Available online at http://www.ijims.com
ISSN: 2348 – 0343

Histomorphological Study on Vascular Tunics of the Adult Surti Buffalo (*Bubalus bubalis*)

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Abstract

The study was conducted on 10 pairs of eye balls to study the histomorphological structures of the vascular tunics of eye ball. The vascular layer includes the choroid, ciliary body and iris. The choroid was composed of four layers such as (i) Suprachoroid (ii) Large vessel layer (iii) Tapetum and (iv) Choriocapillary layer. The mean thickness of choroid at the center of the tunic was 76.55±3.72 µm whereas, it was 48.86±1.78 µm at the peripheral section of the tunic. The ciliary body was composed of ciliary muscles, collagen fibers, blood vessels, melanocytes, fibroblasts and processes.The iris is the most anterior portion of the vascular tunic and is pigmented and contractile for pupil size.

Key words : surti buffalo, eye ball, vascular tunics, histomorphology

Introduction

Buffalo milk is contributing more than 50 % of the overall milk production and also contributing 24.54 % of the total meat produced in India. So, the importance of buffalo in dairy and meat industry is very high but, still research related to buffalo is very insufficient especially in the sense organs like eyes.So the study was carried out to establish basic data bank as well as to provide authentic references for future study.

Materials and Method

The samples were collected immediately after slaughtering of animals from local slaughter house, Anand. The eye balls were fixed in Davidson's fixative to prepare the paraffin sections. The histological sections were stained with Haematoxylin and Eosin Stain[1] for normal routine staining and Masson's trichrome stain[2] for special staining. The micrometrical measurements of the different parameters taken from the center and periphery of choroid were recorded with the help of graduated eye piece. The data was analyzed statistically[3].

Results and Discussion

Choroid

Grossly, the choroid was observed to be a dark pigmented membrane, located between sclera and retina. Anteriorly it was continued as ciliary body and iris. The greenish or bluish coloured membrane, known as tepetum lucidum was found at the dorsal half of the choroid. Similar observations were reported earlier by Sisson and Grossman[4] in domestic animals and Ghosh[5] in cattle.

Histology

The choroid was found to be composed of four layers such as

(1) Suprachoroid

(2) Large vessel layer / vascular layer

(3) Tapetum and

(4) Small vessel layer / choriocapillary layer

In some area of the choroid mainly ventral to the optic nerve, the tapetum was found to be absent.

The suprachoroid layer was composed of the collagen fibers along with pigmented connective tissue that formed a transition between the sclera and the choroid. The vascular layer was composed of large and medium sized blood vessels embedded in loose connective tissue containing melanocytes and fibrocytes. The tapetum layer was fibro-vascular consisting of intermingling collagen fibers and few fibroblast and the arterioles surrounded by pigment cells were seen in this layer (Fig. 1). The fourth layer, choriocapillary layer, was composed of a single layer of capillaries next to the tapetum and also the capillaries were arranged in a continuous chain form (Fig. 2).

These observations are in accordance with the observations of Prince *et al*.[6] in cattle, Dellmann[7] in domestic animals, Ramkrishna *et al*.[8] in Indian water buffalo, Khaled[9] in bovine and Gelatt[10] in domestic animals. However, in contrary to the present observations, they all reported the presence of Bruch's membrane which was difficult to identify in the present study.

Micrometry

The mean thickness of the choroid was 76.55±3.72 µm with the range between 66.00 µm to 94.57 µm in the center of the choroid whereas, it was 48.86±1.78 µm with the range between 40.53 to 59.63 µm in the peripheral section of choroid. The thickness of tapetum lucidum was varied from 16.5 to 40.53 µm with the average of 29.10 µm.

Prince *et al*.[6] in cattle mentioned that the thickness of the choroid was about 100 to 160 µm excluding a tapetum. The thickness of tapetum was from 10 µm at the periphery to 50 µm at the center. Khaled[9] in bovine reported the thickness of choroid as 208.6±6.905 µm. The present observations of the thickness of choroid are much lower than these observations but for the tapetum lucidum, it was in accordance to their observations. These variations in the thickness of choroid may be due to the differences in the species, breed or some other factors.

Ciliary Body

In the present study of adult surti buffalo, the ciliary body was found to be composed of ciliary muscles, collagen fibers, blood vessels and processes (Fig. 3). The smooth muscle fibers were parallel to sclera with few circular fibers. The cell population of ciliary body was composed of fibroblasts, numerous flat melanocytes, some smooth muscle cells. The basal plate presented connective tissue core with large blood vessels, arteries and veins and this layer extended as dense network of capillaries into the ciliary processes. The ciliary processes were composed of numerous thin folds covered by two layers of stratified cuboidal epithelium, whose superficial cells were non pigmented while the deeper cells were deeply pigmented (Fig. 4).

