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Chapter 23

Tumors of the Eye

Nedim C. Buyukmihci

Neoplasia of the globe is relatively uncommon when compared with the prevalence of other disorders of the eye. The greatest challenge for the clinician is saving both the eye and the vision. When neoplastic transformation occurs, however, the small size of the organ and the extreme interdependence of the contiguous tissues make it difficult to have a successful therapeutic outcome in terms of vision. The nature of the eye provides unique opportunities for early diagnosis because the clear ocular media allow for visualization of early changes before they become serious in terms of the life of the animal. Since the eye is not essential for life, enucleation of a tumor-containing globe is often a curative procedure. Fortunately, primary neoplasms usually are unilateral, allowing for a considerable degree of visual function to be retained through the remaining normal eye.

At present, little is known about the biologic behavior of most primary ocular neoplasms, particularly in species other than the dog and cat. Because they occur infrequently, there are minimal data available to provide guidelines for clinical diagnosis, treatment, and prognosis. Much of the veterinary literature is anecdotal, describing single or a few cases, although much can be gained by reviewing this literature. Because enucleation is used in the treatment of most intraocular neoplasms, development of therapeutic regimens that would allow salvage of the globe has

been hindered. Another hindrance is the nature of animal patients. They cannot describe or complain about visual field loss or other signs. By the time we notice signs of ocular disease, the condition of the eye has often deteriorated to a point where there is considerable irreversible damage within the eye.

This chapter will cover primary neoplasms of the globe and orbit, whereas primary neoplasms of the eyelids and conjunctiva are covered in chapter 14 (see section on squamous cell carcinoma of the cornea, conjunctiva, and eyelids of horses and cattle). The practitioner must remember, however, that the eye is the "window to the body". It is not uncommon for nonocular neoplasms to metastasize to the eye or to have an effect on the eye. The feline leukemia-lymphoma complex is the most common of these even though neoplastic cells are not always present within the eye. Some neoplasms such as the canine transmissible venereal sarcoma have a propensity for involving the eye if they metastasize. Neoplasms of the sinuses often encroach upon the orbit and globe. When ocular neoplasia is suspected, the veterinarian must carefully evaluate each case to determine if the lesion is limited to the eye or is the result of nonocular disease. Routine procedures such as a thorough general physical examination, thoracic radiographic studies, and liver function tests may aid in differentiating primary from secondary neoplasms. Histologic ex-

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amination of a diseased eye or of tissue aspirated from such an eye may lead to a diagnosis of systemic disease in an animal that has ocular disease and generalized illness of unknown origin.

As stated above, our present level of understanding is meager. As more primary ocular neoplasms are recorded, we may have to alter methods of diagnosis and treatment. In this regard, all veterinarians that establish a diagnosis of primary intraocular or orbital neoplasia should carefully document it. History, clinical findings, and long-term follow-up are essential if we are to progress in administration of appropriate therapies and learn to establish accurate prognoses. Histologic confirmation of all removed tissues is necessary to provide additional background information.

PRIMARY NEOPLASMS OF THE GLOBE

There are no clinical features that reliably distinguish one type of intraocular neoplasm from another. These neoplasms share many general signs, particularly when they involve the uveal tract. In most situations, aqueous flare, miosis, hypotony, and photophobia occur to a variable degree. As the neoplasm enlarges or undergoes necrosis, uveitis increases in intensity. If the neoplasm is near the lens, focal equatorial cataract may occur. Uveitis severe enough to result in anterior or posterior synechiae may predispose the globe to glaucoma. Choroidal neoplasms or those extending into the choroid from the ciliary body are almost always associated with separation of the sensory retina from the retinal epithelium or detachment of the entire retina from the choroid.

One of the most common manifestations of intraocular neoplasia is an eye that becomes blind, glaucomatous, and painful because initial signs were missed. Another common manifestation is simply generalized ocular inflammation. When the eye is moderately to severely inflamed or is glaucomatous, the animal will experience pain severe enough to show blepharospasm, pawing at the eye, or depression. In these situations there will be little to no response to treatment aimed at the signs. If the ocular media are clear, the neoplasm may be visualized. However, if the ocular media are opaque, preventing examination of the eye's interior, one must rely on supportive diagnostic procedures. Such eyes are generally not salvageable and it may be clinically difficult to establish that they contain a neoplasm. If available, ultrasonography may provide the necessary evidence for the presence of an intraocular mass. Even if this cannot be established, if the eye is extremely painful and is considered permanently blind, enucleation fol-

lowed by histologic examination can clarify the cause as well as provide relief to the patient.

Numerous types of intraocular neoplasms have been reported.^{1,2} Because of their frequency, melanoma and ciliary body epithelial neoplasms are discussed here. Also covered in this section are newly described sarcomas. The reader is referred to the publications of Barron and Saunders for a review of extremely rare types of intraocular neoplasms including hemangioma, hemangioendothelioma, chondrosarcoma, and leiomyosarcoma.^{1,2} Whereas retinoblastoma is an important tumor in people, it has rarely, if ever, been documented in animals.³

Melanocytic Neoplasms

Melanoma is the most frequently described primary intraocular neoplasm of dogs and cats.^{1,4-8} It has also been reported in horses, rats, and fish.⁹⁻¹¹ Melanomas are classified according to cell type.¹² Spindle A cells are long and slender, being flattened with ovoid nuclei and without nucleoli. These cells generally have a low mitotic index and contain a variable amount of melanin. Spindle B cells are plump and have large ovoid nuclei with prominent nucleoli. These cells also have a low mitotic index and are variably melanized. Epithelioid cells are large and polyhedral or slightly spindle-shaped. These cells have moderate to abundant cytoplasm, sometimes with indistinct borders. The nuclei are large and round or irregular with prominent nucleoli. There is a high mitotic index relative to spindle cells and melanization is generally poor. When a melanoma contains spindle and epithelioid cells, it is termed mixed. Bleaching of histologic sections with potassium permanganate is often necessary to accurately determine the specific cell type.

Tumors that are grossly pigmented contain well-melanized cells or they are covered by melanized tissue. Amelanotic melanomas have the cytologic capacity to synthesize melanin; they do not, however, and appear as nonpigmented masses which are often confused with unrelated neoplasms.

