

GROSS ANATOMICAL AND OPHTHALMOSCOPIC FINDINGS OF NORMAL RETINAL FUNDUS IN SHEEP

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ABSTRACT

Six heads each from apparently healthy young and adult sheep (irrespective of sex) were collected from local slaughter house around Tirunelveli, Chennai and Thoothukudi districts. The tissues samples were collected from young as well as adult sheep and then ophthalmoscopic examination was done with the help of direct pan ophthalmoscope. The shape of the eye ball was almost spherical whereas that of the pupil was oval in horizontal plane. Optic nerve was located ventral and lateral to the posterior pole. The retina was an off-white coloured delicate membrane which extended from the entrance of the optic nerve to the ciliary body, and it terminated at a circular line, the ora ciliaris retinae. Tapetum in both young and adult sheep was located dorsal to the optic disc mostly on the dorsal side and it was horizontal triangular in shape. It occupied the dorsal half of the retinal fundus and contained optic disc in its ventral part. Tapetum in sheep was blue to bluish green in colour in fresh but changed to metallic blue in colour on fixation. The optic disc in young and adult sheep was located in the non-tapetal areas. The optic nerve head was white in colour and slightly oval in shape. Ophthalmoscopy of retinal fundus showed that the retinal vessels appeared bulged and more prominent in young animals when compared to adult animals. The stars of Winslow appeared as small, uniform scattering of red or dark pink dots or lines throughout the tapetum. The optic nerve head was of kidney shaped and pale pink to white in colour. Large Bermeister's papilla was found. Retinal vascular pattern was holangiatic.

Keywords: Gross anatomy, Ophthalmoscopy, Retinal fundus, Sheep

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Retina is the innermost light sensitive layer of eye. The eye creates a two dimensional image on retina which translates the light image into electrical neural impulses to the brain for visual perception. A complete eye examination includes the examination of the posterior segment of the eye like vitreous humour, and visible parts of retinal fundus. It is only area where the blood vessels and the central nervous system can be seen directly (Alina *et al.*, 2008). The normal fundus of animals consisted of neurosensory retina, retinal pigment epithelium, choroid, sclera, optic nerve head and tapetum. The retinal fundus of each species is typical and varied among species with little individual variation. The detailed study of retina in young and adult sheep regarding the presence of tapetum, visibility of choroidal vessels, retinal vascular pattern, position and shape of optic disc, position of nerve fibres, gross anatomical findings is scanty. So the present study was undertaken to characterise the normal ocular fundus image and gross anatomical examination of retinal fundus in young and adult sheep.

MATERIALS AND METHODS

The study was conducted on six adult apparently healthy young (below 6 months of age) and adult (above 6 months of age) sheep that were brought to Teaching Veterinary Clinical Complex, Tirunelveli for ophthalmoscopic examination. For gross anatomical examinations, eyes

were dissected from the heads of young and adult sheep of Madras red breed (heads purchased from nearby retail mutton shops at Chennai). For ophthalmoscopic examination, indirect ophthalmoscope with camera from smart phone attachment was used. The pupils were dilated with short acting mydriatic-0.5% to 1% Tropicamide 30 minutes prior to examination (Klauss and Constantinescu, 2004). Animals were examined without anaesthesia, so with proper restraining, manual focus ranging from -20 to +20 diopter was used. The eye was started approaching from 10 cm distance and pupils were identified. The lens of the ophthalmoscope was kept close to the cornea (2-3mm) so as to avoid flash artefact. Once the camera was focussed, the flash level was set to medium. With proper focussing, the image of the posterior segment was taken. Then the image was transferred to the desktop computer and different parameters were analysed e.g. tapetum- presence or absence of tapetum, tapetal colour, tapetal reflectivity, shape of the tapetal area, homogeneity of the tapetum, junction of tapetal and non- tapetal border. Non-tapetal area- any elevation, pigmentation; optic disc: location, colour, shape, border and degree of myelination and retinal vascular pattern- detailed analysis of retinal arterioles and veins were done and species were classified based on retinal vascular pattern.

