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CLINICAL AND ULTRASONOGRAPHIC FINDINGS OF SOME OCULAR AFFECTIONS IN DROMEDARY CAMELS

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ABSTRACT

The eyes of 51 camels were examined by clinically and ultrasonographically using direct corneal contact technique. Trauma-related problems were the most common eye troubles seen among camels. Anterior segment affections constituted 72.5% of all examined cases. This included keratitis with or without involvement of the iris and ciliary body in the form of iridocyclitis (31%). Penetrating corneal wounds were 23%. Lesser observations were recorded involving cataract (16%) and glaucoma (2%). Posterior segment affections constituted 27.5% and included intraocular tumour (2%), retinal detachment (6%) and blindness (20%).

Key words: Camel, dromedary, eye, ocular, ultrasound

Camels suffer from a wide range of ophthalmic affections which include laceration of cornea and eyelids panophthalmos, corneal opacity, descematocele etc (Gahlot, 2012). These have been reported elaborately (Bishnoi and Gahlot, 2001; Gahlot, Chauhan, 1992, 2000; Ramadan, 2004). The data on the use of ultrasound in surgical and medical cases in camels are rare, yet some ocular abnormalities, that require ultrasonographic examination have been reported in camels such as congenital cataract, persistent hyaloid artery (Moore *et al,* 1999), anterior uveitis (Madany *et al,* 2006), uveal melanoma, retinal folds and glaucoma (Hegazy *et al,* 2004).

Indications for ocular ultrasound include any clinical entity which impedes visualisation of all or a portion of the globe and retrobulbar region. Another common indication for ocular ultrasound is disparity in ocular size or a protruding globe. Ultrasound is important in these cases to differentiate between enophthalmus, buphthalmus, or exophthalmus due to the presence of retrobulbar masses (Whitcomb, 2002). The ultrasonographic examination of ocular affections in camels is not studied previously. The present study was therefore designed to study some ocular conditions in dromedary camels, clinically and ultrasonographically.

Materials and Methods

The present study was conducted on 51 dromedary camels of different ages (range 2–10 years) and weights (250-550 Kg). Camels were examined at the Veterinary Teaching Hospital, Qassim University, Saudi Arabia (Dec, 2009-April, 2012) for ocular disorders in one or both eyes. Case history was followed by regular ophthalmic examination under sedation with Xylazine (0.2mg/Kg, i.v. Bomazine 10%, BOMAC Lab, Ltd., New Zealand). Surface corneal anaesthetic 2% Lidocaine (Norbrook Laboratories, UK) was also used. The camel's head was firmly held, tilted and the eyelids were spaced out. Ultrasound coupling gel was applied to the cornea. Ultrasonographic examination was performed using a B-mode ocular ultrasound unit (Aloka SSD-500, Tokyo, Japan) with a 7.5 MHz sector probe. The structures of the globe were evaluated at a depth of 4–6 cm. The retrobulbar region was evaluated at a scanning depth of 6–10 cm (Whitacomb, 2002). All images were digitally recorded of those views which gave maximum information.

Ocular abnormalities were evaluated in respect to location (i.e., anterior/posterior segment) and echotexture (isoechoic or hypo/hyper-echoic) was compared to the surrounding tissues. Normal views and measurements were compared to results recorded in an earlier study (El-Tookhy *et al,* 2012). Using the direct corneal contact technique, the transducer was placed directly on the cornea after spreading the coupling gel. Light pressure was applied to maintain good contact between the transducer and the cornea.

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Each eye was examined initially in horizontal section with the ultrasound beam running from the medial to the lateral canthi, and then the head of the transducer was rotated 90° to visualise the vertical section of the eye (Nyland and Mattoon, 1995). After ultrasound examination, excess coupling gel was carefully wiped from the eyes.

Results

Clinical ocular findings recorded were classified according to their anatomical location within the eye (Table 1, Fig 1).

I. Anterior segment

Anterior segment affections represented 72.5% n=37 of all examined cases. Keratitis with or without iridocyclitis 31% n=16. Penetrating corneal wounds were (n=12, 23%). Lesser observations were recorded involving cataract (n=8, 16%) and glaucoma (n=1, 2%).