Many melanomas contain large, rounded cells filled with melanin, which often comprise most of the tumor. They have a low mitotic index and resemble melanocytes, and are probably a benign reactionary component.⁴ Collections of these cells with no indication of malignancy are referred to as melanocytomas or nevi. When they are present with neoplastic cells, they may represent the origin of the neoplasm.¹³

An extensive classification system correlating histologic with clinical features has been developed in human medicine although there is considerable controversy as to its prognostic value.¹⁴⁻¹⁹ Reticulin con-

tent in human tumors appears to be inversely proportional to the tendency for metastasis.²⁰ There is only limited evidence that this is true for nonhuman melanomas.¹ Due to the paucity of case material and lack of long-term follow-up information, we do not know if extrapolation from human data will prove to be of prognostic value for melanomas of animals. For example, the biologic behavior of uveal melanomas in people seems considerably different from that described for dogs. In particular, extension into the sclera or orbit is usually a grave sign in human beings. Scleral or orbital invasion has been observed by me in several dogs. Surgery was done although removal of the affected tissue was incomplete in some. Nevertheless, there was no evidence of metastatic disease nor recurrence of the neoplasm up to two years following surgery. In the case of human choroidal melanomas in particular, there is considerable debate as to whether enucleation might lead to dissemination of the tumor along with poor survival rates.^{17,18,21} Investigators have developed surgical techniques that might minimize the possibility of tumor cell release during enucleation.^{22,23} To date, there have been no data to suggest that enucleation influences the development of metastatic disease in naturally occurring animal melanomas.

A major question concerning melanomas of animals seems to be whether they should be classified as benign or malignant. Whereas the tumors are often locally invasive and destructive to the eye, a major criterion for malignancy, metastasis, is an infrequent event. Thus, it is inappropriate to give a poor prognosis based on the behavior of similar tumors in people. The analyzed animal data simply do not warrant "pigment panic".

There are several theories on the histogenesis of melanomas.¹³ These tumors may be derived from mesodermal elements of the uveal tract. Another origin might be from retinal epithelium or from Schwann cells associated with the ciliary nerves. The most likely origin in human beings, however, seems to be from preexisting nevi.¹³ There is some evidence that this is true in other species but further study is necessary.

Most intraocular melanomas in animals arise from the anterior uveal tract. Another relatively frequent site is the epibulbar region while reports of purely choroidal involvement are rare. When there is extensive involvement of the entire uveal tract, however, it may be impossible to determine the primary site. Since we cannot verify whether such tumors began in the choroid, we may have a false impression of the rareness of choroidal melanomas.

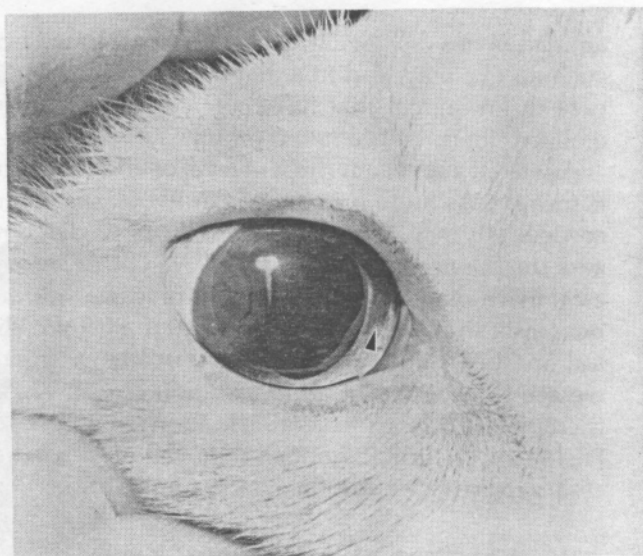


Fig. 23-1. Diffuse and nodular iris melanoma in right eye of a 9-year-old castrated male domestic shorthair cat. Laterally, the mass has protruded into the anterior chamber; in the remainder of the iris, it has caused discoloration only (arrowhead). The zone of intermediate density between pupil and pupillary border of iris is a reflection. There was no evidence of metastatic disease and the cat was healthy for at least 6 months after enucleation.

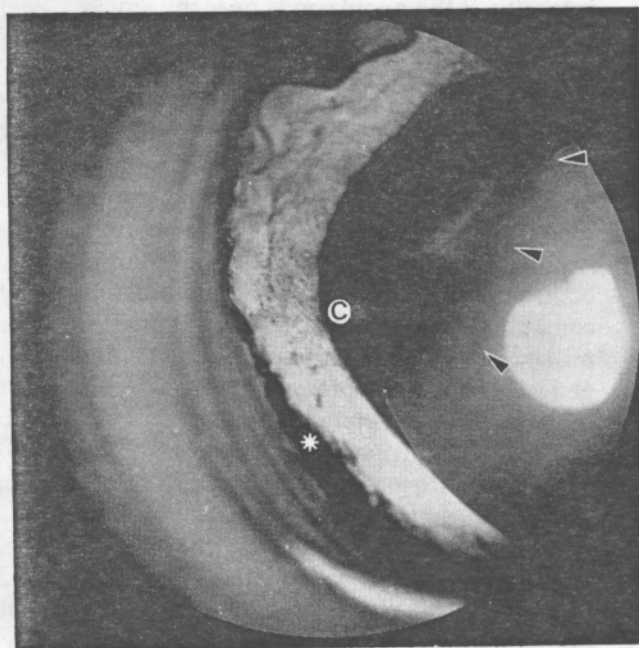


Fig. 23-2. Ciliary body melanoma in right eye of 9-year-old spayed female siamese cat. In this goniophoto, the tumor is demarcated by arrowheads. An aphakic crescent (C) is present laterally due to lens displacement by the tumor. There is also invasion of the drainage angle by the tumor (asterisk). There was no evidence of metastatic disease and the cat was healthy for at least 2½ years after enucleation.

Anterior Uveal Melanomas

These vary from discrete iris nodules to total involvement of iris and ciliary body with neoplastic tissue (Figs. 23-1 and 23-2). Neoplastic tissue may extend into peripheral choroid, sclera, cornea and drainage angle. Occasionally the neoplasm may fill the globe and extend posteriorly to the optic disk or protrude from the anterior segment of the globe (Fig. 23-3).

The age at diagnosis varies from 1 to 13 years but most patients are older than 6 years. German shepherd dogs and Persian cats seem to be at higher risk. Clinical signs in addition to those previously mentioned may include the presence of an anterior chamber or iris mass, thickening and discoloration of the iris, lens subluxation, or protrusion of a mass between the iris and lens through the pupil. Cytologically, spindle A, spindle B, epithelioid, and mixed forms are seen. Melanization varies from none to heavy.