RESULTS AND DISCUSSION

Morphology: The shape of the eye ball was almost

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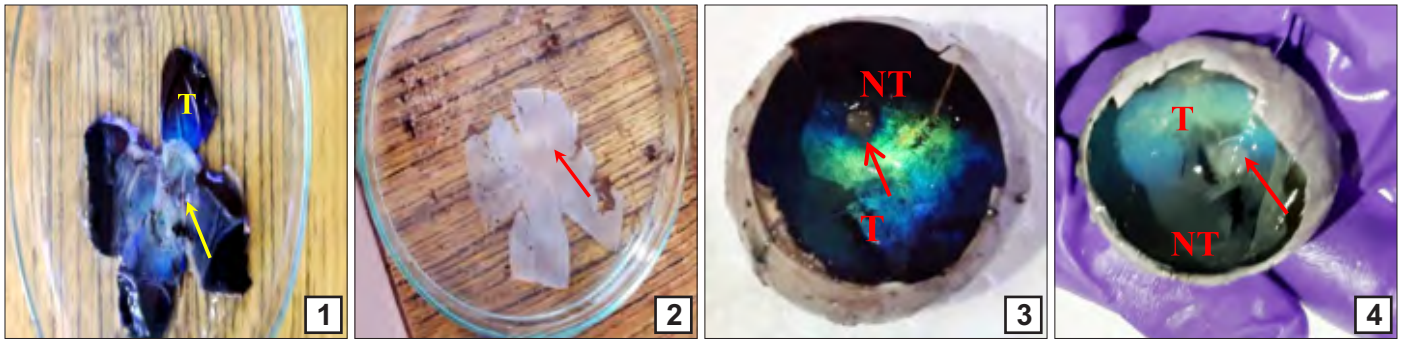


Fig. 1-4. (1) Photograph of retina in adult sheep showing the tapetum (T) in bluish green colour and retina (arrow) in off white colour; (2) Photograph of off-white coloured retina of young sheep showing clear blood vessels (arrow); (3) Photograph showing optic disc (arrow) in the non tapetal area (NT) of adult sheep. T- Tapetum; (4) Photograph showing optic disc (arrow) in the non tapetal area (NT) of young sheep. T- Tapetum

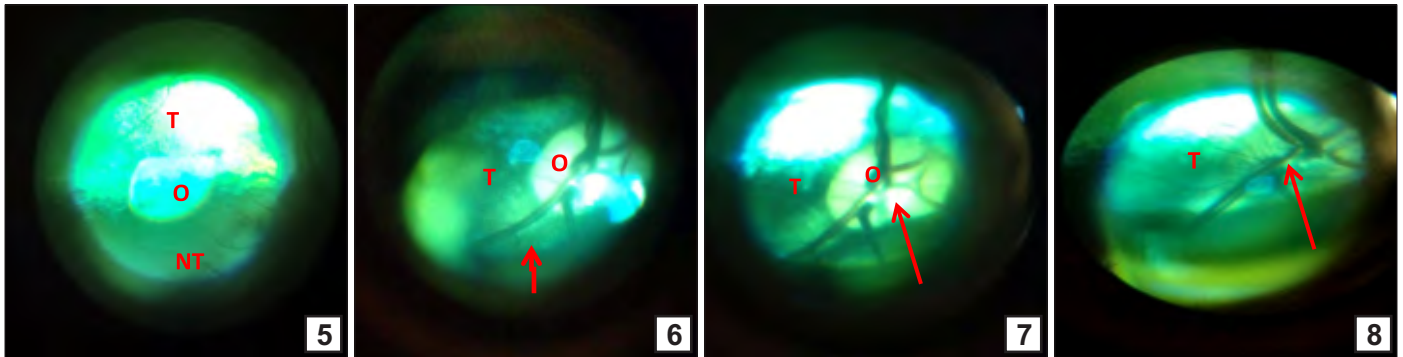


Fig. 5-8. (5) Photograph of ophthalmoscopic image showing Tapetum (T), Non Tapetum (NT) and Optic Disc (O) in adult sheep; (6) Photograph of ophthalmoscopic image showing Stars of Winslow (arrow) in the tapetum (T) of adult sheep. O–Optic disc; (7) Photograph of ophthalmoscopic image showing Bergmeister papilla (arrow) and intertwingling of retinal arteries in the tapetum (T) of young sheep. O–Optic disc; (8) Photograph of ophthalmoscopic image showing retinal blood vessels and its tributaries appearing like hanging branches of tree (arrow) in the tapetum (T) of young sheep

spherical. The shape of the pupil was oval in horizontal plane. Optic nerve was located ventral and lateral to the posterior pole. The retina was an off-white coloured delicate membrane which extended from the entrance of the optic nerve to the ciliary body and it terminated at a circular line, the oraciliaris retinae (Fig. 1). Here the retina continued over the ciliary body and the posterior surface of iris called parsciliaris retinae as described by Sisson and Grossman (1975). The whole retina was very loosely attached with choroid except at the optic papilla. From here, the retina prolonged forward as a thin membrane over the ciliary process and over the posterior face of the iris known as pars ciliaris retinae and pars iridica retinae, respectively.