Keratitis was the most prevalent ocular condition (Fig 2) affecting the anterior ocular segment. Acute conditions were recorded in 5 cases and characterised by corneal oedema, zone of neovascularisation and hypopyon. Moderate conditions of keratitis were seen in 7 cases and chronic pigmentary keratitis was recorded in another 16 cases. Ultrasonographically, corneal oedema was seen as a thickened and diffusely hypoechoic area. The anterior chamber appeared anechoic except when aqueous flare was present which appeared as hyperechoic dots floating in the anterior chamber. In iridocyclitis, the iris was highly reflective than normal and in most cases was partially adhered to the cornea with a thin hypoechoic strands extending from the iris to the posterior surface of cornea (anterior synechia). Penetrating corneal wounds were accidental due to sharp objects. The severity of damage varied from simple corneal cut with partial iris prolapse to complete visual loss due to complications involving other ocular tissues such a lens dislocation, vitreal prolapse, vitreal haemorrhage and retinal detachment.

Cataract was recorded in 8 cases (5 bilateral and 3 unilateral). The lens appeared as hyperechoic mass, either in situ or displaced, with clearly defined thickened echogenic lens capsule with or without irregular margins. The interior of the cataractous lenses exhibited echogenic material (Fig 3). Glaucoma was diagnosed clinically in one camel suffering from buphthalmia, dilated pupil, chemosis and blindness (Fig 4). Ultrasonographically, the anterior chamber depth, axial and sagittal globe measurements exceeded the normal values compared to the opposite eye (normal values: anterior chamber depth 2.3±0.1mm, globe axial length 29.8±0.3 mm; globe sagittal length 33±0.3mm) as reported in a previous study (El-Tookhy *et al*, 2012).

II. Posterior segment

Posterior segment affections constituted (n=14, 27.5%) and included intraocular tumour, retinal detachment and blindness (Fig 5). A unilateral intraocular tumour was recorded in one case (2%). The tumour mass appeared hyperechoic compared to the surrounding ocular structure with well-defined boundaries. Partial retinal detachment was recorded in 3 cases (6%). The detached retinal fold appeared as a thin hypoechoic layer of cells accompanied with

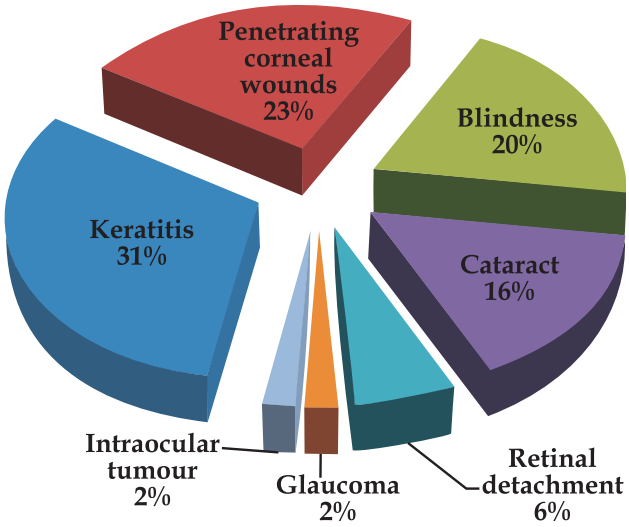

Fig 1. Incidence percentage of different ocular affections recorded in the dromedary camels.

Table 1. Classification of ocular affections seen in the camels.