Enucleation is the most widely used treatment. When follow-up data were available for reported cases, the vast majority of animals had no evidence of recurrence or metastasis as long as 5 years after surgical procedure even when the tumor extended through the sclera.⁴ Tumors of the epithelioid or

mixed type in dogs and cats showed a moderate tendency to metastasize, primarily to the liver and lungs.⁵

The major entities from which anterior uveal melanomas must be differentiated are nevi or melanocytomas, granulomatous inflammation, other intraocular neoplasms and anterior uveal cysts. If the lesion involves only the ciliary body, it may be difficult to recognize. Nevi or melanocytomas are not distinctive; however, they enlarge slowly, if at all, and are not usually invasive. It would be prudent to follow discrete lesions rather than recommend surgery (Fig. 23-4). In this regard, gonioscopy is important in defining the limits of a mass. Nodular inflammatory changes usually appear to be noncohesive compared with a neoplastic mass. If the iris is diffusely inflamed and thickened, it may be impossible to clinically distinguish from diffuse melanoma. Biopsy could lead to dissemination of a neoplasm. Examination of cells from an anterior chamber centesis may help establish a diagnosis but there are often inflammatory cells associated with neoplasms. A short course of topical steroids and careful follow-up may help establish an inflammatory change. Other intraocular neoplasms can easily be confused with melanomas although present treatment for all is enucleation. Anterior uveal cysts, on the other hand, are benign and must be differentiated from melanoma. Cysts are generally

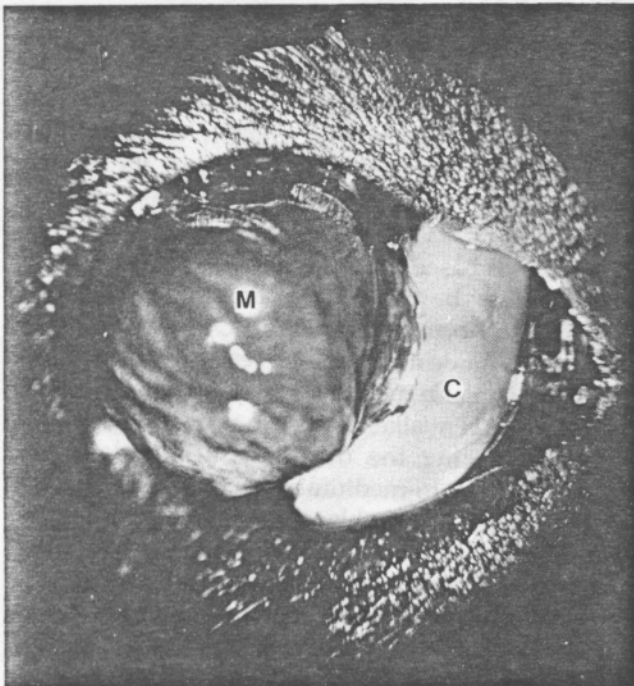


Fig. 23-3. Anterior uveal melanoma in right eye of 8-year-old male German shepherd dog. The tumor (M) has perforated the perilimbal sclera and protrudes from the globe. The cornea (C) is displaced nasally. There was no evidence of metastasis and the dog was healthy for at least 7 months after enucleation.

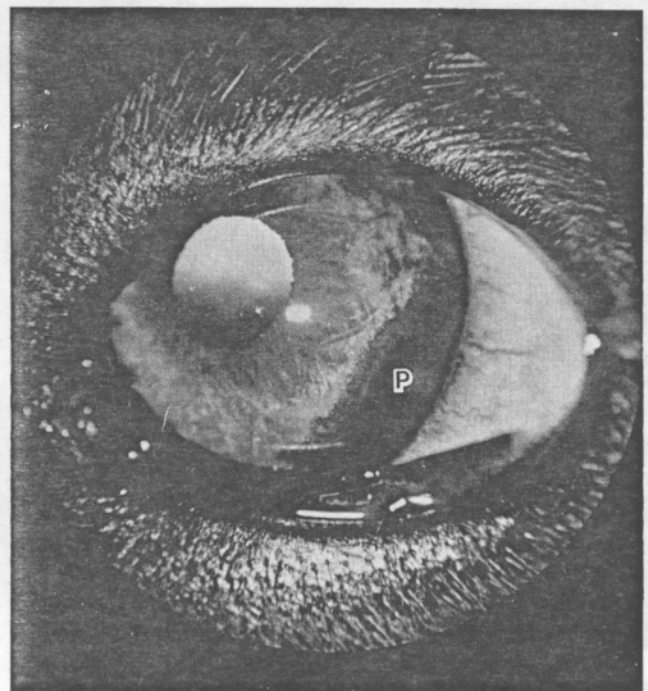


Fig. 23-4. Pigmented mass (P) in left iris of 3-year-old male golden retriever dog. The mass involved the drainage angle although there were no changes in it over a 1½ year period.

smooth and spherical, even when they are multilobular. Occasionally they will be free-floating in the anterior chamber. Moreover, cysts, but not melanomas, will usually transilluminate (Fig. 23-5). This can be accomplished by retroillumination from the fundus or by directing a narrow beam of light at the mass.

Choroidal Melanomas

Only a few cases of exclusively choroidal melanoma have been reported, all in dogs.^{5,24-26} Ophthalmoscopic visualization of choroidal disturbance was noticed as early as 9 months of age.²⁴ Tumor enlargement was slow. The affected globes were enucleated and there was no evidence of metastatic disease. All of the tumors have been of the spindle variety, usually spindle B.

Clinical signs for purely choroidal involvement are initially minimal although there may be subtle signs of uveitis. Early cases will go unnoticed unless the eyes are included in routine physical examinations. The earliest detectable lesion is a circumscribed, moderately pigmented zone that appears to have mass and protrudes slightly into the fundus (Fig. 23-6). Indirect ophthalmoscopy is essential in appreciating these early changes. As the mass enlarges, there is further darkening of the lesion and greater disturbance of overlying retina. The mass may protrude into

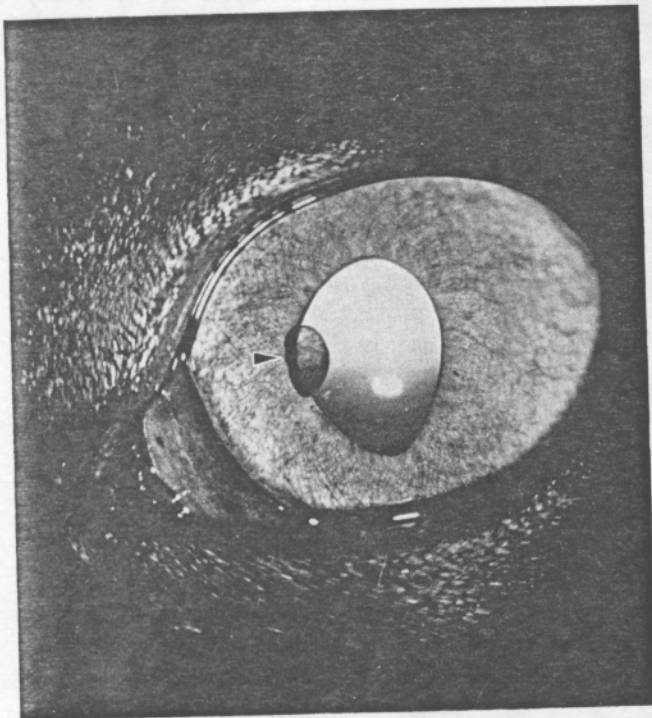


Fig. 23-5. Iris cyst (arrowhead) in left eye of 5½-year-old spayed female Siamese cat. The patient was thought to have a melanoma; notice, however, that the mass transilluminates with light reflected from the fundus.

