The eye and orbit may also be a site for secondary tumours or may be involved in systemic neoplastic disease, e.g. multicentric lymphoma.

Aetiology

The aetiology of most ocular tumours is not known. Prolonged exposure to sunlight is important in the development of SCC of the eyelids in white cats and possibly in some dogs, as previously described (Chapter 1). Previous trauma and/or chronic inflammation have been reported to incite invasive ocular sarcomas in cats (Dubielzig et al. 1990). Genetic factors are known to be important in the development of retinoblastoma in children where the role of the hereditary retinoblastoma gene (Rb) is well documented. However retinoblastoma is very rare in domestic species.

Epidemiology

The eye is not a common site for development of tumours in cats and dogs, neither are tumours a common cause of ocular disease in these species. Nevertheless, tumours of the eye and surrounding structures are important because of the threat they may pose to the patient’s vision, quality of life and survival. The eyelids are the most common site for ocular tumours in the dog and the majority of these tumours are benign. Tumours of the eyelids and conjunctiva are less common in cats but there is a higher incidence of malignant tumours, especially SCC. Tumours of the third eyelid are rare in both cats and dogs. Primary intraocular tumours are not common in either species, although a variety of tumours have been described affecting the cornea, sclera, iris and ciliary body (Table 16.1). The eye may also be a site for secondary tumours or may be involved in systemic neoplastic disease, e.g. multicentric lymphoma.

TUMOURS OF THE EYELID AND CONJUNCTIVA

Pathology

Meibomian (sebaceous) gland adenomas are the most common tumour affecting the eyelids in the dog, accounting for 60% of eyelid tumours in one study (Roberts et al. 1986). They tend to affect older animals; no sex predisposition has been reported. These tumours arise from the meibomian glands sited at the eyelid margin. Most are benign,
although occasionally meibomian gland adenocarcinoma is reported. Viral papillomas may occur in younger dogs and SCC in older animals. SCC is the most common tumour of the eyelid in cats. Other tumours of the skin, for example mast cell tumours, basal cell tumours and melanoma, may affect the skin of the eyelids and epitheliotrophic lymphoma may affect the mucocutaneous junction of the lid margin (Chapters 4 and 15).

Tumours of the third eyelid and conjunctivae are rare but melanoma, haemangioma, histiocytoma, adenoma, adenocarcinoma and basal and squamous cell tumours may arise at this site, as may, rarely, mast cell tumours. Secondary involvement from multicentric lymphosarcoma may be seen as a bilateral nodular form affecting the third eyelid (Fig. 16.1) or a more diffuse inflamed and swollen

Table 16.1 Summary of tumours affecting the eye and orbit.

<table>
<thead>
<tr>
<th>Site</th>
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<tr>
<td>Extraocular</td>
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<td>Eyelids</td>
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<td>Third eyelid</td>
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<td>Conjunctiva</td>
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<tr>
<td>Orbit</td>
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<tr>
<td>Optic nerve</td>
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<td>Ocular</td>
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<tr>
<td>Iris and ciliary body</td>
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<td>Retina and choroid</td>
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![Fig. 16.1](image) Lymphoma presenting as raised nodules on the third eyelid in a dog.
conjunctiva (Fig. 16.2). Ocular signs are also seen in systemic histiocytosis, a rare familial condition in the Bernese mountain dog. In addition to skin lesions (Chapter 4) affected animals often show signs of scleritis, episcleritis and conjunctivitis. Conjunctival biopsies show a diffuse infiltrate of histiocytic cells.

### Presentation/tumour behaviour/paraneoplastic syndromes

Meibomian gland tumours usually arise on the margin of the eyelid but often extend into the eyelid where they present as a bulging of the conjunctiva (Fig. 16.3). These are slowly growing tumours that range in size from 1–10 mm. They may cause ocular irritation or discomfort leading to ocular discharge and blepharospasm and may ultimately lead to corneal damage and ulceration. Meibomian gland tumours are mostly adenomas which are non-invasive and follow a benign course.

SCC of the eyelids is an invasive tumour often presenting as an ulcerated mass causing distortion and destruction of adjacent soft tissues (Figs 16.4 and 16.5). Although locally aggressive, the rate of metastasis is low.