Ocular affection		Number (%)
I. Anterior segment affections (n=37, 72.5%)	1. Keratitis:	16 (31%)
	mild	8
	moderate	5
	severe	3
	2. Penetrating corneal wounds	12 (23%)
	3. Cataract:	8 (16%)
	unilateral	3
	bilateral	5
	4. Glaucoma	1 (2%)
II. Posterior segment affections (n=14, 27.5%)	1. Intraocular tumour	1 (2%)
	2. Retinal detachment	3 (6%)
	3. Blindness:	10 (20%)
	unilateral	2
	bilateral	8

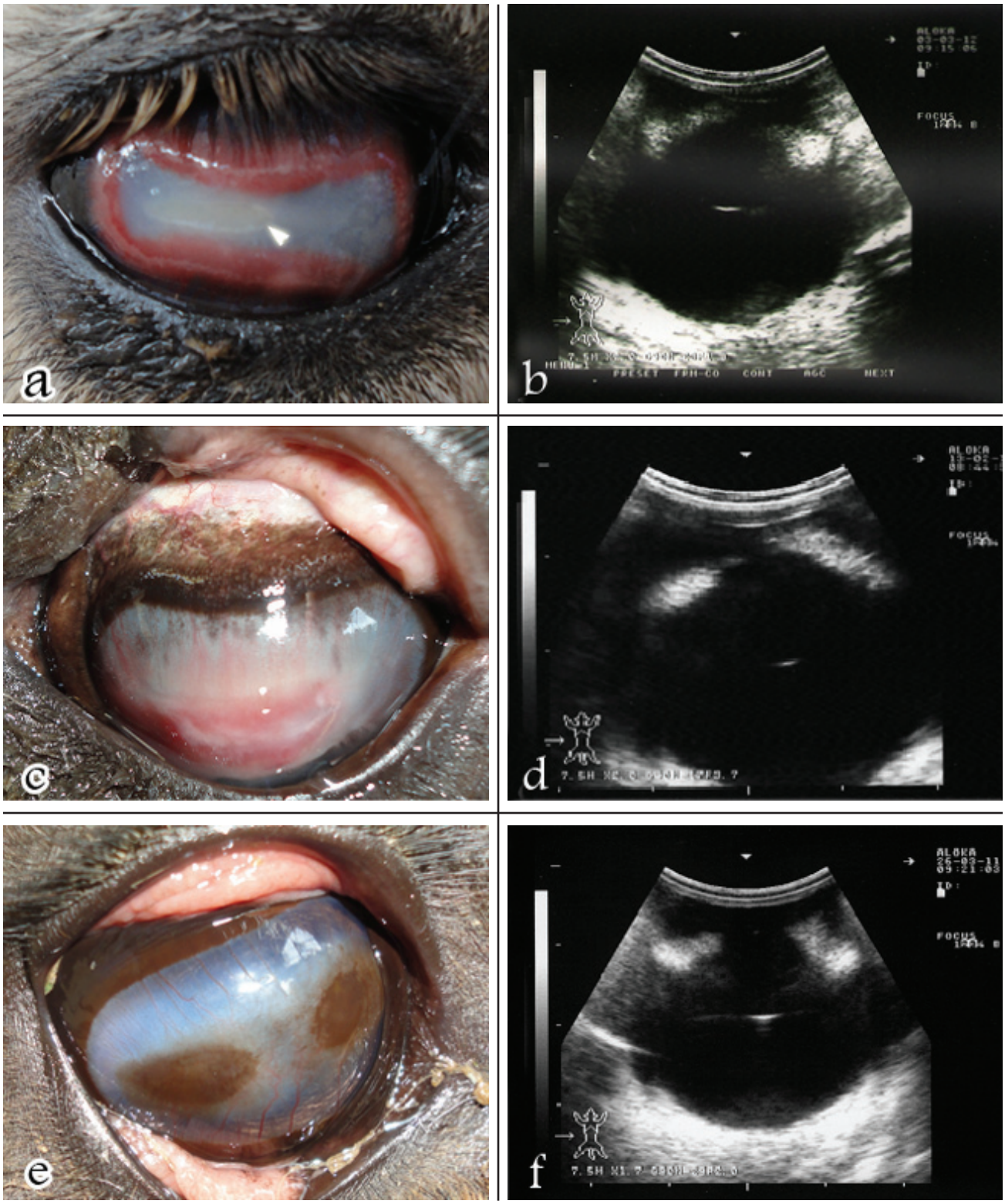

Fig 2. a- Deep keratitis with severe corneal opacity and corneal abscessisation (arrow); b-Iris displaced forward towards the posterior corneal surface. Ciliary body appears hyperechoic indicating iridocyclitis; c- Pigmentary keratitis with long branched neovascularisation surrounding a central area of corneal ulceration; d- Iris adhered to the posterior corneal surface (anterior synechia) with hyperechoic ciliary body, corneal tissue is thickened (arrow) with hyperechoic aqueous flare; e- Regression of symptoms of keratitis, yet partial corneal opacity, neovascularisation exists with two patches of melanin pigment deposition within the corneal stroma; clearer corneal tissue can be seen ventrally with long thin blood vessels; f- backward retraction of the iris with slight signs of iridocyclitis.