The present observations are similar with the observations of Ramkrishna *et al*.[8] in Indian water buffalo and Khaled[9] in bovine.

Iris

Grossly, the iris was found to form a dumb bell shaped pupil in the present study. At the pupillary margin, some black granules like structures were found, which were more prominent in the dorsal part. These structures are known as iris granules. The similar observations are also reported earlier by Sisson and Grossman[4] in domestic animals.

Histologically, the thickness of the iris was observed to be decreased towards the free margin (Fig. 5). The stroma was composed of loose connective tissue with smooth muscles, blood vessels, melanocytes and fibroblasts. The anterior surface was composed of pigmented cells and the posterior surface showed two layered pigmented epithelium (Fig. 6).

The present histological observations of iris in adult surti buffalo are in accordance with the observations of Khaled[9] in bovine, Ramkrishna *et al*.[8] in Indian water buffalo and Zayed *et al*.[11] in buffaloes.

Irido-corneal angle

The irido-corneal angle was the area located at the periphery of the anterior chamber. The iridio-corneal angle was formed by the junction of the corneoscleral tunic (Limbic zone), base of the iris, and anterior ciliary body (Fig. 7). It was comprised of the pectinate ligament, the ciliary cleft, the trabecular meshwork (uveal and corneoscleral) and the angular aqueous plexus (AAP).

The pectinate ligament was located on the anterior part of the irido-corneal angle. It was a strong, band-like structure extending from the iridal base to the limbic zone. The ciliary cleft was the space, which was bordered by the pectinate ligament anteriorly, the limbal zone from the outer aspect, and the base of the iris and the ciliary body from the inner aspect. The ciliary cleft was containing large amount of trabecular tissue. Trabecular tissue had two parts: the uveal part and the corneoscleral part. The uveal meshwork was the

inner part of the trabecular meshwork. It was composed of numerous strands of trabeculae. The corneoscleral meshwork was the external part of the trabecular meshwork. The trabeculae were made of collagen, and there were melanin pigments and endothelial cells on their surface. There were intertrabecular spaces between the trabeculae. These spaces were wide anteriorly and decreased gradually till became narrow posteriorly. The AAP consisted few veins lined by endothelial cells positioned between the outer border of the corneoscleral meshwork and the inner border of the sclera.

The observations of present study are similar as described by Kassab *et al.*[12] in buffalo, Gelatt[10] in domestic animal and Kassab and Zoghby[13] in goat.

Conclusions

The choroid was composed of four layers such as (i) Suprachoroid (ii) Large vessel layer (iii) Tapetum (iv) Choriocapillary layer. The micrometrical mean thickness of the choroid was higher at the center than that of the peripheral section. The micrometrical mean thickness of the choroid was 76.55±3.72 µm at the center of the choroid whereas, in the peripheral section of choroid, it was 48.86±1.78 µm. The irido-corneal angle was the area located at the periphery of the anterior chamber and formed by the junction of the corneoscleral tunic (Limbic zone), base of the iris and anterior ciliary body. The irido-corneal angle of the eye was comprised of the pectinate ligament, the ciliary cleft, the trabecular meshwork (uveal and corneoscleral) and the angular aqueous plexus.

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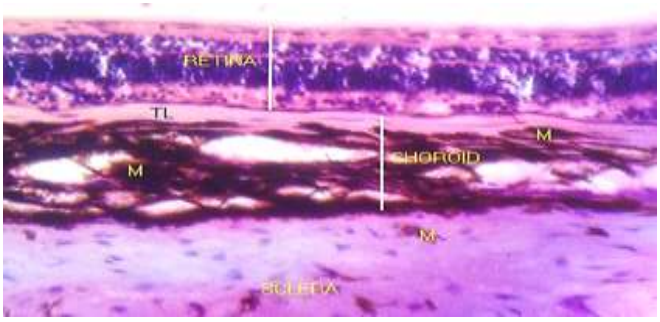

Fig. 1 : Photomicrograph of tunics of eye ball of surti buffalo (150X magnification) stained with H&E stain showing the layers of retina, choroid and some portion of sclera, (TL) Tapetum lucidum and (M) Melanocytes.

