CASE REPORT

Endogenous endophthalmitis caused by *Enterococcus faecalis* in a cat

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A three-year-old male neutered domestic shorthair cat was presented for loss of vision associated with hyperthermia, lethargy and anorexia. Ophthalmic examination revealed a bilateral panuveitis. Cytological examination of aqueous and vitreous humours was performed and revealed a suppurative inflammation associated with numerous cocci. *Enterococcus faecalis* was identified by bacterial culture from aqueous and vitreous humour. No primary infection site was identified. Active uveitis resolved after systemic antibiotic therapy, but the vision loss was permanent. To the authors' knowledge, this is the first reported case of endogenous bacterial endophthalmitis secondary to *E. faecalis* infection in a cat.

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INTRODUCTION

Endophthalmitis is a severe intra-ocular inflammation of bacterial or fungal origin that may lead to blindness and frequently to enucleation (Khan *et al.* 2002, Jackson *et al.* 2003, Ramakrishnan *et al.* 2009). In veterinary medicine, most cases are of exogenous origin such as intra-ocular surgery, penetrating injury, corneal ulcer or spread of infectious organisms from ocular adnexa. Endogenous endophthalmitis is rarely described. It results from haematogenous spread of infectious organisms, with an initial site of infection distal to the eye (Khan *et al.* 2002, Jackson *et al.* 2003, Ramakrishnan *et al.* 2009). This report describes a case of acute vision loss secondary to bilateral bacterial endogenous endophthalmitis in a cat.

CASE HISTORY

A three-year-old male neutered indoor/outdoor domestic shorthair cat was referred to the National Veterinary School of Alfort, Maisons-Alfort, France, for acute vision loss, lethargy and anorexia. Five days before initial presentation, the cat was found to be weak and the owners noticed that the right cornea had turned white.

The initial general examination revealed hyperthermia (39·4°C) and moderate dehydration. On the initial ophthalmic examination, no menace response could be elicited in either eye. Direct and consensual pupillary light reflexes (PLR) were present in the left eye (OS) and absent in the right eye (OD). On examination of the anterior segment, a mild aqueous flare was observed (1+) OS and diffuse corneal oedema, circumlimbal corneal vascularisation, aqueous flare (4+), a fibrin clot within the anterior chamber and iridal hyperaemia were found OD (Fig 1). Indirect ophthalmoscopy revealed diffuse vitreous haemorrhages, active chorioretinitis and hyperreflective areas on the tapetal fundus OS and a cloudy posterior segment precluding fundus examination OD. The intra-ocular pressure (IOP) measured by rebound tonometry (Tonovet; Tiolat) was within reference limits OS (12 mmHg) but abnormally high OD (33 mmHg).

The conclusion of the ophthalmic examination was blindness secondary to bilateral panuveitis associated with ocular hypertension in the right eye. Several potential causes were considered: trauma, infectious diseases, neoplasia and idiopathic uveitis. Routine haematology, serum biochemistry (ALT, ALP, urea, creatinine, albumin, total protein and glucose) were all within their respective reference intervals. Tests for common infectious agents (feline immunodeficiency virus (FIV), feline leukaemia virus and feline enteric coronavirus) were all negative. The right posterior segment examined by ocular ultrasound was filled with diffuse heterogeneous hyperechoic material (Fig 2). A sample of aqueous and vitreous humour was collected by fine needle paracentesis from the right eye, under general anaesthesia, for cytological examination and bacterial culture. Cytological examination of

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FIG 1. Patient at initial presentation showing conjunctival hyperaemia, diffuse corneal oedema, iridal hyperaemia, dyscoria and cloudy aqueous humour OD (photograph taken under general anaesthesia before aqueous humour and vitreous aspiration)