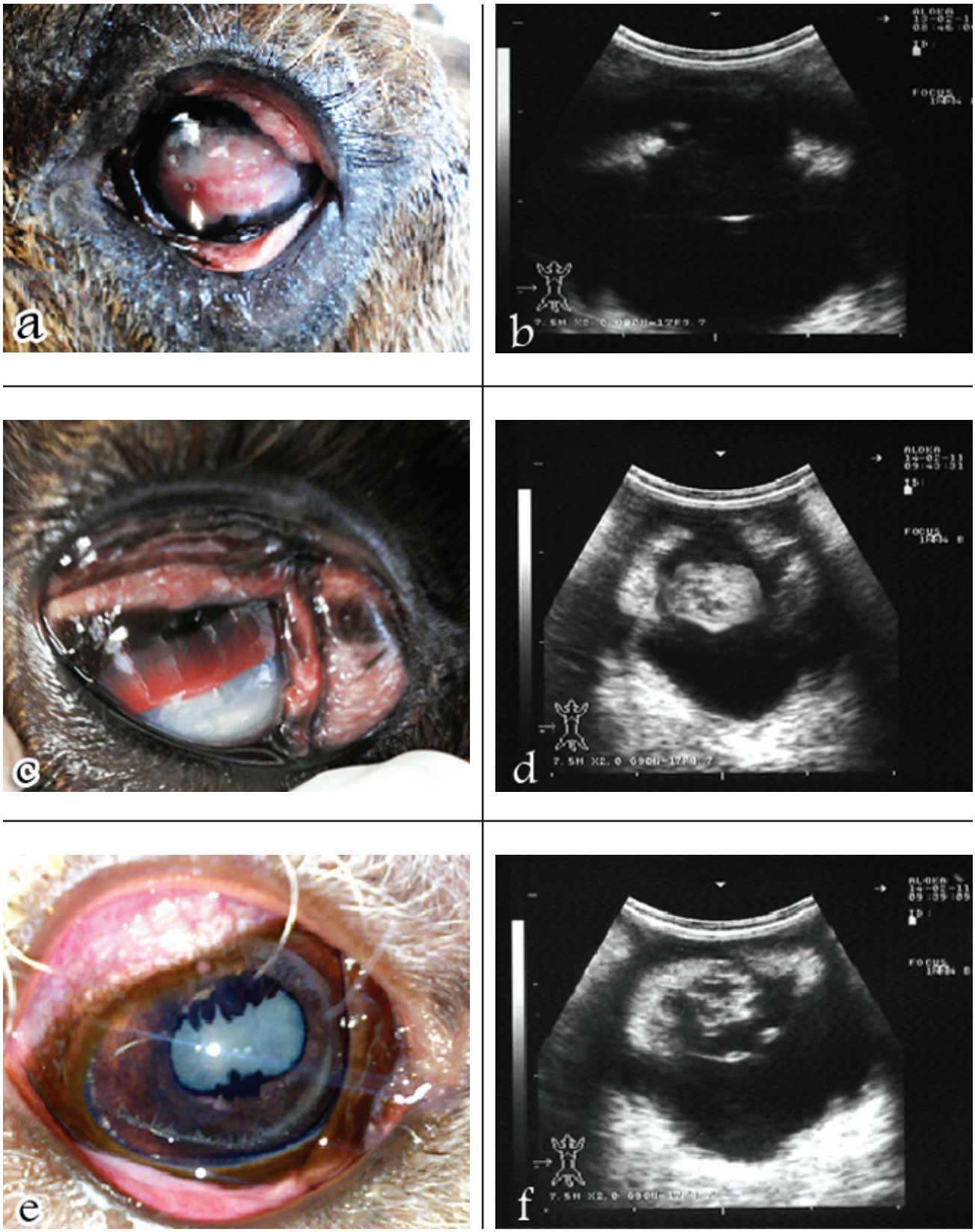

Fig 3. a- Complicated case with deep keratitis, severe corneal opacity and central corneal ulceration (arrow); b-iridocyclitis with dilated pupil; c- hypermature cataract as with short, brush-like neovascularisation indicating severe deep keratitis d- increased echogenicity of the lens with irregular lenticular boarders; e- mature cataract with normally dilated pupil and normal corneal tissue; f- the cataract appeared to involve the anterior capsule, nucleus and slightly affecting the posterior lens capsule.