Melanoma of the eyelid may follow a benign course, especially if the tumour is cutaneous, heavily pigmented and well differentiated histologically. Tumours sited at the mucocutaneous junction of the lid and tumours affecting the conjunctivae tend to be more anaplastic morphologically and malignant in their behaviour with a high rate of distant (haematogenous) metastasis.

Paraneoplastic syndromes are not commonly associated with primary tumours of the eyelids.
Investigations

In the case of meibomian gland tumours and other primary tumours of the eyelids a presumptive diagnosis of a neoplasia may be made on clinical examination. Lymphoma of the third eyelid or conjunctiva may be confused with inflammatory conditions of these tissues.

Bloods

These are not generally indicated in the diagnosis of primary tumours of the eyelids, although they would be included in the work-up of cases with lymphoma.

Imaging techniques

Radiography/ultrasonography of the primary tumour is not necessary. Thoracic films are important to look for metastases in cases of malignant tumours, but most tumours at this site have low metastatic potential.

Biopsy/FNA

FNAs may be difficult to perform safely at this site unless the patient is anaesthetised, in which case it is probably preferable to collect a total excisional biopsy of the lesion for histological diagnosis. Cytological preparations from impression smears and tissue scrapings are of limited diagnostic value. Many meibomian gland tumours are small at initial presentation and as they are non-invasive an excisional biopsy would be justified in such cases. Incisional or punch biopsies are indicated for ulcerative lesions, suspicious of SCC or other malignant tumours, and for multiple or diffuse lesions prior to treatment.

Staging

There is no staging system specific to the eyelids but the clinical staging system for tumours of the skin (Table 4.2) is applicable to this site.

Treatment

Surgery

Most solitary tumours of the eyelids are amenable to surgical resection. Cryosurgery may be preferred for treatment of small, benign lesions as this may provide better preservation of the eyelid margin. Cryosurgery may also be used for early, superficial, non-invasive SCC in the cat. In any tumour of the eyelid it is preferable to treat early, upon initial detection of the problem. Smaller tumours can be resected with minimal damage to the lids; removal of larger tumours may require substantial reconstructive eyelid surgery. In the case of meibomian gland adenoma the surgical resection needs to include any extension of the tumour into the conjunctiva. Larger benign tumours that involve less than 25% of the margin, may be excised by a partial or full thickness wedge resection. Radical surgical resection is required for carcinomas and other malignant tumours of the eyelid and this will require complex reconstructive techniques (Bedford 1999). Removal of the eye may be considered as a salvage procedure for treatment of advanced tumours or those with extensive conjunctival involvement.

Radiotherapy

External beam radiation is rarely used in the treatment of periocular tumours because of the damaging effects of radiation on the tissues of the eye (Chapter 3). Brachytherapy offers a more localised form of radiotherapy that may have a role in the management of periocular carcinomas. Implantation techniques are not widely used in small animals.
due to lack of specialist containment facilities, although irridium brachytherapy is used in treatment of periccular SCC in horses (Fig. 3.7). Strontium 90 provides a superficial source of radiotherapy which could be applied to perioribital tumours, but this technique has not been widely used in small animals.

Chemotherapy

The main indication for chemotherapy in the treatment of eyelid tumours is in the management of lymphoma as described in Chapter 15. A cream containing a 5% solution of the antimetabolite 5-Fluorouracil is available for topical treatment of superficial squamous and basal cell tumours and has been used for SCC of the third eyelid in horses. This agent must not be used (even topically) in cats.

Other

Manual expression of meibomian gland adenomas may release trapped secretions and provide short term alleviation of ocular discomfort prior to surgical management. Photodynamic therapy may offer an alternative to surgical excision or cryosurgery for treatment of early, superficial SCC (Chapter 3).

Prognosis

The prognosis for tumours of the eyelids depends on the histological type. Most meibomian gland tumours are benign and the prognosis following surgical resection or cryosurgery is very good. The prognosis for early SCC (in both cats and dogs) following surgery is also favourable due to the low rate of metastasis from this site. More advanced and invasive SCC carry a guarded prognosis as local recurrence may result from inability to achieve adequate margins of excision. The prognosis for melanoma of the eyelid is guarded because while most are benign, a proportion of such tumours follow a malignant course with haematogenous metastasis.