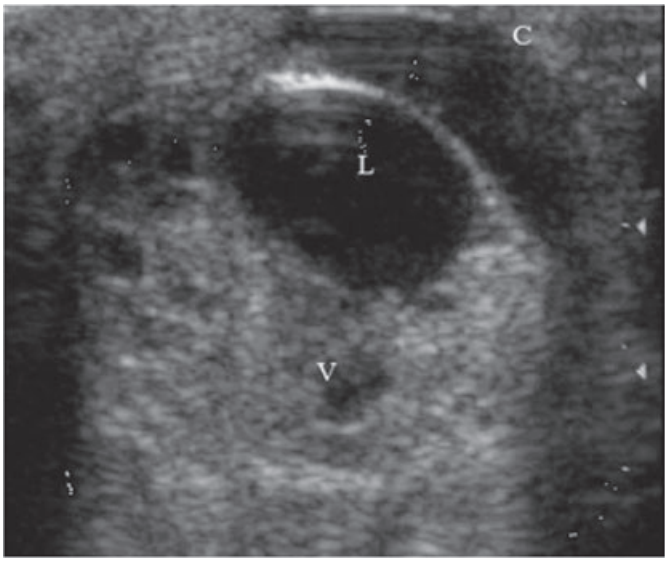

FIG 2. Ultrasound findings showing diffuse heterogeneous hyperechoic material in the posterior segment OD. Linear transducer (15 MHz). C, cornea; L, lens; V, vitreous

the vitreous revealed a suppurative inflammation associated with numerous intra- and extracellular cocci (Fig 3). The results with the aqueous humour were similar, but cocci were less abundant. As there were no signs of trauma and no history of previous ocular surgery, endogenous bacterial endophthalmitis was suspected. Urinalysis, thoracic radiography, abdominal ultrasound examination, echocardiography and blood culture did not detect a primary infection site.

While the bacterial culture was pending, a treatment combining systemic broad spectrum antibiotics: 15 mg/kg cefalexin (Rilexine; Virbac) intravenously (iv) every 12 hours and 2 mg/kg marbofloxacin (Marbocyl; Vetoquinol) iv every 24 hours were initiated. A dose of 0·2 mg/kg meloxicam (Métacam; Boehringer Ingelheim) subcutaneously (sc) every 24 hours was administered in association with iv fluid therapy. Bilateral subconjunctival

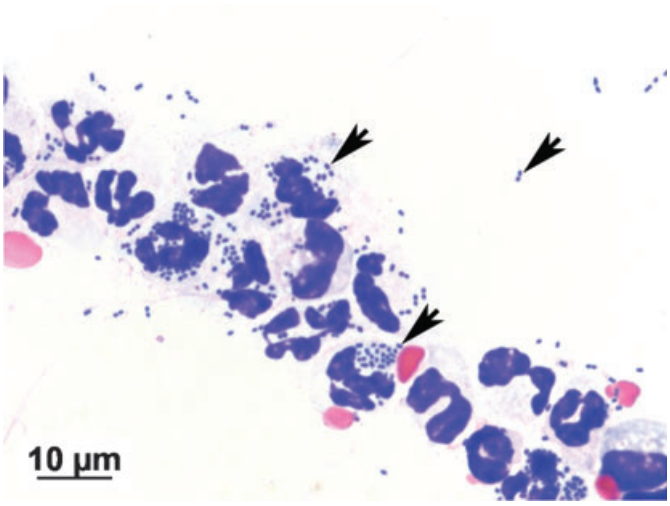

FIG 3. Cytological examination of the vitreous: suppurative inflammation with numerous intra- and extracellular cocci (arrow), OD. May-Grünwald & Giemsa

Table 1. Culture susceptibility (vitreous, OD)

Ampicillin	Sensitive
Gentamycin	Intermediate
Amoxicillin/clavulanic acid	Intermediate
Kanamycin	Resistant
Fusidic acid	Resistant
Cephalexin	Resistant
Enrofloxacin	Resistant
Trimethoprim/sulphonamide	Sensitive/intermediate
Penicillin	Intermediate
Tetracycline	Resistant
Marbofloxacin	Resistant
Ceftiofur	Resistant
Erythromycin	Resistant
Flumequine	Resistant
Cefixime	Resistant