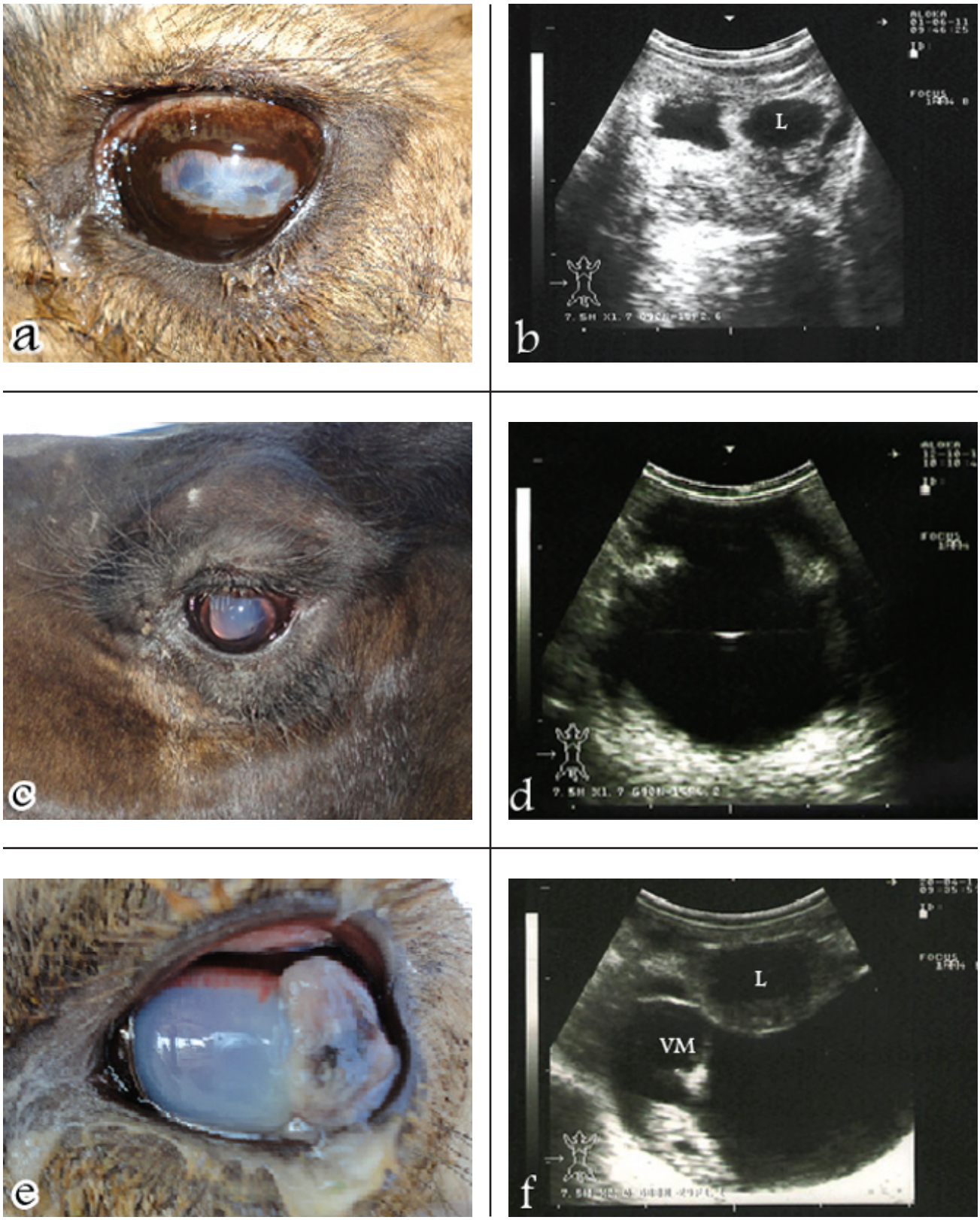

Fig 4. a- Fibrin within the anterior chamber and dislocated lens; b- the anterior chamber contains hyperechoic material (Fibrin), the lens is dislocated (L) and vitreal haemorrhage represented by point-like echoes; c- Buphthalmia with severely dilated unresponsive pupil in case of glucoma; d- dilated pupil with increased ocular dimensions; e- Old infected penetrating corneal wound with corneal opacity, deep keratitis, iris prolapsed with purulent ocular discharge; f- dislocated lens (L) with capsular cataract, vitreal membrane represented by point-like echoes with a uniform high reflective mass seen on the fundus.

