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CASE REPORT

Congenital cataract associated with persistent hyperplastic primary vitreous and persistent tunica vasculosa lentis in a sambar deer (*Rusa unicolor)* – clinical, ultrasonographic, and histological findings

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Key Clinical Message

Ultrasonography suggested the diagnosis of cataract associated with persistent fetal intraocular vasculature in a 26-day-old sambar deer. The deer was ill and died despite intense critical care. Globes were removed. Histological characteristics of persistent fetal vasculature and secondary cataract are reported expanding the knowledge of ophthalmic disorders in wild ungulates.

Keywords

Cataract, eye, histology, persistent fetal vasculature, *Rusa unicolor*.

Introduction

The sambar deer (*Rusa unicolor)* is the largest species of deer naturally occurring in Southeast Asia [1]. It is also considered an invasive species in other locations where it has been introduced including the USA and Australia [2–5].

Reference values for diagnostic ophthalmic tests in sambar deer and some features of the bony orbital anatomy and ocular histology have been published [6]. Several unrelated visual defects in free-ranging deer also have been previously reported in other species of deer [7, 8], as well the pattern of vascularization of the eye of Japanese deer [9]. However, there still is little detailed information about congenital ocular anomalies of the posterior segment in members of the Cervidae family.

This study describes the clinical, ultrasonographic, and histological findings in a case of congenital cataract, persistent hyperplasic primary vitreous (PHPV), and persistent tunica vasculosa lentis (PTVL) in a sambar deer.

Case History

The Comparative Ophthalmology Laboratory and Service (LABOCO) at the Federal University of Paraná (UFPR) was contacted to examine a female sambar deer (*Rusa unicolor*) fawn for unilateral ocular opacity, which was due to a cataract in the right eye (OD). A 26-day-old, intact female fawn had been abandoned by its mother,

Table 1. Ocular measurements obtained in the ultrasonographic evaluation.

Measure (mm)	OD	OS
Corneal thickness	0.76	0.68
Axial length	20.9	20.5
Anterior chamber depth	0.94	2.8
Lens thickness	8.8	7.2
Vitreous chamber depth	10.0	9.5

and at this time was noted that the animal was extremely weak with presence of unilateral cataract. An ultrasonographic evaluation was carried out when the animal was 32-day-old, with the animal in sternal recumbency with his head manually restrained. The animal became more depressed due to lack of maternal care and resulting inanition and unfortunately died. The veterinary ophthalmology service removed the globes and submitted them for histopathological evaluation in order to establish the origin of the cataracts as well to investigate the presence of other ocular abnormalities.

Investigation and Outcome

At first examination, animal was 30-day-old. The right eye (OD) had an obvious lenticular opacity (cataract) (Fig. 1). Tear production as measured by Schirmer tear test (Schering-Plough Animal Health, Union, NJ) was 17 and 22 mm/min in the right (OD) and left (OS) eyes, respectively. Menace reflex was absent in OD and present in OS. Direct pupillary light reflexes were accessed using a Finoff transiluminator (Welch Allyn, Skaneateles Falls, NY) and were normal in both eyes, but the indirect pupillary light reflex was subtly reduced in OS. Anterior ocular structures were examined using a slit lamp biomicroscope (Hawk Eye, Dioptrix, L'Union, France) revealing an intumescent cataract in the right eye, causing shallowing of the anterior chamber (Fig. 1). The intraocular pressure (IOP) was evaluated by rebound tonometry (Tonovet® Veterinary Division of S&V Technologies AG, Henningsdorf, Germany) with the patient in sternal recumbency. The IOP was 7 and 13 mmHg in OD and OS, respectively. The posterior segment examination was carried out after pharmacological induction of mydriasis with topical tropicamide 1% ophthalmic solution (Alcon Laboratories, Forth Worth, TX) using a binocular indirect ophthalmoscope (Welch Allyn) and a 20 diopter lens (Volk Optical Inc, Mentor, OH) and revealed no abnormalities in the OS. The cataract precluded fundus examination of the OD.

Ocular ultrasonography was carried out when the animal was already 32-day-old, using an ultrasound system (MyLab 30 – Easote, Genova, Italy) equipped with a 14 MHz probe that was gently placed on the corneal surface perpendicular to the center of the cornea using ultrasonic transmission gel (Aquasonic-100; Parker Laboratories Inc., Fairfield, NJ) after instillation of topical tetracaine hydrochloride 0.5% eye drops (Colírio Anestésico; Allergan Produtos Farmaceuticos, São Paulo, SP, Brazil). The probe was positioned so that all four principal landmarks (cornea, anterior lens surface, posterior lens surface, and retinal surface) were perpendicular to the globe axis. Five measurements were performed on the B-scan image: D1 corneal thickness, D2 axial globe length (anterior cornea to the chorioretinal surface); D3 anterior chamber depth (anterior lens capsule to posterior cornea); D4 lens thickness (anterior lens capsule to the posterior lens capsule); D5 vitreous chamber depth (posterior lens capsule to the chorioretinal surface).Table 1 contains the condensed results of the ocular measurements obtained in the ultrasonographic evaluation. Ultrasonographic evaluation of OS revealed no ocular abnormalities. No evidence of lens luxation or subluxation or other abnormalities were observed in the left eye. The ultrasonographic evaluation of OD revealed that the anterior chamber was narrowed, and a linear hyperechoic structure attached to the posterior lens capsule and extended through the vitreous body to the area of the optic disc. These sonographic findings suggest the presence of persistent hyperplastic primary vitreous and persistent tunica vasculosa lentis (Fig. 2).

