

Some Gross Anatomical Features on Ostriches' Eye and its Application for Clinical Treatment of Ocular Abnormalities

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Abstract: The ostrich (*Struthiocamelus*) is an important animal in the commercial farming sector. Like other livestock, productivity of these birds is at threat of disease. The eye of the ostrich is the best largest amongst contemporary terrestrial vertebrates and is of the flat type. In the present study we investigated the gross anatomical features on the eye of its clinical value during ocular anesthesia in this species. For this study, twenty eyes from ten light-adapted ostriches that were killed for reasons other than ocular lesions, immediately after slaughtering were examined. After the ostriches were killed, the eyeballs were quickly removed and pierced behind the corneo-scleral junction. Then anatomical position and shape of all the structures included in the eye and orbital cavity were studied in details. The characteristic feature of eye in the ostrich is similar to that of the other domestic birds except the best largest size. The mean of vertical and horizontal ocular lengths of the ostrich's eye were 6.3 cm and 9.63 cm, respectively. The total mean of the ostrich's optic nerve length and diameter were 4.5 cm and 0.54 cm, respectively. In addition, there were a number of extra-ocular muscles in the caudal aspect of the eyeball. Internally, the eye of the ostrich consists of fibrous, vascular and nervous layers. These data can be useful for tracking the ocular nerves and its ramifications and are necessary for the desensitization of the skin of the upper and lower eyelid during clinical treatment of the ocular traumatic injuries. In conclusion, this article provides some anatomical features of the normal ostrich's eye which maybe facilitate selection of the appropriate surgical indication or eye anesthesia during ocular traumatic injuries in this specie.

Key words: Gross Anatomy • Eye • Ostriches • Anesthesia • Clinical Application

INTRODUCTION

The ostrich (*Struthiocamelus*) is an important animal in the commercial farming sector. Like other livestock, productivity of these birds is at threat of disease [1]. The ostrich is unique in that it has two toes. It is of high economic value, as its meat is tender, delicious and highly nutritious and its leather is flexible, permeable and highly durable, making it one of the three top-grade leathers, the other two being crocodile skin [2]. Hence, ostrich farming is improving greatly these years and research into ostrich anatomy and histology is also picking up [3].

The eye of the ostrich is the best largest amongst contemporary terrestrial vertebrates and is of the flat type. In the ostrich, eye complications due to avian influenza and poxviruses [4, 5], spontaneously occurring cataract [6, 7] and laceration, abrasion and ulceration due to direct contact of objects have been reported. On the other hands, although the anatomy of the eye has been studied in many birds [8] and animals [9, 10], but detailed information on the anatomical features of the ostrich's eye is rare. Also, to our knowledge, there are little studies has been carried out to characterize the structure of the eye in ostriches. Therefore, in the present study we investigated the gross anatomical features on the eye of its clinical value during ocular anesthesia in this species.

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MATERIALS AND METHODS

For this study, twenty eyes from ten light-adapted ostriches that were killed for reasons other than ocular lesions, immediately after slaughtering were examined. All ostriches were 3-4-month old and had an average weight of 42 ± 3 kg. The specimens were obtained from a commercial husbandry located in the Tehran province (Tehran, Iran). After the ostriches were killed, the eyeballs were quickly removed and pierced behind the corneo-scleral junction. Then anatomical position and shape of all the structures included in the eye and orbital cavity were studied in details. In addition, the extra-ocular muscles were dissected and named. The morphometrical measurements of the eye include vertical and horizontal ocular lengths as well as the length and diameter of the optic nerve were done using scale, thread and digital calipers and the results were presented as means $\pm$ SD. For the terminology, the *Nomina Anatomica Avium* was used (International Committee on Avian Anatomical Nomenclature, 1993) [11].

RESULTS AND DISCUSSION

The characteristic feature of eye in the ostrich is similar to that of the other domestic birds except the best largest size (Figure 1-a). The mean of vertical and horizontal ocular lengths of the ostrich's eye were 6.3 cm and 9.63 cm, respectively (Figure 1-b). These data can be useful for tracking the ocular nerves and its ramifications and are necessary for the desensitization of the skin of the upper and lower eyelid during clinical treatment of the ocular traumatic injuries. Similar to other birds, the eyeball is protected by upper, lower and third eyelids. The lower eyelid is finer and more extensive than the upper eyelids and is mainly responsible for closing of the eye. The free margins both layers carry rows of long, overlapping bristle feathers which resemble eyelashes (Figure 1-c). Previous studies had been showed that in the birds the lids have no meibomian, sweat and sebaceous glands [9, 10]; these results are in line with present findings on the ostrich's eye. The total mean of the ostrich's optic nerve length and diameter were 4.5 cm and 0.54 cm, respectively. The optic nerve enters the eye through the ventro-medial aspect of the sclera. At this point the dura matter surrounding the optic nerve attaches to the sclera. The morphological structure of the eye



Fig. 1: Some anatomical features of the ostrich's eye.