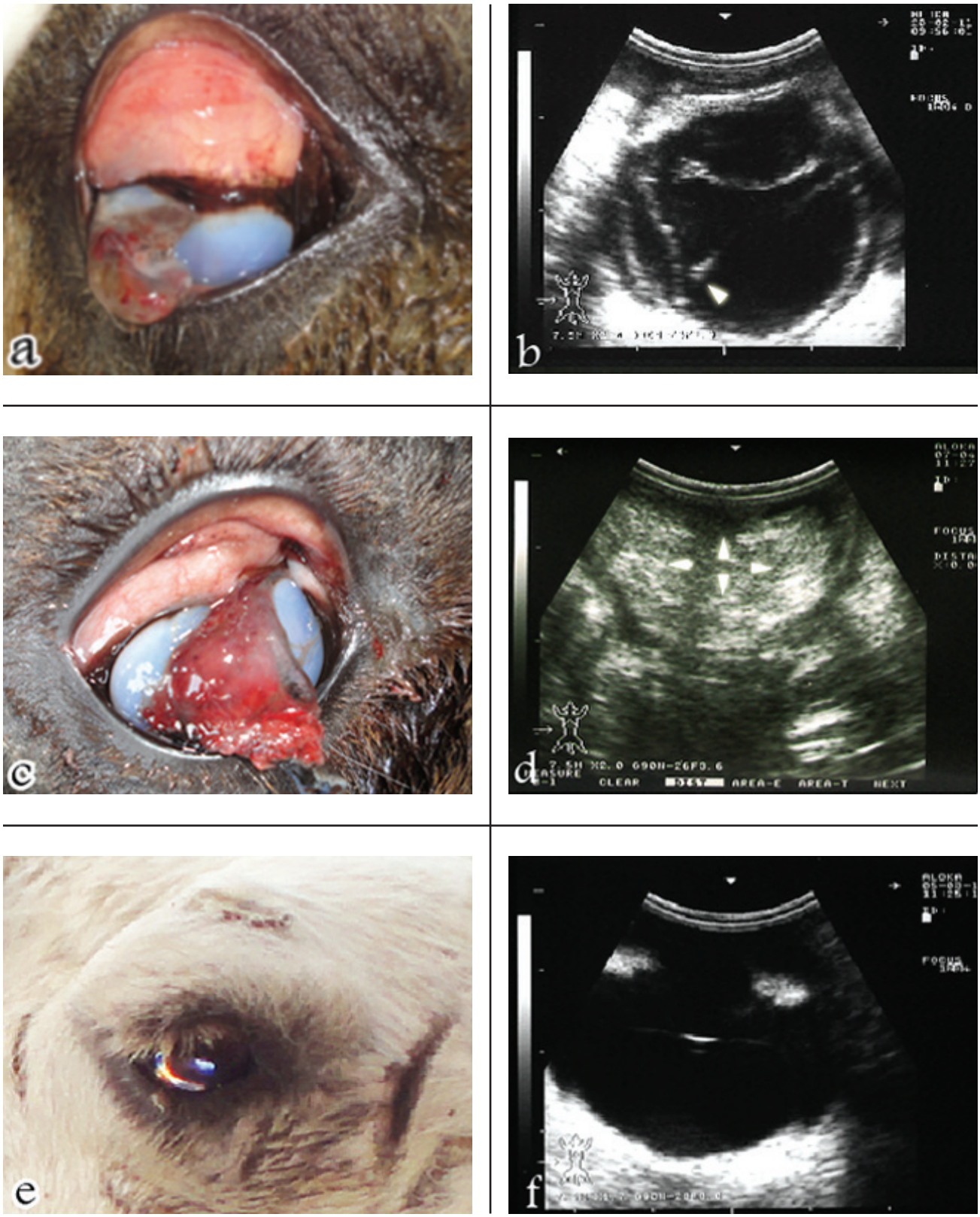

Fig 5. a- Penetrating corneal wound, corneal opacity, with slight vitreous prolapse; b-partial retinal detachment (arrow) and retinal folds are seen within the vitreous body; c- Penetrating corneal wound due to severe trauma with prolapse of blood mixed vitreous material; d- high reflective wide-spread opacities covering the lens (arrows) and occupying the vitreal space corresponding to vitreal haemorrhage; e- Blind eye with dilated irresponsive pupil from which fundal reflection was pictured. Traditional firing lines around the eye are evident; f-clear ocular sonographic image with widely dilated pupil.

echogenic pinpoint swirling echoes representing vitreal hemorrhages and degeneration. Blindness in apparently normal eyes was recorded in 10 cases (20%); 8 were bilateral and 2 were unilateral.

Discussion

In this study, the majority of ocular problems seen in dromedary camels were traumatic with the involvement of one or more ocular tissue. Similarly, Gionfriddo (2010) considered trauma-related diseases as the most common eye problems for which camelids are presented to veterinarians. In a simple comparison, the proportion of llamas with ocular disease was significantly higher than that of cattle or horses (Gionfriddo *et al,* 1997). In cases of ocular trauma, ultrasound can be used to evaluate the integrity of the globe. Ultrasound can also be used to confirm ophthalmoscopic findings, such as retinal detachment or early cataractous changes (Whitcomb, 2002).