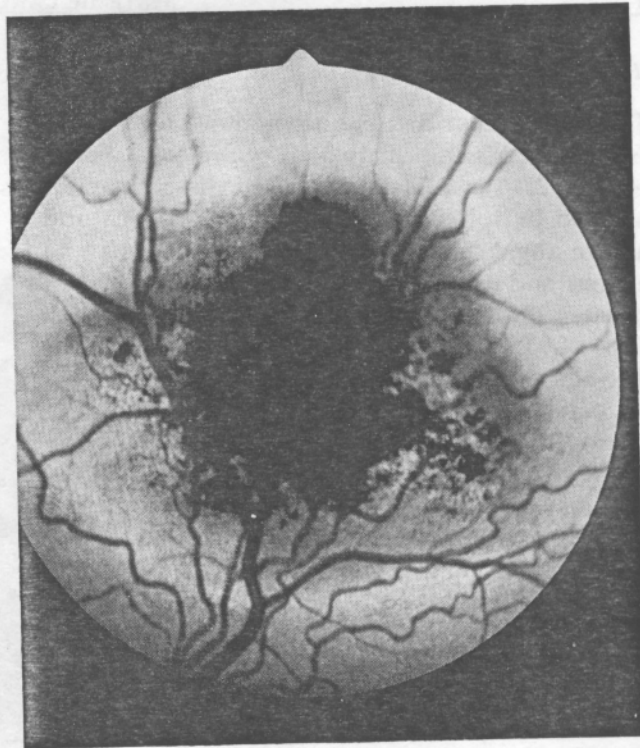


Fig. 23-6. Presumed choroidal melanoma in an 11½-year-old male Beagle. Notice the dark coloration of the tapetum surrounding the darkly pigmented central zone; this indicates a choroidal mass. The dog was followed for 1½ years with only minimal change in the lesion and no other illness. (Photograph courtesy Dr. Steve Gross, Animal Medical Center, New York.)

the vitreal cavity, underneath the retina, or it may cause retinal separation or detachment (Fig. 23-7). At this point, signs of uveitis may become obvious. The animal's vision, however, is unlikely to be affected unless retinal involvement is severe in the tumor-bearing eye and the fellow eye is otherwise compromised.

Diagnosis is based on clinical observations. The initial lesion may be difficult to clinically differentiate from a melanocytoma or nevus. Occasionally focal choroiditis with destruction of overlying tapetum unrelated to neoplasia may give the impression of a pigmented mass. If available, A-scan ultrasonography is helpful in making the diagnosis. Choroidal melanomas have low-to-medium reflectivity.²⁵ When unsure, the most reasonable approach is periodic observation. Enucleation would seem to be warranted only if the lesion shows signs of enlargement or is associated with intractable ocular inflammation or pain.

Epibulbar Melanomas

These tumors have been reported only in dogs although I have seen one in a cat (Fig. 23-8) and a

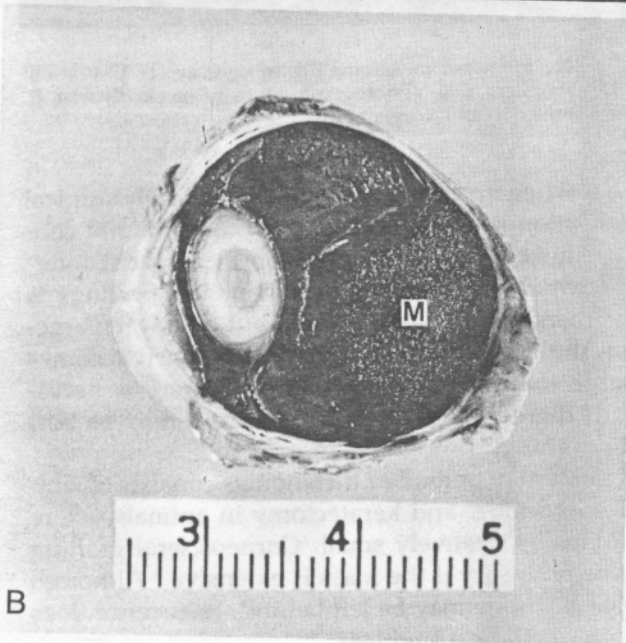
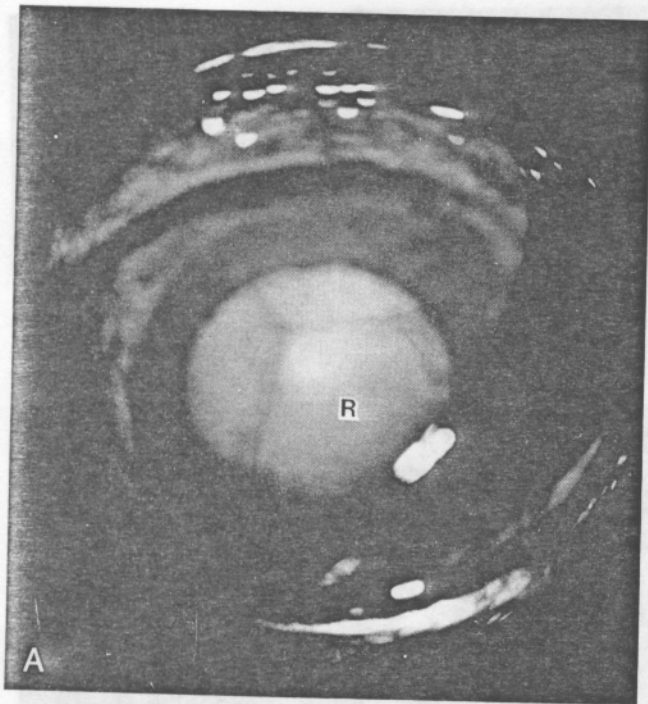


Fig. 23-7. *A*, Choroidal melanoma in right eye of 10-year-old mongrel dog. Although the tumor was inapparent clinically, it had caused uveitis, glaucoma and retinal separation (*R*) which is visible through the pupil. Because the eye was blind, painful and untreatable, it was enucleated. There was no evidence of metastatic disease and the dog was healthy for at least 3½ years after enucleation. *B*, Gross appearance of eye opened in a sagittal plane. There is a melanoma (*M*) arising from the choroid. The ruler is marked off in millimeters.