TUMOURS OF THE ORBIT

Tumours of the orbit are not common but neoplasia is the most common cause of orbital disease. Tumours affecting the orbit may be:

- Primary, usually soft tissue tumours, e.g. fibrosarcoma, mast cell tumour, arising within the retrobulbar space
- Tumours of the adjacent skull, e.g. osteosarcoma, multilobular osteochondrosarcoma, which extend into the orbit
- Local extension of tumours arising in the nasal cavity and paranasal sinuses (e.g. nasal carcinoma – dog) and local extension of tumours of the oral cavity (e.g. squamous cell carcinoma – cat).

Most tumours of the orbit are thus malignant.

Tumour behaviour/paraneoplastic syndromes

The behaviour of tumours which may affect the orbit has been discussed in previous chapters: Chapter 4, Skin; Chapter 5, Soft tissues; Chapter 6, Skeletal system; Chapter 7, Head and neck. Paraneoplastic syndromes are not commonly associated with most of these tumours.

Presentation/signs

Most orbital or retrobulbar tumours are relatively slow growing and usually present as gradual onset exophthalmos with or without conjunctival swelling or chemosis. This may first be noticed as a widening of the palpebral fissure and is clinically detectable as a reduced ability to retropulse the affected eye. As the globe is gradually displaced by the increasing retrobulbar mass, deviation of the eye from its normal axis will result in strabismus. In cases where the tumour is anterior to the midpoint of the globe its growth may cause enophthalmos, but this would be unusual. Conjunctival swelling and oedema may be marked and in some cases may obscure the globe. Unless there are secondary complications (e.g. corneal ulceration or glaucoma) the eye is not usually painful and this lack of pain is a useful sign to distinguish retrobulbar neoplasia from a retrobulbar abscess. However, some retro-
bulbar tumours, e.g. carcinomas that erode into the orbit from adjacent sites, may be more acute in onset than outlined above and these may be associated with considerable pain. Retrobulbar mast cell tumours can also have a more acute presentation due to inflammation mediated through local release of histamine with sporadic massive chemosis.

**Investigations**

A complete ophthalmic examination with pupil dilation is important in the investigation of cases presenting with exophthalmos, as is a full examination of the head and mouth. The main differential diagnoses for exophthalmos are:

- Retrobulbar abscess
- Foreign body
- Cellulitis
- Zygomatic salivary gland inflammation or mucocele.

**Bloods**

These are not generally indicated in the diagnosis of tumours of the orbit. A neutrophilia with a left shift might support a differential diagnosis of infection or abscessation, but a similar picture may occur in tumours containing areas of necrosis.

**Imaging techniques**

Radiography of the skull including the nasal and paranasal sinuses, the orbit and the maxilla may be useful in the evaluation of tumours involving these sites. Ultrasound is a more useful technique for evaluation of the soft tissues of the orbit and retrobulbar space (Fig. 16.6). CT or MRI images can provide excellent detail of the eye and adjacent structures (Fig. 16.7).

**Biopsy/FNA**

FNA is a useful technique in investigation of an orbital lesion. Cytological examination of FNA samples may at least differentiate between inflammatory and neoplastic conditions and in some cases provide a cytological diagnosis (Boydell 1991). Ultrasound guidance for aspirate collection is useful both to direct the needle to the abnormal

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**Fig. 16.6** Ultrasonogram of the eye and retrobulbar mass, showing a discrete hypoechoic mass in the medial aspect of the orbit. (Courtesy of Ruth Dennis, Animal Health Trust, Newmarket, previously published in *Journal of Small Animal Practice* (2000), (41), 145–55, with permission.)

**Fig. 16.7** Contrast enhanced, dorsal plane T1W MRI scan of a cat with an orbital mass. Enhancement of frontal lobe tissue indicates intracranial extension of the tumour. The final diagnosis was lymphoma. (Courtesy of Ruth Dennis, Animal Health Trust, Newmarket, previously published in *Journal of Small Animal Practice* (2000), (41), 145–55, with permission.)
tissue and to aid avoidance of the globe, optic nerve and major blood vessels. A needle biopsy (e.g. truecut) may be considered if there is a large mass to provide tissue for histological diagnosis but an exploratory orbitotomy may be preferable for providing representative biopsy material (Slatter & Abdelbaki 1979).

