Proceedings of the
World Small Animal Veterinary Association
Mexico City, Mexico – 2005

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The ocular manifestations of parasitic disease are of great importance in veterinary ophthalmology. In this text the term ‘parasitic disease’ is used in a very broad sense. Rickettsia, fungi and algae (which are not considered in the strict sense as parasites) are included. The epidemiology, due to the increasing migration of companion animals, is changing for many infections. One can observe clinical signs of these diseases far from the traditional endemic areas.

Protozoa

- **Leishmania**

  Canine leishmaniasis (CanL) is caused by protozoa of the *Leishmania donovani* species complex and is transmitted by sand flies. *Leishmania infantum* is the causative agent of the Old World canine leishmaniasis. The disease has been reported around the Mediterranean Basin, Southern Europe, West, East and North Africa, the Middle East, India and China. *Leishmania chagazi*, considered now as synonymous with *L. infantum* is responsible for the disease in the New World.

  Ocular lesions can appear independently of systemic signs, or can be combined with, be seen before or after anti-leishmanial therapy. Any ocular tissue or adnexa can be involved, but blepharitis, conjunctivitis, keratitis and anterior uveitis are the most frequent lesions.

  - **Eyelids:** Periocular alopecia with desquamation is a characteristic feature of the disease. A differential diagnosis should be made with the same type of lesion caused by demodex or pemphigus. In rare cases, multiple granulomas can be observed on the eyelid margins.

  - **Conjunctiva, Sclera and Nictitating Membrane:** Conjunctival hyperaemia is a common finding. The classical conjunctival alteration is chemosis. Multifocal pink granulomas can appear on the nictitating membrane margins or at the limbus.

  - **Cornea:** Corneal involvement is rarely seen independently. More often concurrent inflammation of the conjunctiva (kerato-conjunctivitis) or anterior uvea (kerato- uveitis) are present. Keratitis can be superficial and can lead to epithelial erosions, neovascularisation and eventually pigmentation. Large limbal conjunctival granulomas can extend to the cornea. Interstitial keratitis is characterized by focal opacities (oedema or infiltrate of inflammatory cells). Deep keratitis with vessel growth and endothelial changes is secondary to anterior uveitis.

  - **Anterior uvea:** In this series, in an endemic area, 70% of cases of anterior uveitis in dogs are caused by CanL. In CanL that anterior uveitis is often associated with very low antibody titres and response to anti-leishmanial therapy is very poor.

  - **Posterior segment:** In this series, only 9% of CanL ocular signs involved the posterior segment. Hyalitis, chorioretinitis, papillitis, small retinal haemorrhages and retinal detachment have been seen. Frequently, chorioretinal abnormalities appear to be secondary to involvement of another organ (e.g. renal insufficiency).

  - **Infrequent signs:** These include: corneal dystrophies, exophthalmos and strabismus.

  - **Complications:** The most severe complication is glaucoma secondary to anterior
uveitis, (the cause of 10% of the cases of blindness in this survey). The other observed complications are Keratoconjunctivitis sicca, corneal pigmentation, iris atrophy, cataract, retinal detachment, pan-ophthalmitis and phtisis bulbi.

The diagnosis of ocular manifestations of CanL is based on clinical findings, parasitological techniques, serological tests and more recently using molecular techniques (PCR).

- Treatment: As a rule, ocular inflammation must be treated aggressively to avoid complications. When uveitis is diagnosed, the classical treatment for anterior uveitis should be applied and requires the use of systemic non-steroidal anti inflammatory drugs (NSAIDS).

  · **Toxoplasma**

  The usual hosts of *T. gondii* are Felidae. The ocular signs of the disease therefore are infrequent in dogs. More often, in the canine species, the disease is concomitant with an immune system depression. In order of prevalence, the ocular clinical signs reported in the dog are: anterior uveitis, chorioretinitis, myositis, scleritis and optic neuritis. Serology (ELISA) can help to make a presumptive diagnosis. Other ways of diagnosis are observation of organisms in infected tissues or PCR. The efficiency of treatment is currently controversial. The most commonly used product is clindamycine (25 mg/kg/twice daily). Some cases will need control of the inflammation by corticosteroids.

  · **Neosporum**

  *N. caninum* is a coccidian parasite very similar to *T. gondii*. The infection, in the dog, is usually congenital and very often lethal. The ocular lesions are chorioretinitis, uveitis, and myositis. Intra-tissular oocysts of *N. caninum* can be confused with oocysts of *T. gondii*. Treatment is the same as for toxoplasmosis.

  · **Hepatozoon**

  *H. canis* is a protozoa (*order Coccidia*). Transmission to the dog follows the ingestion of an infected tick (*Rhipicephalus sanguineus*). Conjunctivitis and secretions are present in more than 50% of infected dogs. Other ocular manifestations are uncommon. The diagnosis is difficult because of the number of concomitant infections (leishmaniasis, ehrlichiosis). Treatment with toltrazuril (10mg/kg) is reported to be more efficient than with imidocarb.