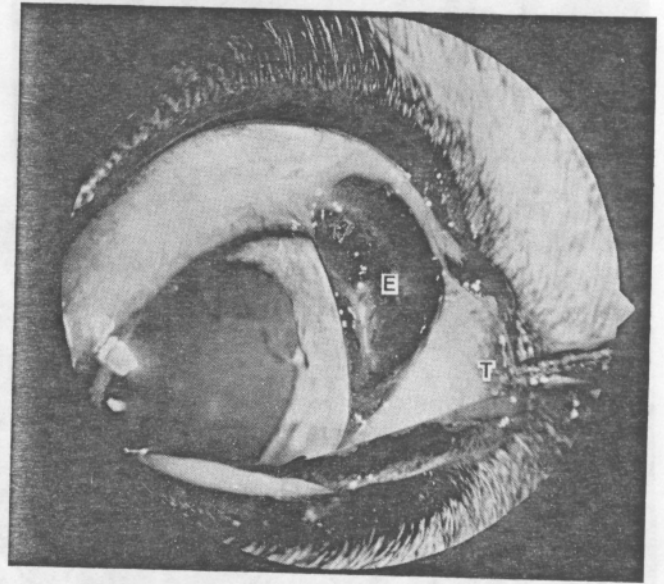


Fig. 23-8. Epibulbar melanoma (*E*) in right eye of a 10-year-old female domestic shorthair cat. The third eyelid (*T*) is retracted with forceps. There was no evidence of recurrence or metastatic disease at least 4½ years after removal of the mass.

melanocytoma has been reported in one horse.^{4-6,27} German shepherd dogs may be at greater risk than other canine breeds.

The age at which epibulbar melanomas have been diagnosed has varied from 2 to 11 years but most patients have been 3 to 7 years old.²⁸ The tumors arise in the limbal tissues with a predisposition for the dorsal half of the globe. Although amelanotic forms are seen (Fig. 23-9), these tumors are usually heavily melanized and are easily visible to the client and clinician (Fig. 23-10). Conjunctiva covers the tumors giving them a smooth surface. Although many grow so slowly that they appear unchanging, some are invasive and may extend widely into cornea or sclera. Occasionally they may extend inward into the iris and ciliary body. In these cases it may be difficult to be sure that the tumor is not an epibulbar extension of an intraocular tumor. The available reports indicate that epibulbar melanomas do not metastasize.

There are usually no clinical signs associated with epibulbar melanomas. Epiphora and conjunctivitis are sometimes seen. If the tumor enlarges and invades cornea or uveal tissue, corneal erosion or iridocyclitis may be produced.

Epibulbar melanomas must be differentiated from nodular inflammatory lesions, scleral staphyloma, uveal prolapse, congenital or acquired benign melanosis, and melanocytomas or nevi. Nodular inflammatory lesions are not melanized and there usually is considerable inflammation of the ocular anterior segment. Since inflammatory nodules may respond

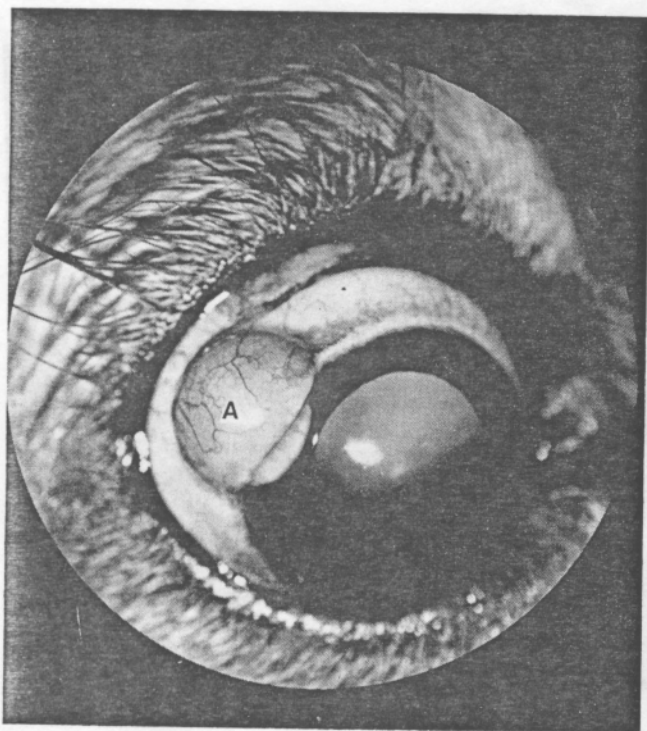


Fig. 23-9. Amelanotic epibulbar melanoma (A) in right eye of 2-year-old American cocker spaniel. (Photograph courtesy of Dr. Charles L. Martin, University of Georgia.)

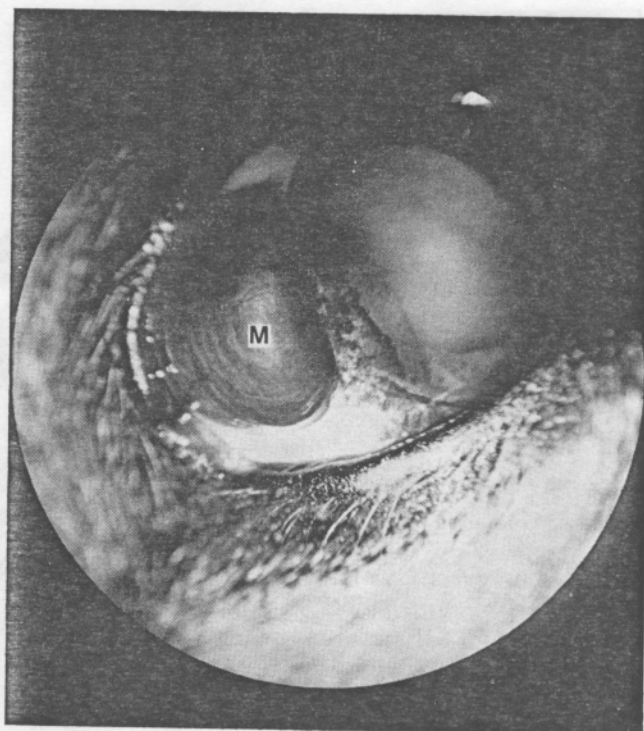


Fig. 23-10. Epibulbar melanoma (M) in right eye of 12-year-old German shepherd dog. (Photograph courtesy of Dr. Charles L. Martin, University of Georgia.)