Despite all the efforts of the intensive care veterinary staff, the animal became extremely weak, resulting in death, at the age of 34-day-old. The eyes were enucleated and fixed in 10% formalin. On gross evaluation, the left globe had normal shape and measured 23 mm (axial

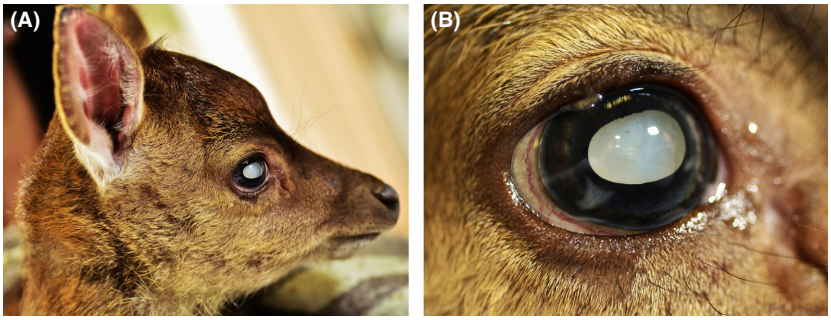

Figure 1. (A) Lateral photograph of the sambar deer fawn demonstrating a lenticular opacity in the right eye. (B) A close-up image of the same eye showing an intumescent cataract. The anterior chamber is shallow due to the presence of an intumescent cataract.

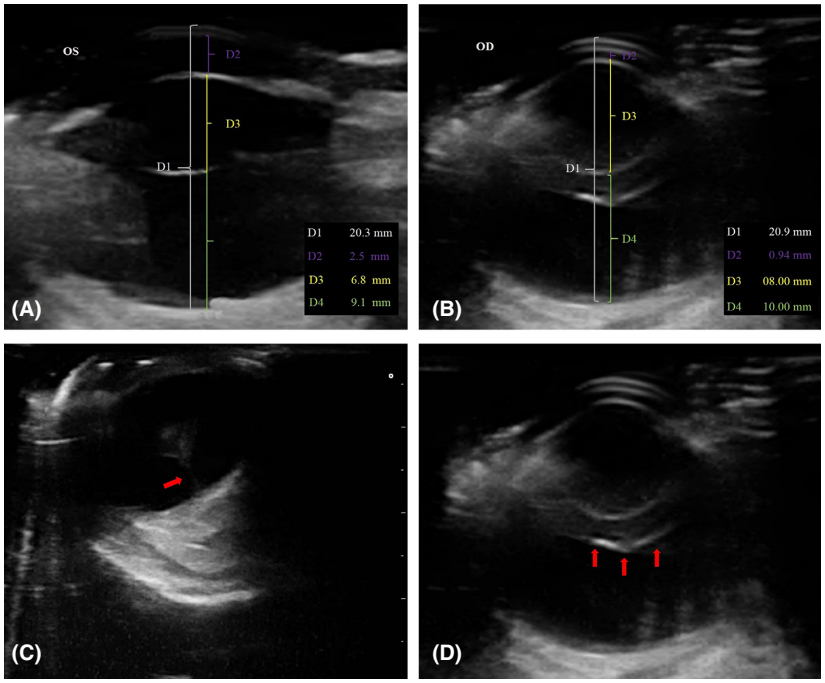

Figure 2. Representative B-scan ultrasonographic images of both eyes of a sambar deer fawn with a unilateral cataract. Left eye (OS) (A). Right eye (OD) (B), (C), and (D). The probe was positioned so that all four principal landmarks (cornea, anterior lens surface, posterior lens surface, and retinal surface) were perpendicular to the globe axis. Four measurements were performed on the B-scan image: D1 corneal thickness; D2 axial globe length (anterior cornea to the chorioretinal surface); D3 anterior chamber depth (anterior lens capsule to posterior cornea); D4 lens thickness (anterior lens capsule to the posterior lens capsule); D5 vitreous chamber depth (posterior lens capsule to the chorioretinal surface). The OS sonogram (A) is slightly off-centered, compared to the OD ones. Note the difference between the anterior chamber depth and lens thickness of the left and right eyes due to lens intumescence in OD, which decreases the anterior chamber depth. (C) Note the shallowing anterior chamber space and the presence of a cone-shaped hyperechoic strip in the vitreous chamber attached to the posterior lens capsular area, extending through the vitreous body to the area of the optic disc (red arrow). (D) A hyperechoic linear structure lines the posterior lens capsule (red arrows).