### Staging

There is no clinical staging system described for tumours of the orbit in cats or dogs.

### Treatment

#### Surgery

Surgical resection is the theoretical treatment of choice for most primary tumours of the orbit, e.g. fibrosarcoma (Gilger et al. 1994). The surgical approach will often necessitate removal of the eye and supporting structures but because of the relatively advanced stage of many tumours by the time of diagnosis, it may not be possible to achieve the margins required for complete eradication of the tumour. Surgical resection of tumours which have invaded into the orbit from the nasal or oral cavity is rarely feasible.

#### Radiotherapy

The use of radiotherapy in the orbit is limited by the sensitivity of the eye to radiation (Chapter 3). Radiotherapy may have a role as an adjunct to cytoreductive surgery (including removal of the eye) in the management of locally invasive retrobulbar tumours, especially soft tissue sarcomas. Radiotherapy has been used alone for treatment of carcinomas of the nasal and paranasal sinuses with retrobulbar involvement, but such treatment is only palliative and carries a high risk of radiation-induced keratitis, keratoconjunctivitis sicca and corneal ulceration.

#### Chemotherapy

With the exception of lymphoma, most tumours involving the orbit are not amenable to chemotherapy.

### Prognosis

Irrespective of tumour type, most tumours affecting the orbit carry a guarded to poor prognosis because:

- Most tumours at this site are malignant and although distant metastasis is not usually a major problem, the locally invasive nature of their growth precludes adequate surgical resection.
- Diagnosis is often delayed until the tumour has reached a relatively advanced stage.
- Treatment is complicated by the proximity of critical structures such as the eye and brain.

### Ocular Tumours

Melanoma and lymphoma are the two most important tumours of the globe in cats and in dogs. Melanoma is the most common primary tumour in both species and usually affects the iris and ciliary body (i.e. intra-ocular melanoma). In dogs melanoma may also be limbal (epibulbar) and in rare cases, arise in the choroid. Ocular lymphoma is usually a manifestation of systemic or multicentric disease which may involve the conjunctiva, the iris, the choroid and the retina. Primary epithelial tumours of the iris and ciliary body are not common in either species although adenoma and adenocarcinoma have been reported and rarely, in young dogs, medulloepithelioma (Dubielzig 1990; Dubielzig et al. 1998). In cats an invasive soft tissue sarcoma may arise secondary to lens rupture several years following ocular trauma. Primary tumours of the choroid and retina are rare in the cat and the dog.

#### Presentation/signs

Primary ocular tumours are usually unilateral. In dogs ocular melanoma usually presents as a nodular pigmented lesion. Epibulbar or limbal tumours may be detected by the owner as a non-painful, pigmented mass bulging from the sclera,
The Eye and Orbit

visible in the pupil, as a result of distortion of the iris or as a result of secondary ocular changes. In cats, spindle cell sarcoma and osteosarcoma have been reported in animals with a history of ocular trauma, 1–10 years prior to the onset of tumour. Post-traumatic sarcomas present as a firm, swollen, opaque, usually non-painful globe (Dubielzig et al. 1990).

In cats and dogs with lymphoma, ocular involvement is more likely to be bilateral and diffuse in nature. Infiltration of the iris may lead to a detectable change in the eye, the iris becoming paler and assuming a swollen appearance. More often, though, such cases present with signs of anterior uveitis, hyphema or hypopyon (Fig. 16.10). Other tumours which metastasise to the eye, e.g. haemangiosarcoma, are also more likely to show a bilateral presentation and intraocular haemorrhage as a common feature.

**Tumour behaviour/paraneoplastic syndromes**

While the biological behaviour of an ocular tumour in terms of malignancy is important for overall
prognosis it is important to appreciate that even benign intra-ocular tumours can cause severe intra-ocular damage and blindness due to space occupying and pressure effects.

