whereas, the lens appeared as a hyperattenuating round structure in the centre of the globe. The bony limits of the orbital cavity, ocular and peri-ocular tissues were well identified in axial and reconstructed CT images. CT provided detailed information of the bony orbit.

Key words: Cadaver head, camel, computed tomography, dromedary eye

Computed tomography (CT) is now extensively used in veterinary medicine for understanding and diagnosing a variety of diseases (Pollard and Puchalski, 2011). Many researchers have done CT studies in camels to understand the anatomical details of various body parts. CT of the eyes (Abedallah *et al*, 2017), brain (Blanco *et al*, 2015), temporomandibular joint (Arencibia *et al*, 2012), tarsus (Hagag *et al*, 2013), metatarsus and digits (El-Shafey and Kassab, 2013), hind limbs in healthy dromedary camel foot (Elnahas *et al*, 2015), arthrography of carpus (Badawy, 2016 and Badawy *et al*, 2016) and structures of the nasal cavity, paranasal sinuses, oral cavity, orbit, and cranium (Alsafy *et al*, 2014) have been done in recent decade.

CT provides cross-sectional and three-dimensional images of the eye and orbital cavity (Dennis, 2000 and Smallwood *et al*, 2002) and different tissues are visualised with good anatomic resolution, high contrast and also possible to scan from different tomographic planes of the body. The cross-sectional anatomy of the dromedary camel eye could be useful in the evaluation of different conditions like congenital diseases, fractures, tumours, etc. The present study was aimed to describe normal anatomical details of the camel eye using CT imaging.

Materials and Methods

Three adult cadaver camel heads without ocular pathology were collected immediately after the death for the CT scanning using 16 slice CT scan machine (Supria, Hitachi, Ltd). The head was positioned on table with the rostral side directed towards the gantry (Fig 1). Axial CT images were obtained using 120 KV, 100-350 mAs and 5 mm slice thickness. The appearance of orbit and ocular contents were initially recorded in axial plane and later reconstructed as multiplanar and 3-D images were also obtained. The orit and the globe were examined in bone window (Window Width, WW = 2000, Window level WL = 200) and soft tissue window (WW = 300, WL = 40), respectively.

Results and Discussion

The present study documents that anatomy of the eye by CT images. These CT images delineated the dromedary eye and surrounding periorbital structures. Similar results have been observed in llamas by Hathcock *et al* (1995). CT images provided good discrimination between bone and soft tissue structures of the orbit. Images were obtained in the axial plane and their multiplanar reconstructed images. The osseous structures of the orbit were visible as hyperattenuating structures. The orbit was visualised well in axial and 3-D reconstructed CT images. The globe was completely circular and encircled by orbit. The margins of the bony orbit were formed by the frontal bone dorsally and its zygomatic process caudally, zygomatic bone ventrally and lacrimal bone rostrally (Fig 2). Anterior chamber, eye lens, vitreous chamber, peri-orbital fat, ocular muscles and optic nerve path were evident in both axial (Fig 3(A)) and dorsal planes (Fig 3(B)) of CT images. The eyeball appeared as hypoattenuating structure whereas the lens appeared as a hyperattenuating

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round structure in the centre of the globe. The aqueous and vitreous chambers were visualised as being filled with fluid attenuating densities cranial and caudal to lens, respectively. The ocular muscles were visualised as hyperattenuating bands intercalated by fat and optic nerve which travels in the centre of the muscle towards the optic canal. The optic nerve path was visualised in the dorsal plane of the CT image.

CT scanning images provide better peri-ocular details than images from the other imaging modalities. CT imaging was performed on cadaver heads immediately after the death of the camel to avoid or minimise the post mortem changes during CT imaging which was in agreement with Blanco *et al* (2015). In present study the eye lens, vitreous body

Fig 1. Positioning of cadaver camel head for CT scan.