length) × 22 mm (height) × 23 mm (width). The cornea was 15 mm wide by 12 mm high. No abnormalities were found in the macroscopic evaluation. The right globe also had a normal shape and measured 22 mm (axial length) × 22 mm (height) × 23 mm (width). The cornea was 16 mm wide by 13 mm high. Hemisection of the right globe revealed a cataract, a shallow anterior chamber and an apparent anterior displacement of the iris. An off-white structure extending from the optic disc, adhering to, and coating the posterior capsule of the lens also was noted. (Fig. 3).

Light microscopic (Leica DM 1000; Leica Microsystems, Wetzlar, Germany) evaluation of histological sections stained with hematoxylin-eosin, confirmed the presence of cataract. The lens had extensive cortical lens fiber liquefaction with the formation of bladder cells and Morgagnian globules (Fig. 4A). The anterior vitreous contained a nonpigmented retrolental fibrovascular tissue extending from adjacent to the optic nerve head to the posterior lens capsule (Fig. 4A and B). The retrolental tissue was composed of fibroblasts, a meshwork of collagen fibers and a blood vessel (hyaloid vasculature) (Fig. 4A), lending the diagnosis of persistent hyperplastic primary vitreous (PHPV) and persistent tunica vasculosa lentis (PTVL). The retina was detached with associated hypertrophy of the retinal pigmented epithelial cells (Fig. 4C).

Discussion

Cases of persistent fetal intraocular vasculature have been documented in several species including human beings, [10, 11] dogs [12–16], horses [17], cattle [18], cats [19], mice [20], rabbits [21], ferrets [22], llamas [23], dromedary camels [24], and seals [25]. However, according to our knowledge there are only few reports of ocular diseases in members of the Cervidae family [7, 8, 25, 26] One brief report describes six cases of ocular diseases such as microphthalmia, colobomatous defects, cataracts, and retinal detachment [7].

PHPV and PTVL are congenital eye diseases that result from failure of the primary vitreous and hyaloid vasculature to regress [1–3], which also occasionally become

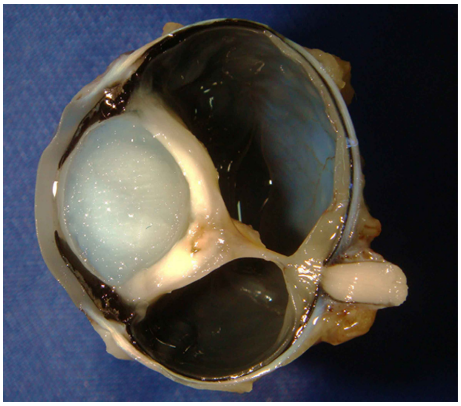

Figure 3. The hemisected right globe of a sambar deer fawn. Notice the narrowing of the anterior chamber, cataract, and prominent off-white structure (presumed persistent hyperplastic primary vitreous/persistent tunica vasculosa lentis, PHPV/PTVL) extending from the optic disc and adhering to and coating the posterior lens capsule.

hyperplastic. Although the incidence of cataracts with or without associated PHPV/PTVL in deer is unknown, the presence of fetal vasculature is a frequent cause of cataracts in other species [7, 23, 24, 27], and now sambar deer can be added to this list. A frequent complication of PHPV/PTVL is intraocular hemorrhage, which was not observed in this case [13]. Intraocular hemorrhage worsens the prognosis, especially when surgical treatment is considered. Persistent intraocular vasculature is commonly a unilateral condition in humans [28] as in this sambar deer fawn. However, in Doberman pinscher dogs, a breed in which this disease has been extensively studied, it tends to manifest as a bilateral condition [15].

The ultrasonographic appearance of this sambar deer fawn's eyes showed great similarity to other ungulates [30–33]. Ultrasonographic biometry has been used in several other domestic and wild species [33–38]. In this case, ultrasonographic ocular biometry showed no difference in axial globe length measurements between the left and the right eyes. This is particularly important, because in some cases of congenital ocular disease, such is PHPV/PTVL, concomitant microphthalmia can be present [39].