to topical corticosteroids, a short course of therapy may be warranted to differentiate them from amelanotic melanomas. If there is no response, excision and histologic examination may be necessary for a definitive diagnosis. Eyes with staphylomas are often hypotonic. The bulging uveal tissue is soft and is easily indented. Such eyes, as in the case of uveal prolapse, usually have a history of trauma or severe focal inflammation that would account for the exposure of the uveal tissue. Benign melanosis and melanocytomas or nevi may be difficult to distinguish from melanomas since they can enlarge over time. Histologic examination is the only reliable means of differentiation. Because many pigmented epibulbar masses have not enlarged significantly after as long as 2 years' observation, and have not caused difficulty for the animal, it seems prudent to take a conservative approach in their management regardless of their histologic nature. Thus, when there is a suspicious focal epibulbar mass, a thorough ocular examination should be done to determine its limits. Ophthalmoscopy and gonioscopy are essential in this regard. It is also important to ensure that the client knows exactly where the mass is and what to watch for concerning its progression. If there is a history of rapid enlargement or if there is extensive involvement of

the eye when first seen by the clinician, timely surgical intervention is warranted. When growth is not confirmed historically, reexamination at frequent intervals with careful documentation of the findings is recommended. If there is slow but steady enlargement, the mass should be removed before it becomes so large that major reconstructive surgery is necessary. If there is no growth, however, it may be best to do nothing.

Treatment of epibulbar melanomas consists of lamellar sclerectomy and keratectomy in animals where the tumor is relatively small. Corneoscleral grafting may be necessary if the mass is extensive.⁶ Although neoplastic tissue may be left behind, recurrence does not appear to be a problem.

If tumor extends into the globe, it may result in moderate to severe clinical signs as explained earlier. Thus, although these tumors have not been shown to metastasize, enucleation may be necessary simply to alleviate pain.

Investigative Ocular Melanoma Research

The seriousness of ocular melanoma in human beings has led to considerable research on experimentally induced melanomas in animals. It is unclear to what degree the results of this work will have appli-

cability in clinical veterinary medicine. The diagnosis of melanoma and other intraocular neoplasms may be enhanced by use of hematoporphyrin derivative. This material selectively accumulates within neoplastic tissue and fluoresces red when excited by blue light. After intravenous injection of hematoporphyrin derivative, appropriately filtered light is used to illuminate the suspicious tissue. Lesions anterior to the lens usually are discerned. The lens fluoresces, too, so that a modified indirect ophthalmoscope must be used for lesions of the ocular posterior segment.²⁹ There have been no direct toxic effects from hematoporphyrin derivative although transient photosensitization may occur.

In some cases it may be difficult to distinguish histologically between an amelanotic or hypomelanotic ocular melanoma and a carcinoma metastatic to the eye. The clinical implications would be considerably different. In one study on people, most melanotic and essentially no nonmelanotic tumors were positive for the presence of S-100 protein which was not related to the degree of melanin synthesis.³⁰

Metastasis of a uveal melanoma is usually not evident until rather late in the clinical course of the disease. Routine methods of thoracic radiography or gross liver function tests are ineffective until there has been considerable spread and tissue damage. Serum hepatic cell-surface enzymes, isoenzymes and sialic acid may be helpful in detecting early metastatic disease. In a study using human patients with uveal melanoma, those with metastasis and those without were differentiated on the basis of these biochemical assays.³¹ Furthermore, this differentiation was possible early in the disease process, long before other diagnostic methods suggested metastasis.

Various nonexcisional treatment regimens have been tried for ocular human melanomas and in animals with induced tumors.³²⁻³⁴ The most promising treatment for melanomas of the ocular anterior segment is hematoporphyrin phototherapy.³³ Hematoporphyrin derivative is given intravenously and accumulates in the neoplastic tissue making it photosensitive. When the eye is exposed to red light a phototoxic reaction occurs leading to cell death and tumor remission. Large tumors can be treated with repeated small doses of hematoporphyrin derivative to minimize serious intraocular inflammation that may occur with massive cell die-off. It appears that the uptake is not limited to melanomas so that knowledge of the neoplastic cell type may not be necessary prior to initiating therapy.

Ciliary Body Epithelial Neoplasms

These are the second most frequently reported primary intraocular neoplasms in animals. Although

there have been occasional reports of tumors arising from iris epithelium, the vast majority are from ciliary body epithelium. These tumors are classified as congenital or acquired.

Most of these tumors appear nonpigmented because the neoplastic cells do not produce melanin. There usually are a few scattered melanocytes throughout the tissue but they are not enough to impart a dark appearance. In some cases, however, the tumor may be covered by normal, pigmented tissue. The mass may be mistaken for a melanoma and only histologic examination can provide precise tumor classification.

Congenital Ciliary Body Neoplasms

These are thought to arise from primitive ciliary epithelium and are called medulloepitheliomas.³⁵ They can occasionally arise from tissues of the posterior segment of the eye.³⁶ Nonteratoid forms resemble developing retina histologically. They often have a net-like architecture and have previously been called diktyomas. Teratoid medulloepitheliomas contain tissue not normally seen at this site. The pluripotential nature of the ciliary epithelium is manifest by the presence of retinal epithelium, photoreceptors, neurons, neuroglia, vitreous, smooth muscle, striated muscle and hyaline cartilage. These tumors previously were termed teratoneuromas.

Medulloepitheliomas are rarely seen but have been reported in a variety of species.^{3,36-38} Nonteratoid medulloepithelioma appears to be the most commonly recognized primary intraocular neoplasm in the horse.³⁸

Medulloepitheliomas are usually apparent within the first 6 to 12 months of life. However, they have been seen in animals several years old. The clinical signs are similar to those seen with other intraocular neoplasms. These tumors, however, seem to have a tendency to shed neoplastic cells which clump together and may appear in the anterior chamber. Groups of cells may then become adherent to the iris or cornea and mimic granulomatous precipitates. In all species, these tumors can be locally invasive. It is conceivable that they may invade the optic nerve and enter the brain via this route. They have not, however, been associated with metastatic disease. Enucleation is generally curative and is the treatment of choice.

Acquired Ciliary Body Neoplasms

These tumors have primarily been seen in middle-aged or older dogs.³⁹ They arise from mature ciliary epithelium and are comprised of adenomas (benign epitheliomas) and adenocarcinomas. Both appear as

pink-white masses that may protrude through the pupil or displace the iris and lens as growth occurs (Fig. 23-11). Significant intraocular inflammation is associated with both benign and malignant forms, although necrosis, local tissue invasion, and other factors may result in subjectively greater inflammation with adenocarcinomas. These tumors may be clinically inapparent, being found only incidentally in eyes enucleated for other reasons. Although adenocarcinomas have the potential to metastasize, it is an uncommon event. Since enucleation is the treatment of choice for adenomas and adenocarcinomas, it may be a moot point whether clinical differentiation is possible.