Ocular ultrasonography is an easy, noninvasive diagnostic procedure used to evaluate ocular problems and used as a complement to traditional ocular examination. Ocular ultrasound is practiced in animals with ocular trauma, disparity in ocular size or with any condition that impedes visualisation of posterior ocular structures (Whitcomb, 2002). In this study, the majority of examined camel cases suffered from ocular traumatic injuries as well as possible infectious diseases. This goes with the results reported in cattle (Punch and Slatter, 1984).

Keratitis with or without iridocyclitis was the utmost repeated condition diagnosed in dromedary camels (31%). Likewise, Gionfriddo *et al* (1997) reported that the most frequently affected ocular structure in llamas was the cornea; and ulcerative keratitis was the most common corneal disease. The second most commonly affected structure was the uveal tract. Corneal inflammation and ulcerations caused thickening of the corneal tissue due to malfunction of corneal permeability and increase water absorption. Fluid within the corneal tissue was identified by the corneal opacity and seen as diffusely hypoechoic cornea due to fluid infiltration coinciding with description made by Whitcomb (2002).

The main ocular conditions related to the lens were cataract and dislocated lens. Mature cataract was diagnosed clinically. Ultrasonographically, the normal lens appears anechoic and only the anterior and posterior reflections of the lens can be seen. Cataract was seen in 16% of examined cases. In a similar study on llamas, the incidence of cataract was 20% (Gionfriddo *et al,* 1997). In this study, lens sub/complete luxation accompanied traumatic injuries of the eye in the camels.