The direct observation of vascular components is the quickest and easiest method to diagnose persistent intraocular vasculature. However, ultrasonography is a

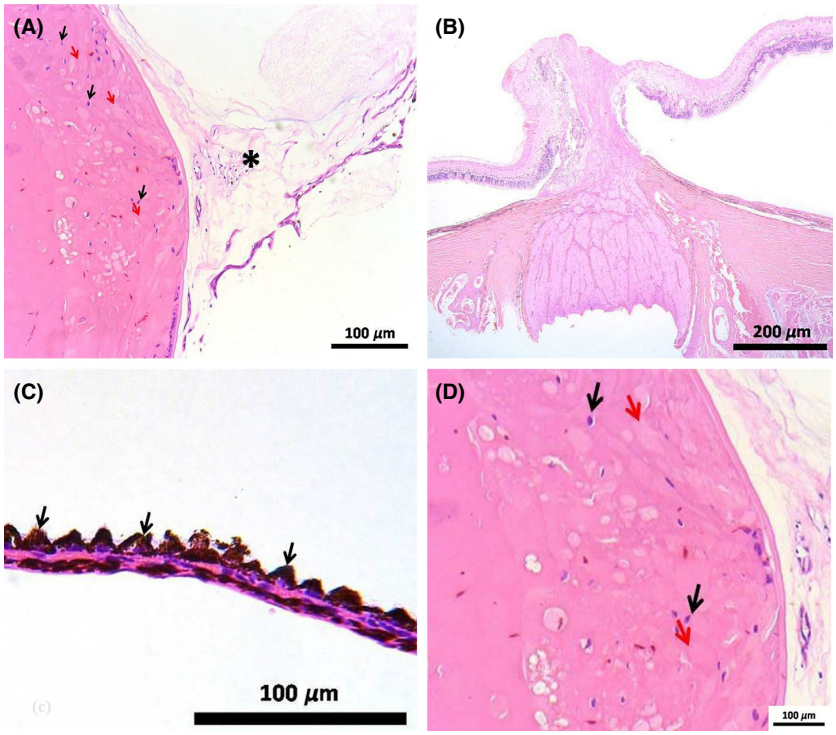

Figure 4. Histopathological findings in a case of unilateral (OD) persistent fetal vasculature in a sambar deer fawn. (A) Persistent tunica vasculosa lentis (PTVL) (black asterisk) surrounding the posterior lens capsule. Note the presence of cortical lens fiber liquefaction with formation of bladder cells (black arrows) and Morgagnian globules (red arrows) in the posterior lens cortex. (B) A partially sampled fibrovascular tissue arises over the optic nerve head and extends into the vitreous. The retina is also detached. (C) Hypertrophy of the retinal pigmented epithelial cells (black arrows) confirms the premortem retinal detachment not evident on ultrasound. (D) Higher magnification of (A) highlighting cortical lens fiber liquefaction with formation of bladder cells (black arrows) and Morgagnian globules (red arrows).

useful diagnostic tool to evaluate potential cases of PHPV/PTVL [16, 39–43]. In this case, color-flow Doppler was not used, and thus the patency of the suspected vascular components could not be evaluated. Ultrasonographic examination is even more important in cases where ocular media opacity precludes the direct examination of parts of the globe [13, 41, 42], justifying our decision to utilize this diagnostic method. Although no obvious ultrasonographic evidence of retinal detachment was present, this possibility was not completely excluded by the authors because retinal detachment is a related condition in cases of PHPV/PTVL [24, 43].

Mean STT values for both eyes were 17 and 22 mm/min in the right (OD) and left (OS), respectively, which fell within the reported mean and SD 18.8 ± 4.7 mm/min previously reported for the species using applanation tonometry (Tonopen® XL; Reichert® Technologies, New York, NY) [6]. The IOP of the OD was 7 mmHg, which was considerably lower when compared to the OS (13 mmHg) and to the mean SD reported value for the species 11.4 ± 2.8 mmHg [6]. Possibly, this hypotony may be caused by the facogenic uveitis or by the presence of persistent hyperplastic primary vitreous and persistent tunica vasculosa lentis and retinal detachment led to a ruptured blood aqueous barrier and a decreased IOP.

Previously, histological diagnoses of ocular diseases have been made in deer, such as anophthalmia [44], microphthalmia [7, 44, 45], coloboma, cataract, retinal detachment, and the presence of panophthalmitis [7] and severe ocular dysplasia [8]. In the present case, histological analysis allowed the additional diagnosis of retinal detachment, which was not seen ultrasonographically, and also the elucidation of the tissue seen connecting the optic nerve head to the posterior lens capsule. Retinal detachment has been reported in ferrets [22] and humans [11] secondary to persistent fetal vasculature; however, this is a less common entity in dogs that have the hereditary form of the disease [12, 46, 47].

In addition to describing a case of cataract associated with PHPV/PTVL, this report provides detailed information about the normal features of the sambar deer eye, including information obtained by ultrasonographic, gross, and histological evaluation. This furthers the understanding of ocular anomalies in these animals, and in addition, provides information for future investigations.

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Conflict of Interest

None declared.

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