Histologically, adenomas and adenocarcinomas take on solid, papillary, or pleomorphic patterns. The cell type can vary considerably because of the pluripotential nature of the ciliary or iridal epithelium. There may be bone or cartilage formation as well as cystic changes with pools of mucoid material. Primary adenocarcinomas may be confused with metastatic adenocarcinomas; however, histochemical differentiation is possible. Hyaluronic acid is part of the vitreous humor which is a product of normal ciliary epithelium. Secretion of hyaluronic acid by an adenocarcinoma is considered evidence that the neoplasm is primary to the ciliary body.⁴⁰

Small adenomas can be removed by partial iridocyclectomy, although limited experience has shown this could be dangerous. The neoplasm may not be completely excised and may recur with malignant transformation.⁴¹ Thus, it seems prudent to enucleate an eye containing a ciliary body tumor. In some cases, eyes with ciliary body neoplasms have intractable

uveitis, glaucoma or cataract which creates severe functional deficits and enucleation is the therapy of choice.

Sarcoma in Traumatized Eyes

There have been two reports of sarcomas occurring in traumatized cat eyes.^{42,43} Although the type of trauma was unknown, in each case the alleged occurrence was several years prior to discovery of neoplasia. Most of the eyes were phthisical and had severe lens damage. Sarcoma extended into the optic nerve, and, in one cat, into the brain.⁴³

It is unclear what the pathogenesis was in these cases; however, one can speculate that chronic inflammation provided fertile soil for transduction of normal cellular oncogenes into FeLV sequences. Unfortunately, the FeLV status of these cats was unknown (see chapter 13, part I, for additional information on inflammation and development of neoplasia). In one patient, there was intraocular bone which may have undergone neoplastic transformation.⁴² Lens epithelium and retinal epithelium are other possibilities as sources of tissue that transformed independent of whether FeLV was present.

Whereas neoplasia of this sort appears to be an extremely rare occurrence, the reported cases point to the need of being circumspect in dealing with phthisical eyes. Such eyes are of no use to the animal regardless of neoplasm presence. If there is a change in character, such as chronic inflammation or enlargement, enucleation with radical optic neurectomy is indicated.

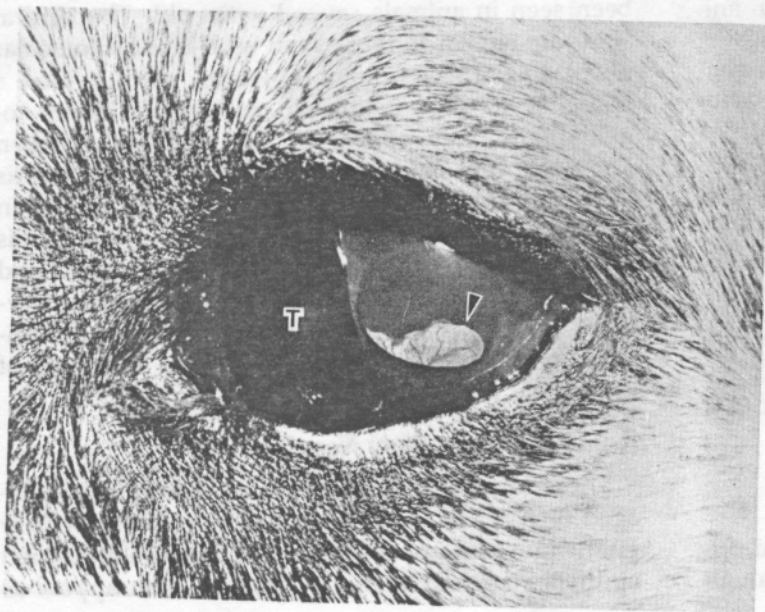


Fig. 23-11. Ciliary body adenoma (arrowhead) in left eye of 5-year-old male Great Dane dog. The third eyelid (T) is protruding across the nasal aspect of the globe.

PRIMARY NEOPLASMS OF THE ORBIT

Primary orbital neoplasms occur infrequently; therefore, little information is available on their biologic behavior and treatment. There are essentially no clinical features that positively differentiate one histologic type of orbital neoplasm from another. Regardless of the type, an orbital tumor produces signs referable to a space-occupying lesion with globe displacement. The degree and direction of displacement of the globe will depend on the size and location of the tumor. Lesions in the orbital apex or within the extraocular muscle cone result in rostral displacement. This is best visualized by observing the animal from above. Tumors involving the orbital walls usually cause displacement of the globe to the opposite side (Fig. 23-12A) and, if the lesion is deep enough within the orbit, exophthalmos. Protrusion of the third eyelid is a frequent occurrence regardless of tumor location (Fig. 23-12A). As the tumor enlarges, globe displacement, particularly exophthalmos, becomes greater and ocular motility is reduced or prevented. Exposure keratitis is a common complication. Although pain is not a feature of orbital neoplasia itself, secondary changes such as keratitis or orbital inflammation are painful. Occasionally, the tumor

may penetrate the sclera or perforate it and enter the intraocular space, resulting in uveitis and retinal detachment or separation.

One of the most common systematic errors in the diagnosis of orbital neoplasia is mistaking the signs for those of glaucoma. The prominent eye can be misleading. When an eye enlarges because of glaucoma, however, the cornea does so as well. In addition to measuring intraocular pressure, comparison of corneal diameter in patients having one normal eye should be helpful in this regard. More importantly, glaucomatous globes can usually be retropulsed into the orbit whereas this is impeded in orbital neoplasia. With an orbital neoplasm, careful attempts at retropulsion can generally identify resistance and localize the mass. Ophthalmoscopic examination may reveal indentation of the posterior aspect of the globe as manifested by folding or gray discoloration of the retina (Fig. 23-12B). Retropulsion simultaneous with ophthalmoscopy may make this more pronounced.