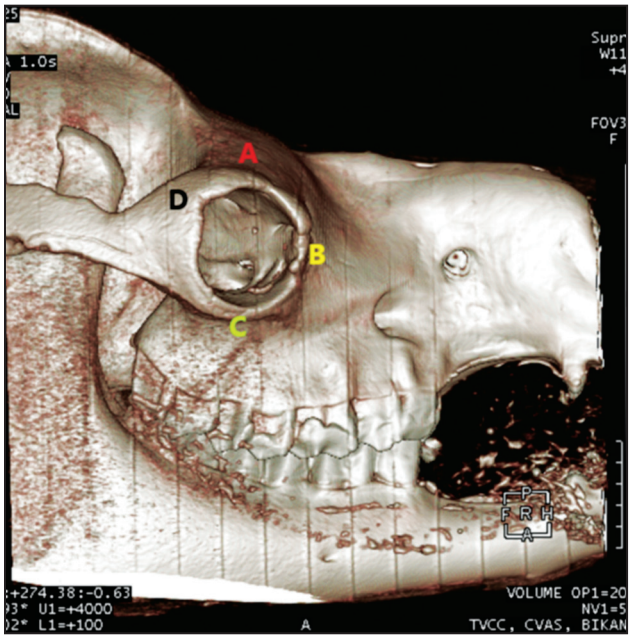

Fig 2. 3 D reconstructed CT image of camel head demonstrating bony orbit (right side). A-Frontal bone, B-Lacrimal bone, C-Zygomatic bone, D-zygomaticprocess of frontal bone.

Fig 3A. Reformatted transaxial CT image of camel head demonstrating ocular structures. 1- Ethmoidal labrynth; 2- periorbital fat/tissue; 3-perpendicular plate of ethmoid bone; 4- eyeball; 5- masseter muscle; 6-upper and lower 5th cheek tooth; 7-molar part of mandible; zy bo-zygomatic bone; arrowhead – communication with nasal cavity

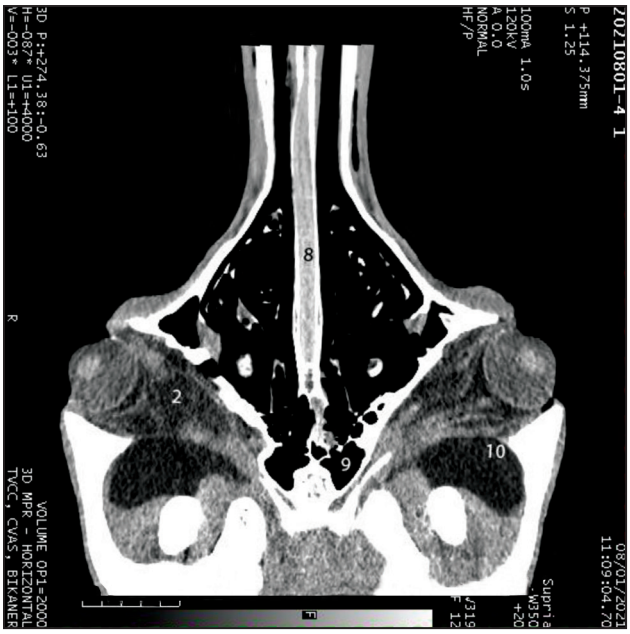

Fig 3B. Reformatted CT image in dorsal plane of camel head demonstrating ocular structures. 8- Interfrontal septum; 9- sphenoidal sinus; 10-maxillary sinus.

of eye, anterior chamber, and muscles of eye and periorbital fat were evident on the CT images and similar results were documented by Alsafy *et al* (2014) for dromedary eye.

CT allowed good visualisation of the anterior eye chamber, lens, scleral ring, posterior ocular wall, retrobulbar space, ocular nerve, and entire skull but was an inadequate technique for examining the cornea and uvea. The retrobulbar fat provided excellent image contrast that enabled easy visualisation of the extraocular structures and cortical bone (Daniel and Mitchell, 1999). Technical parameters (kV, mA) used in the present study were in agreement with that used for CT imaging of the head in camels (Arencibia *et al*, 2012; Blanco *et al*, 2015; Emam *et al*, 2020) and equines (Morrow *et al*, 2000; Solano and Brawer, 2004). The appearance of the lens, orbit, and globe during CT imaging was found similar to those reported previously by other researchers (Abedellaah *et al*, 2017). Anterior chamber, eye lens, vitreous chamber, peri-orbital fat, ocular muscles and optic nerve path were evident in both axial and dorsal plane of CT images which was in agreement with results of Solano and Brawer (2004) and Abedellaah *et al* (2017).

The present study describes the normal appearance of the eye of dromedary camels and can be used as reference later for future research.

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