  · **Babesia**

  *B. canis* is an intra-erythrocytic protozoa. The vectors in France are the ticks *Dermacentor reticulatus* and *Rhipicephalus sanguineus*. The most frequent ocular signs of the disease are retinal haemorrhages and detachments. Uveitis is an uncommon finding. Diagnosis is based on observation of the organisms in the red blood cells and possibly on serology. Treatment is by piviridine and imidocarb.

  · **Trypanosoma**

  Trypanosomes are flagellate protozoa. Several types cause ocular disease in the dog.

  *T. brucei*, *T. cruzi* are associated with blepharitis, conjunctivitis, keratitis and uveitis. *T. venezuele* is reported to cause blepharitis, conjunctivitis, keratitis and panophthalmitis. *T. congolense* has been associated with corneal lesions. The diagnosis is based on the observation of the flagellates in the blood or aqueous humour. Pentamidine and berenil are used in treatment. The inflammation is controlled by non steroidal anti inflammatory drugs (NSAIDS).

**Rickettsia**

· *Rickettsia rickettsii* is the cause of Rocky Mountain spotted fever.

The ticks: *Dermacentor andersoni, D. varabilis* and *Amblyomma americanum* are the vectors. Ocular clinical signs include: uveitis, deep corneal vascularisation, corneal oedema and retinal haemorrhages. The diagnosis is made by serology or PCR. The therapy is based on the administration of tetracyclines.

· *Ehrlichia canis* is a rickettsial organism transmitted by the tick *Rhipicephalus sanguineus*. Ocular signs are: conjunctivitis, keratitis, uveitis, haemorrhages in the anterior chamber and the vitreous, focal chorioretinitis, vascular tortuosity, aneurisms and retinal detachments. The cause of the ocular lesions is mainly thrombocytopenia and vasculitis. The best diagnostic method is serology. Detection of morulae by cytology is often
disappointing. Doxycycline (10mg/kg/daily) or Fluoroquinolones (enrofloxacin 5mg/kg/daily) are efficient treatments.

- *Ehrlichia platys* can cause uveitis. Serology (if available) is the best diagnostic technique.

**Fungi/Algae**

- **Skin mycosis**
  
  *Microsporum canis, M.gypseum and Trychophyton* can be the cause of lid lesions.
  
  - **Cryptocoiodes**: *C.immitis* can cause uveitis, keratitis and granulomatous panuveitis.
  
  - **Cryptococcus**: *C.neoformans* infections are more frequent in the cat
  
  - **Blastomyces**: The ocular manifestations of *B. dermatidis* infection in the dog are: granulomatous chorioretinitis, retinal detachment, anterior uveitis and optic neuritis.
  
  - **Histoplasma**: A granulomatous anterior uveitis is the main ocular presenting sign of infection with *H. capsulatum*.
  
  - **Geotrichum**: Geotrichosis (*G.candidum*) is an uncommon disease. The result of the ocular inflammation is panuveitis.
  
  - **Aspergillus**: Nervous signs are the more frequent manifestations of *A.fumigatus* infections but some dogs present with an anterior uveitis.

**Parasites**

- **Demodex**: *D.canis* can cause blepharitis with periocular alopecia. Diagnosis is based on direct observation of the parasite in smears.
  
  - **Fly larvae**: Intra ocular fly larvae have been found.
  
  - **Thelazia**: *T. californiensis* and *T. callipaeda* are parasites of carnivorous species. They are localised in lacrimal glands, conjunctival fornix and lacrimal ducts. They cause excessive lacrimation, conjunctivitis and sometimes keratitis. The treatment is removal of the parasites. Administration of an anti-helminthic drug is advised.
  
  - **Dirofilaria**: Ocular manifestations of canine dirofilariosis due to *D.immitis* are conjunctivitis, corneal oedema, and uveitis. Larvae may be visible in the anterior chamber or in the vitreous. The treatment is surgical and requires the removal of the larva before the specific treatment (Systemic NSAIDS and Filaricid) is applied. Care must be taken not to rupture the worm. A rare case of thrombo-embolism was reported to cause blindness.
  
  - **Angiostrongylus**: *A. Vasorum* larvae migrans can be found inside the eye in a similar way to *D.immitis*.
  
  - **Toxocara**: *T.canis* infestation has a very high rate of prevalence in canine populations. Surprisingly, ocular manifestations are very uncommon. Usually the parasite is detected via the pathology. Chorioretinitis, retinal degeneration and optic nerve atrophy have been reported.

**Conclusion**

In many circumstances, ocular lesions are a signal of systemic infections. This is the case with parasitic diseases. The different ocular sensitivity between species against the same parasite is surprising. In all cases control of intra ocular inflammation should be a high priority.