- The lateral view of the head of the ostrich. This part of figure shows the location of the eyeball in the head region.
- The lateral view of the ocular cavity of the ostrich when the eye globe is extracted completely. This part of figure shows the vertical (VOL) and horizontal (HOL) ocular lengths.
- The rostral view of the ostrich eyeball after extracting from the ocular cavity. This part of figure shows the upper (UE), third (TE) and lower (LE) eyelids. Additionally, the figure demonstrates the fibrous layer of the eye. (C: cornea, I: iris, S: sclera).
- Caudal view of the extra-ocular muscles of ostrich's eyeball. The arrow indicates the location of the optic nerve. (1: obliquus oculi dorsalis, 2: obliquus oculi ventralis, 3: rectus oculi medialis, 4: rectus oculi lateralis, 5: rectus oculi dorsalis, 6: rectus oculi ventralis, 7: quadrates nictitans, 8: pyramidalis nictitans).

has been described in many bird species [9, 10]. This study presents some characteristics of this organ in the ostrich. In addition, there was a number of extra-ocular muscles include obliquus oculi dorsalis, obliquus oculi ventralis, rectus oculi medialis, rectus oculi lateralis, rectus oculi dorsalis, rectus oculi ventralis, quadrates nictitans and pyramidalis nictitans (Figure 1-d). These muscles are controlled the movements of the eye [9]. These data are necessary for achieving the regional ocular nerves anesthesia and also have clinical importance for desensitization of the eye globe. The injection of the local anesthetic agents can be made in the dorsal, ventral, rostral and caudal aspects of the eye globe to eyeball nerves block in the ocular zone.

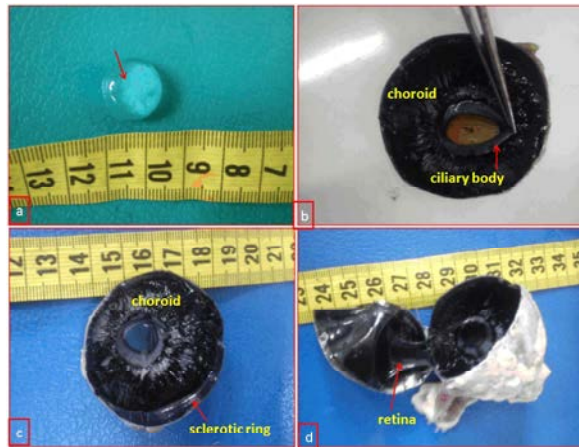


Fig. 2: Some anatomical features of the ostrich's eye.
a): The rostral view of the lens of the ostrich's eye.
b): The caudal view of the vascular layer of the eye of ostrich after removing the extra-ocular muscles and caudal part of the sclera.
c): The caudal view of the ostrich eye after removing the extra-ocular muscles and caudal part of the sclera. The arrow indicates the location of the sclerotic ring.
d): Lateral view of the ostrich's eye. The arrow indicates the location of the retina.

Internally, the eye of the ostrich consists of fibrous, vascular and nervous layers. The fibrous layer consists of an anterior, transparent cornea and a large posterior section, the sclera (Figure 1-c). It has been reported that the sclera and cornea meets at the limbus of the eye [12]. The vascular layer consists of the choroid, the ciliary body and the iris. The lens is a round and flattened anterior-posteriorly (Figure 2-a). The choroid is a thick, highly vascular and darkly pigmented layer between the sclera suspends the lens by zonular fibers (Figure 2-b). There were small bony plates inside the eye (sclerotic ring) to provide rigidity (Figure 2-c). Similar results had been reported by previous researchers on the various birds [9, 10, 12]. The retina forms the innermost layer of the eye, covering the choroid, ciliary body and the posterior surface of the iris (Figure 2-d). In the ostrich's eye the cavity of the eyeball is divided in to three parts. The part behind the lens and ciliary body contains the vitreous body, the part between lens and iris a posterior chamber; and the part between iris and cornea is the interior chamber. The posterior and anterior chambers are continued through the pupil and both are filled with aqueous humour.

Appropriate ocular examination does require knowledge of the normal eye, basic instrumentation and lots of practice. In order to be able to appreciate ocular abnormalities, it is essential to know the basic anatomy of the normal eye. This data presents some of the anatomical characteristics of the orbital cavity in ostriches. In conclusion, this article provides some gross anatomical features of the normal ostrich's eye which maybe facilitate selection of the appropriate surgical indication or eye anesthesia during ocular traumatic injuries in this specie.

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