Glaucoma was a rare condition in examined cases. This result is consistent with that reported in other camelids such as llamas (Gionfriddo *et al,* 1997). Clinical signs of glaucoma included buphthalmia, dilated irresponsive pupil, elevated intra ocular pressure and chemosis. Ultrasonographically, an evident distention of the anterior chamber was noted similar to the findings in horses (Whitcomb, 2002). The iris and ciliary body were seen as echogenic linear structures which extend from the peripheral globe towards the cornea. The anterior chamber depth, the axial and sagittal globe measurements exceeded the normal values (El-Tookhy *et al,* 2012).

Vitreal affections were best diagnosed using the ultrasound. The normal vitreal chamber is filled with anechoic fluid. In most examined traumatic cases, echogenic pinpoint swirling echoes were seen. These echoes represent vitreal haemorrhages or vitreal debris secondary to inflammation (Whitcomb, 2002).

The retina is a layer of cells lining the posterior portion of the vitreal chamber. The normal retina cannot be differentiated sonographically from the other choroidal layers. Retinal detachment was rarely seen in examined camels. Two cases with partial retinal detachment were recorded representing 6% of examined cases. Relatedly, in other camelids such as llamas, it was reported that retinal diseases were infrequent (Gionfriddo *et al,* 1997).

Most intraocular tumours could be diagnosed, or at least suspected, when examined with the ophthalmoscope and the slit lamp. Sometimes, however, tumours may be suspected but not proven by optical examinations because of opaque ocular media or atypical appearance of the tumour. In such cases, clinical echography plays a prominent role in establishing the diagnosis and localizing the tumour. In this study, intraocular tumour was uncommon in examined cases and was detected coincidental. Different types of intraocular tumours have been reported in camelids such as retinoblastoma in llama (Fugaro *et al,* 2005); medulloepithelioma (Hendrix *et al,* 2000 and Schoeniger *et al*, 2006) in llama and malignant osteogenic intraocular melanoma in alpaca (Hill and Hughes, 2009 and Mollat *et al,* 2009).

Blindness was the third highest ocular problem seen in dromedary camels and the highest problem affecting the posterior segment of the eye. The real cause of blindness was unknown due to lack

of animal history and the delay in presenting the animal to the clinic, yet bilateral conditions could be attributed to systemic infection with diseases similar to BVD in cattle that also affect other camelids (Belknap *et al,* 2000). It was also prompted that equine herpes virus-1 can cause nervous symptoms as well as blindness in llamas and alpacas (House *et al,* 1991). The ocular lesions described in affected llamas and alpacas included retinal detachment, optic disc necrosis, and hemorrhage (Rebhun *et al,* 1988). Blindness was often central as well as peripheral, with necrosis of the optic nerve and lateral geniculate nucleus. The period from the onset of fever to blindness was 2-4 weeks (House *et al,* 1991). This can explain the absence of systemic abnormalities at the time of admittance to the clinic. A rare case of nematode causing blindness in llama was recorded (Dunkel *et al,* 2011). Mineral and metabolic toxicity are possible causes of blindness. Polioencephalomalacia (PEM) is a metabolic disorder of all ruminant animals resulting from thiamin deficiency induced by high thiaminase activity or excessive sulfur within the rumen (Loneragan and Gould, 2002). A rapid change from high forage to high concentrate, low fiber diet is often associated with polioencephalomalacia conditions. Common clinical signs associated with this condition include depression, seizures, opisthotonos, blindness, hyperesthesia and sudden death. Polioencephalomalacia has been reported in young and adult llamas and alpacas (Kiupel *et al,* 2003). Acute lead poisoning, sodium toxicosis/ water deprivation) can result in PEM and subsequent blindness as well (Gould, 2010).

In conclusion, this study has demonstrated the usefulness of using ultrasound when examining camels with different ocular affections. In such cases, it would have been difficult to reach a confirmatory diagnosis without the use of ultrasonography. From the clinical point of view, the present study provides detailed ultrasonographic information about ocular affections that hindered normal examination such as keratitis, penetrating corneal wounds, cataract, and aided in the diagnosis of ocular problems such as glaucoma, intraocular tumour, retinal detachment and blindness.

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