Distribution and Morphology of Tapetum lucidum:

Tapetum in both young and adult sheep was located dorsal to the optic disc mostly on the dorsal side and it was triangular in shape. It occupied the dorsal half of the retinal fundus and contained optic disc in its ventral part. Tapetum in sheep was blue to bluish green in colour in fresh but changed to metallic blue in colour on fixation (Fig. 2). The transition between tapetum and non-tapetum was gradual and not sharply demarcated in the present study. But the transition was sharply demarcated in canines. But tapetum

was absent in primates, pigs and rodents (Ofri, 2008).

Optic nerve head: The optic disc in young and adult sheep was located in the non-tapetal areas. The optic nerve head was white in colour in young and adult sheep (Fig. 3 & 4). The shape of the optic nerve head was slightly oval in sheep in both young and adult animals.

Ophthalmoscopic Findings: In the present study, ophthalmoscopy of retinal fundus showed that the difference between young and adult animals was minimal. The retinal vessels appeared bulged and more prominent in young animals when compared to adult animals.

The tapetum in sheep was bluish green in colour (Fig. 5) with a tinge of yellow. Any difference in colour of tapetum reflects its pathology in ruminants (Crispin, 2005). Tapetal fundus in sheep had a mild uniform stippling on the end of the capillaries called stars of winslow. The stars of winslow in sheep appeared as small, uniform scattering of red or dark pink dots or lines throughout the tapetum (Fig. 6). Similar observation was documented in goats (Galen *et al.*, 2006). The tapetal and nontepetal junction in sheep showed a clear demarcation. The non-tapetal area was homogenous, brown or black with rich visible choroidal vasculature in sheep. Similar observations

were also recorded in sheep, goat and bovines by Maggs (2013) and Galen *et al.* (2006) in sheep and goats. In sheep, the optic nerve head was of kidney shaped (Fig. 7) but was ovoid in cattle (Maggs, 2013). The optic disc was located in the non tapetal area near the tapetal and non tapetal junction in sheep. But in cattle, it was located at the junction of tapetum and nontapetal areas (Pearce and Moore, 2013). The colour of the optic disc varied from pale pink to white in sheep. But in ruminants, the colour of the optic disc varied from pale pink to dense white (Maggs, 2013).

Bergmeister's papilla is the remnant of hyaloid artery and was found to protrude from the centre of the optic disc into the vitrous humour as grey translucent protuberance (McCormack, 1974). It was visible in sheep by ophthalmoscopic examination in the present study and the Bergmeister's papilla was small and found at the centre of the optic disc (Fig. 7). Similar results were found in cattle and goats (Maggs, 2013). Retinal vascular pattern is holangiotoxic in sheep. Sheep retina had three to four primary retinal vessels (artery and vein) which were named as dorsal, ventral, ventronasal and ventro temporal with seven to eight arterioles and venules around the optic disc.

Three to four primary retinal vessels were large and very distinct in ruminant (Crispin, 2005). Veins were straight and dark bluish red in colour in both sheep. The dorsal retinal venule and arteriole often intertwined in sheep (Fig. 8) and the tributaries of the dorsal vessels appeared like a hanging branches of the tree. Similar observation was found in goats (Maggs, 2013). In camels, the vessels emerged dorsally and extended peripherally with the artery and vein spiralling around each other. Two pairs of venules were found leaving the optic disc horizontally (Rajathi *et al.*, 2020).

CONCLUSION

The retina was an off-white coloured delicate membrane in both young and adult sheep. Tapetum in both

young and adult sheep was located dorsal to the optic disc mostly on the dorsal side and it was triangular in shape. Tapetum in sheep was blue to bluish green in colour. The optic disc in young and adult sheep was located in the non-tapetal areas and was white in colour. Ophthalmoscopic image showed that the retinal vessels were appeared bulged and more prominent in young animals when compared to adult animals. The tapetum in sheep was bluish green in colour with yellow tinge. Tapetum showed stars of winslow. Optic nerve head was kidney shaped with small Bergmeister papilla. Retinal vascular pattern is holangiotoxic in sheep.

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