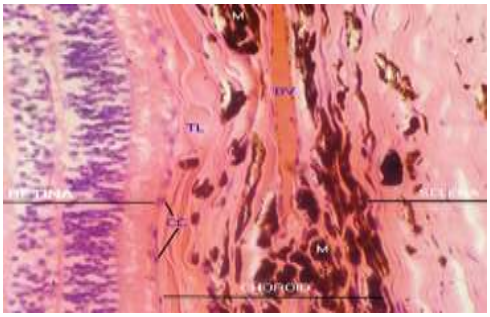

Fig.2 : Photomicrograph of tunics of eye ball of surti buffalo (300X magnification) stained with H&E stain showing Retina, Choroid, Sclera, (CC) Choriocapillary, (TL) Tapetum lucidum, (M) Melanocytes and (BV) Blood vessel.

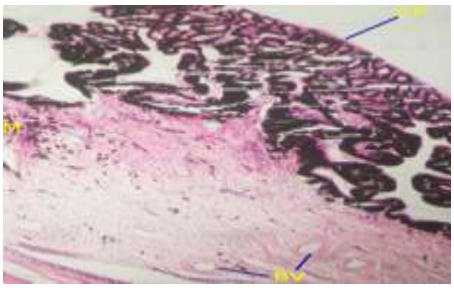

Fig. 3 : Photomicrograph of ciliary body of surti buffalo (75X magnification) stained with H&E stain showing (CP) Ciliary processes, (BV) Blood vessels and (M) Melanocytes.

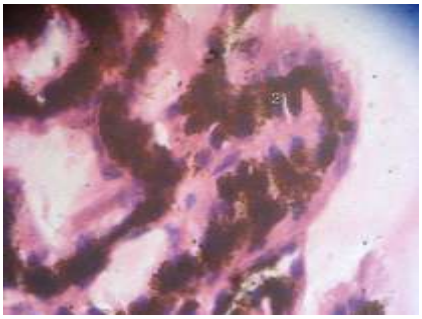

Fig. 4 : Photomicrograph of ciliary processes of surti buffalo (750X magnification) stained with H&E stain showing (1) Non-pigmented epithelium (2) Pigmented epithelium

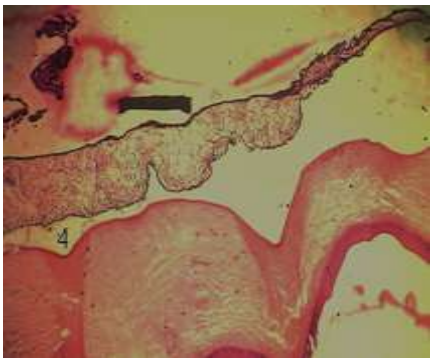

Fig. 5 : Photomicrograph of iris of surti buffalo (30X magnification) stained with H&E stain showing (1) Iris (2) Tip of iris (3) Cornea and (4) Anterior chamber.

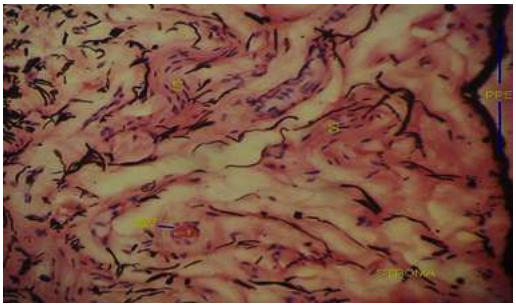

Fig. 6 : Photomicrograph of iris of surti buffalo (75X magnification) stained with H&E stain showing Stroma, (PPE) Posterior pigmented epithelium, (APE) Anterior pigmented epithelium, (BV) Blood vessels and (S) Smooth muscle.

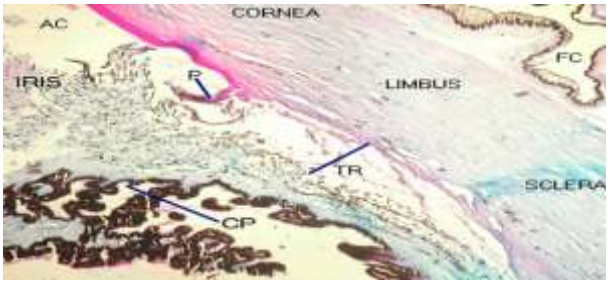

Fig. 7 : Photomicrograph of tunic of surti buffalo (30X magnification) stained with Periodic Acid Stain showing cornea, sclera, limbus, (FC) fornix of conjunctiva, iris, ciliary processes, (P) pectinate ligament and (TB) Trabecular meshwork