Orbital neoplasms from muscle, bone, nerves, blood vessels, connective tissue, fat, lacrimal gland, and zygomatic salivary gland have been reported.⁴⁴ Most reports are of one animal; however, even when a series of orbital neoplasms has been reported, there has not been enough information to provide definitive guidelines for therapy. Malignant tumors have pre-

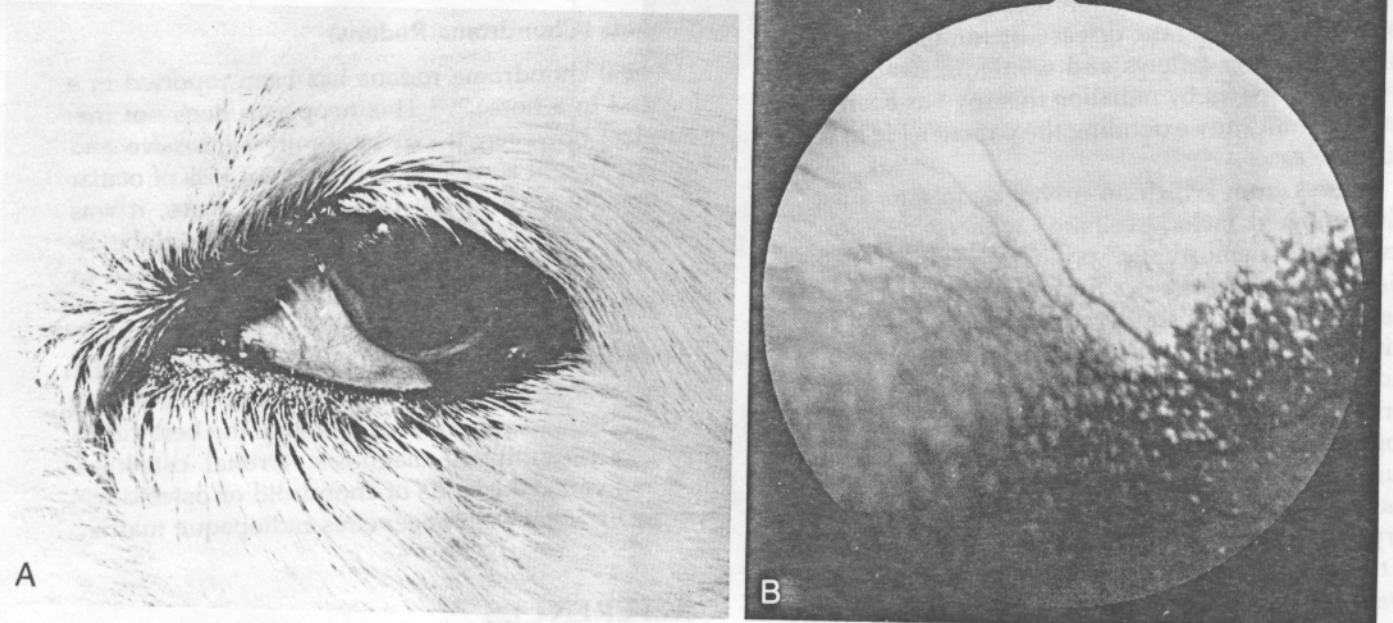


Fig. 23-12. Fibrosarcoma in left orbit of 7-year-old male Samoyed. *A*, The only changes visible in this photograph are protrusion of the third eyelid and slight lateral displacement of the globe. *B*, Fundus of the eye. Notice the fuzzy, gray zone to the left which is situated nasally in the eye. The neoplasm was located in the medial orbital wall.

dominated among those animals reported making therapy more difficult.

Diagnosis of orbital neoplasia depends upon an astute clinician who recognizes the subtleties of neoplasia found in clinical signs. Skull radiography, dacryocystorhinography, sialography, venography, contrast orbitography, and ultrasonography are procedures that help in giving information needed for an accurate diagnosis.⁴⁵ None of these methods, however, leads to an unequivocal diagnosis of orbital neoplasia. The techniques listed help localize the lesion or provide information about its extent within the orbit. Computed tomography has been helpful in determining whether there has been intracranial extension which would be strongly suggestive of neoplasia.⁴⁶ Occasionally, abnormal tissue will be easily accessible so exploratory procedures or biopsies can be done.^{47,48} Fine needle aspirates or needle biopsies also can be useful although interpretation may be difficult.

The philosophy of therapy should probably parallel invasive oral and nasal neoplasms (see chapters 18 and 19 for details). If the lesion is known to be small and well-circumscribed, orbital exploration can provide a method for removing the tumor completely and also saving the globe.^{47,48} Enucleation of the globe, however, is often necessary even for small tumors. Unfortunately, in most cases, tumor is extensive before the animal is brought to the clinician for consultation. Thus, even with procedures such as exenteration, neoplastic tissue often remains and recurrence is frequent. Metastatic disease or intracranial extension frequently follows and results in death. Exenteration followed by radiation therapy has been helpful in significantly extending the patient's life in some of these cases.

Entities from which an orbital neoplasm must be differentiated include cellulitis with or without abscessation, hemorrhage, proliferative inflammatory disease, congenital cysts and arteriovenous fistulas. Cellulitis is usually sudden in onset and is associated with considerable pain, especially upon opening the mouth, ocular discharge, and inflammation of the anterior ocular tissues. Centesis of the orbit through a point behind the last upper molar tooth may yield purulent material, an unlikely finding with a neoplasm. Orbital hemorrhage will usually follow a history of trauma or other physical findings suggestive of trauma. The hemorrhage may appear subconjunctivally by extension from the orbit. Proliferative inflammatory disease is a rare condition but may respond to steroids. Congenital or acquired arteriovenous fistulas are extremely rare conditions that may lead to a presumptive diagnosis of neoplasia,

however, bruits may be heard over the orbital area or a pulsating exophthalmos may be present.

Meningiomas

Meningiomas arise from arachnoid cells of the orbital portion of the optic nerve sheath and only have been reported in the dog usually over 6 years of age.⁴⁹ Clinical signs vary although they are generally typical for a space-occupying lesion of the orbit. Occasionally the neoplasm may extend into the globe, resulting in retinal detachment or separation, uveitis, or glaucoma. Some tumors will ossify, making them radiographically apparent. The most important sign, however, is detection of optic nerve dysfunction. Unilateral blindness and loss of pupillary response to light are frequent findings. These signs are not specific for optic nerve meningiomas; however, they suggest optic nerve degeneration with a guarded prognosis when combined with a space-occupying orbital lesion.

Although well-circumscribed optic nerve meningiomas can be successfully excised, enucleation is usually necessary. Whereas meningiomas rarely metastasize, they can invade the cranium via the optic nerve and cause more serious CNS damage. When orbital involvement is extensive, however, surgical intervention may lead to extracranial metastatic disease.^{49,50}

Osteoma (Chondroma Rodens)

Orbital chondroma rodens has been reported in a dog and in a horse.^{51,52} This neoplasm does not metastasize; however, it can be locally aggressive and early treatment is necessary to prevent loss of ocular function. In each of the two reported cases, it was possible to resect the tumor and save the globe although postoperative radiation therapy was used in the dog.

This infrequent tumor is discussed because it is relatively easy to diagnose and it is one of the few orbital tumors that has a good prognosis after surgical resection. Skull radiography is probably the best aid to giving a presumptive diagnosis. Orbital osteomas have mineralized islands of chondroid or osteoid tissue giving them a homogeneous radiopaque matrix.

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