injection of 1·6 mg/eye triamcinolone acetate (Canitedarol; Merial) was performed, and eyedrops containing 0·1% dexamethasone/polymixin B/neomycin TID (Maxidrol; Alcon) and 1% brinzolamide TID (Azopt; Alcon) were administered. Three days after the initial presentation, the cat had recovered normal appetite and rectal temperature. However there was still no menace response from either eye. In the right eye, an *iris bombé* was observed with a large fibrin clot. The IOP had increased (59 mmHg). The left eye was unchanged. *Enterococcus faecalis* was identified by bacterial culture. The strain was multi-drug resistant but susceptible to ampicillin and marginally sensitive to gentamicin (Table 1). The cat was discharged on 20 mg/kg oral ampicillin (Ampicat; Virbac) every 12 hours, oral meloxicam, topical 1% brinzolamide every 8 hours, 0·5% timolol maleate (Timoptol 0·5%; MSD France) every 12 hours in the right eye and 0·3% gentamicin (Gentalline; MSD France) every 8 hours and 0·1% dexamethasone (Maxidex; Alcon) every 8 hours in both eyes. Anterior uveitis and vitreous inflammation decreased gradually in both eyes during the 2-month follow-up but retinal degeneration was observed OS. Oral ampicillin was discontinued after 3 weeks and topical medication was limited

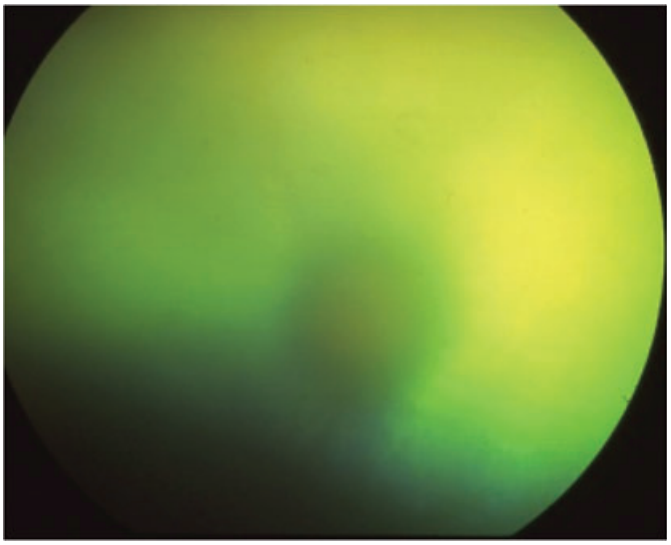

FIG 4. Funduscopic findings showing cloudy vitreous, vascular attenuation and tapetal hyper-reflectivity OS 6 months after initial presentation

to 0·1% dexamethasone solution every 12 hours OU and topical 1% brinzolamide OD. Six months after the initial presentation, the IOP was within reference limits but aqueous flare (+1) was persistent and preiridal fibrovascular membranes and secluded pupil were noted OD. Complete retinal degeneration was confirmed OS (Fig 4). One year after the initial presentation, a mild aqueous flare (+1) and mature cataract were noticed OD.

DISCUSSION

Endogenous bacterial endophthalmitis is an uncommon condition seldom reported in veterinary medicine and includes only one case in a cat (Westermeyer *et al.* 2013), two cases in dogs (Massa *et al.* 2002, Ledbetter *et al.* 2009) and five cases in horses (Blogg *et al.* 1983, Reuss *et al.* 2009, Priest *et al.* 2012). In a recent report, an endogenous endophthalmitis secondary to *Actinomyces* following multiple dental extractions was described in a cat (Westermeyer *et al.* 2013). Other bacteria, such as *Brucella canis*, *Staphylococcus intermedius*, *Rhodococcus equi* and *Borrelia burgdorferi*, were isolated from aqueous or vitreous humour in dogs and horses (Blogg *et al.* 1983, Massa *et al.* 2002, Ledbetter *et al.* 2009, Reuss *et al.* 2009, Priest *et al.* 2012). In humans, endogenous bacterial endophthalmitis is a rare, but well-documented, condition (Binder *et al.* 2003, Jackson *et al.* 2003). It accounts for 2 to 8% of all cases of endophthalmitis (Callegan *et al.* 2002). Causes include abscesses, pneumonia, endocarditis, soft tissue infections, urinary tract infections, meningo-encephalitis, septic arthritis, orbital cellulitis and peritonitis (Jackson *et al.* 2003). In the present case, all these potential causes were investigated and eventually ruled out. However, in humans, the primary infection site is often not identified. In two case series, the infection site could be identified in only 42 and 79% of patients, respectively (Binder *et al.* 2003, Jackson *et al.* 2003). It is worth noting that blood culture was considered by some authors as the most reliable way of establishing the diagnosis (Jackson *et al.* 2003). In a retrospective study, approximately 75% of blood cultures were positive. In the present case, the blood culture was negative. However, a single blood culture was performed and antibiotic therapy was started thereafter. Because bacteraemia is often intermittent, at least three blood cultures are usually recommended and, conceivably, a positive bacterial culture might have been found if several bacterial cultures had been performed (Greiner *et al.* 2008, Nutsi *et al.* 2010).