Canine ocular melanomas may be described as benign or malignant according to histological criteria (e.g. cellular anaplasia, presence of mitoses); however, local infiltration and progressive destruction of the eye are features common to both benign and malignant variants. Although there was a popular perception of canine ocular melanoma as a malignant tumour with a high risk of systemic metastasis, clinical studies have shown that limbal and benign uveal melanomas do not metastasise. Even in those tumours with histological features of malignancy, the actual incidence of metastasis is low (Wilcock & Peiffer 1986). In contrast, feline ocular melanomas are truly malignant tumours; they are locally destructive of adjacent ocular structures and the development of systemic metastases, especially to the liver, has been documented (Acland et al. 1980).

Benign and malignant variants of iridociliary epithelial tumours have been described. Invasive behaviour is one criterion used to make this distinction, with tumours demonstrating scleral invasion being designated as malignant (i.e. adenocarcinoma) although the actual rate of metastasis in such cases appeared to be very low in one study, if it occurred at all (Dubielzig et al. 1998).

Feline ocular sarcomas are aggressive, infiltrating tumours that invade the retina and optic nerve early in the course of the disease. Tumour extension along the course of the optic nerve may lead to involvement of the optic chiasm, thus affecting vision in the other eye. Orbital extension of the tumour is also possible.

**Investigations**

A complete ophthalmic examination with pupil dilation is important in the investigation of cases presenting with an ocular mass, or with less specific signs of ocular disease.

**Bloods**

These are not generally indicated in the diagnosis of ocular tumours, although would be indicated in the investigation of animals with lymphoma and are important in pre-surgical assessment of the patient.

**Imaging techniques**

Radiography is of little value in the evaluation of ocular tumours, but thoracic and abdominal films would be required in the evaluation of animals with malignant or systemic tumours. Ultrasound is a more useful technique for evaluation of the eye and can provide detail on the size and position of a mass and its relationship with adjacent structures. CT or MRI images can be useful where orbital extension is possible.

**Biopsy/FNA**

While FNA or biopsy via iridectomy might assist in the diagnosis of some ocular tumours, most ocular tumours are diagnosed following either an excisional biopsy or, in more advanced cases, following enucleation of the eye.

**Staging**

There is no clinical staging system described for ocular tumours in cats or dogs. In animals with lymphoma, ocular involvement would signify stage V disease according to the WHO stage grouping (Owen 1980).
Treatment

Surgery

Surgical resection is the treatment of choice for most primary ocular tumours. In some cases, small, localised lesions of the iris can be excised successfully without loss of the eye. Limbal melanomas in dogs and cats may also be treated by local surgical excision. Most cases, however, will require at least enucleation of the eye and in cases where the tumour has invaded the sclera and extraocular tissues, exenteration of the orbit is recommended.

Radiotherapy

Most ocular tumours are not amenable to radiotherapy although radiotherapy may have a role as an adjunct to cytoreductive surgery (including removal of the eye) in the management of locally invasive tumours, such as ocular sarcomas.

Chemotherapy

With the exception of lymphoma, ocular tumours are not amenable to chemotherapy. In dogs and cats with multicentric lymphoma, ocular lesions may improve following systemic chemotherapy with any of the protocols described in Chapter 15, although the prognosis for animals with ocular involvement (i.e. stage V lymphoma) is very guarded. Survival times tend to be shorter than those for stage III or IV lymphoma and recurrence of ocular signs often heralds systemic relapse.

Other

Non-invasive diode laser photocoagulation has been used for treatment of solitary lesions of the iris in dogs, presumed to be melanoma, and this would appear to be a safe and effective alternative for isolated lesions (Cook & Wilkie 1999).

Prognosis

The prognosis for ocular tumours depends on histological type and species. Irrespective of whether the tumour is described as benign and malignant it would seem that most canine ocular melanomas carry a favourable prognosis following enucleation. In contrast most feline ocular melanomas are malignant and the prognosis for such cases is poor due to a high risk of systemic metastasis. The prognosis for iridociliary epithelial tumours is favourable in both species but feline ocular sarcomas are aggressive tumours and are unlikely to be cured by surgical resection. The prognosis for ocular lymphoma is poor for the reasons outlined above.

References