There are only a few case reports of *E. faecalis* infection in veterinary medicine, and no ocular involvement has been reported in any (Adamo & Cherubini 2001, Manson *et al.* 2003, Tessier-Vetzel *et al.* 2003, Pomba *et al.* 2010). In the present case, *E. faecalis,* a Gram-positive streptococcus (Sood *et al.* 2008), was identified in intra-ocular fluids. *E. faecalis* belongs to the normal feline gastrointestinal flora (Jackson *et al.* 2009). In humans, *E. faecalis* is an uncommon cause of endophthalmitis (Uchio *et al.* 1992, Scott *et al.* 2003, Chen *et al.* 2009, Rishi *et al.* 2009), mainly observed in old or debilitated patients, when the mucosal or epithelial barrier is disrupted or in cases of alteration of the normal bacterial flora secondary to treatment with antibiotics (Chen *et al.* 2009). In the present case, the cat was young and had reportedly not received any prior treatment. The only general signs were transient lethargy and anorexia. Risk factors such as FIV or diabetes were excluded. Nevertheless, the hypothesis of mucosal intestinal disruption cannot be ruled out.

In humans, ocular findings associated with *E. faecalis* endophthalmitis frequently include a hypopion and a marked vitreous inflammation with exudates (Scott *et al.* 2003, Chen *et al.* 2009, Rishi *et al.* 2009), which can preclude funduscopic examination (Rishi *et al.* 2009). Increased IOP has also been reported (Chen *et al.* 2009). All these features were observed in this case.

In humans, treatment of bacterial endophthalmitis consists of intravitreal injection of antibiotics (Callegan *et al.* 2002, Binder *et al.* 2003, Scott *et al.* 2003, Schiedler *et al.* 2004, Chen *et al.* 2009, Rishi *et al.* 2009). Systemic administration of antibiotics has also been reported (Binder *et al.* 2003, Schiedler *et al.* 2004) but was not consistently prescribed. Indeed, the intravitreal concentrations obtained are frequently below the minimal inhibitory concentrations for many ocular pathogens (Callegan *et al.* 2002, Jackson *et al.* 2003). In veterinary ophthalmology, intravitreal injections are rarely performed because of the risk of intra-ocular haemorrhage (Boeve & Stades 2007, Regnier 2007). The cat in this report was treated with systemic ampicillin. The penetration of penicillins into normal eyes is generally poor but in case of inflammation, the breakdown of the blood-aqueous barrier facilitates the intra-ocular penetration of ampicillin (Regnier 2007). A posterior vitrectomy is also often performed to remove bacteria, inflammatory cells, membranes and toxic debris in humans (Binder *et al.* 2003, Scott *et al.* 2003, Schiedler *et al.* 2004, Chen *et al.* 2009, Rishi *et al.* 2009), and to promote the distribution of antibiotics (Callegan *et al.* 2002, Jackson *et al.* 2003). This surgical procedure has not been described for this condition in veterinary medicine and was not available for the present case.

Bacterial endophthalmitis in humans is known to have a poor visual outcome (Binder *et al*. 2003, Jackson *et al*. 2003, Schiedler *et al*. 2004). It depends on several prognostic factors: delay to diagnosis, type of organism involved, time to treatment initiation, visual acuity at initial presentation and presence of retinal detachment or hypopion (Khan *et al*. 2002, Binder *et al*. 2003). *E. faecalis* infection is associated with a poor outcome (Scott *et al*. 2003, Chen *et al*. 2009, Rishi *et al*. 2009).

In conclusion, to the authors' knowledge, this is the first described case of vision loss secondary to endogenous endophthalmitis with isolation of *E. faecalis* in a cat, with preservation of both globes over a 1-year follow-up.

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Conflict of interest

None of the authors of this article has a financial or personal relationship with other people or organisations that could inappropriately influence or bias the content of the paper.

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