The anatomy of reptile ears and eyes differ from that of mammals, and among different reptile groups. Species predilections exist for different Problems associated with the ears of reptiles include nodular swelling, discolored tympanum, head tilt, and circling. Problems of the eyes include pronounced or frequent blinking, periorbital swelling, blepharoedema (palpebral edema), buphthalmos (enlarged globe), exophthalmos (protruding globe), enophthalmos (sunken globe), microphthalmos, ocular discharge, inability to open eyes, apparent blindness (lack of response to visual stimuli), abnormal cornea, abnormal spectacle, abnormal aqueous chamber, abnormal lens, abnormal subspectacular (sub-brillar) space, and abnormal conjunctiva. The problem-solving process begins with these clinical signs and, through a series of dichotomous steps, progresses towards the diagnoses described in this manuscript. Treatment is based on a specific diagnosis, and may include surgical and medical approaches.

Anatomy of Reptile Ears

Reptile ear anatomy is species specific, and many anatomical differences exist among mammals, birds, and reptiles. The external acoustic canal of most mammals is well developed and tubular, and lined by epithelium that is continuous with an external pinna. By contrast, birds and reptiles lack a pinna, and the external acoustic canal is aglandular and relatively shallow in birds and most lizards; it is absent in some lizards, all chelonians, and all snakes. Snakes, chameleons, and many legless lizards lack a tympanic membrane, though it is fully developed in most reptiles, including birds.

The ossicles of the middle ear of mammals include malleus, incus, and stapes (also known as the hammer, anvil, and stirrup respectively). In all reptiles, the singular columella, connects the tympanum to the oval window of the cochlea. This bone evolved into the stapes of mammals, and the incus and malleus were derived from the quadrate bone of reptiles, which participates in sound transfer from the skull and mandible to the columella in many reptiles and is particularly important in the species that lack a tympanum. The quadrate bone also participates in the mobility of the beak in many birds via its articulation with the jugal arch and mandible. In some gecko species, the tympanae are transparent and the tissues of the head so reduced that light can pass in one acoustic canal and out the contralateral canal.

The middle ear is connected to the infundibulum in the pharyngeal cavity via the Eustachian duct, which is lined by simple cuboidal epithelium. Otoconia (otoliths) are present in many
reptiles, and are present in the otic labyrinth of the inner ear which consists of the utricle, saccule, and cochlear duct, which contain a calcium-rich endolymph that can extend to into a periotic labyrinth that may include bilateral pouches on the ventral neck of many geckos and some iguanids, and can extend along the vertebrae in some species. The labyrinth contains epithelium that collects sonic sensations that are transmitted to a branch of the vestibulocochlear nerve. Semicircular canals with their associated ampulae collect sensations of equilibrium that are transmitted to the vestibular nuclei of the medulla oblongata via branches of the vestibulocochlear nerve. The epithelium of the inner ear varies from simple squamous to cuboidal, to columnar, depending upon function.

**Diseases of Reptile Ears**

The differential diagnosis for nodular swelling in reptile ears varies according to species. Turtles often have aural abscesses that may be associated with squamous metaplasia (hypovitaminosis A), depressed immune response and opportunistic infection, bacterial pathogens, or parasites including dipteran larvae (maggots). Ear swelling in other reptiles is uncommon and may be neoplastic or infectious.

A discolored tympanum may occur with trauma, infection, or neoplasia. *Cryptosporidium* spp. have been identified in tympanic disease. Head tilt and circling are signs of diseases of the vestibular system which can include the semicircular canals, vestibular nerve, or brainstem. Differential diagnoses include xanthomatosis, neoplasia, trauma, granuloma (bacterial or fungal). Obtain a specific diagnosis via cytology, cultures, and histopathology. Medical and surgical therapy follow the principles of mammalian medicine, although aural abscesses are generally caused by hypovitaminosis A-induced squamous metaplasia, which requires surgical ototomy with thorough lavage of the middle ear to remove the keratinous exudate.

**Anatomy of Reptile Eyes**

The anatomy of reptile eyes is species specific and includes many of the same structures found in mammals. Many species of birds and other reptiles have a ring of ossicles in the sclera that help maintain the asymmetrical shape of the globe. Many reptiles also have a vascular conus papillaris that protrudes from the retina and probably participates in metabolic exchanges in the vitreous because the retina is avascular, similar to the pecten oculi of birds. Ocular movement varies among species, from more than 270 degree rotation in chameleons, so only a few degrees in snakes. Interestingly, snakes do exhibit the normal nystagmus expected with equilibrium and vestibular function.

The cornea of snakes and some geckos is covered by a fixed spectacle, or brille, which is continuous with the dermal epithelium and replaces the eyelids. The conjunctival space contains a thin layer of tears and is drained by a single lachrymal canaliculus. Most lizards and crocodilians also have a nasolachrymal duct and a tarsus in an eyelid (bony structure in the upper lid of crocodilians, and cartilaginous structure in lower lid of most lizards), but turtles and tortoises lack both of these structures. Lachrymal secretions bathe the chemosensory Jacobson’s organ in
most reptiles. Eublepharine lizards, crocodilians, and chelonians have a nictitating membrane, but snakes and lizards with a spectacle do not. Harder’s gland is present in the adnexa anterior and medial to the globe in most reptiles and birds; it participates in lachrymal secretions.

Most reptiles accommodate in the same manner as mammals, by changing the shape of the lens via the ciliary muscle contraction. Most snakes have a rigid lens, and focus images on the retina by displacing the lens toward the cornea via contraction of the muscles in the root of the iris. Nocturnal lizards and snakes have increased dependence on cone-type vision retina than diurnal species, which have well-developed retinal rods and fovea in most species.

Diseases of Reptile Eyes

Ophthalmic examination follows the same procedures that are used in mammalian and avian patients. This may include gross examination and palpation, examination with a magnifying loupe and focal light source, indirect ophthalmoscopy, direct lens exam, panophthalmoscopy, fluorescein dye test, conjunctival cytology, tonometry, and ultrasonography. The iris muscles are under voluntary control in reptiles, so pupil dilation requires intracameral injection with a neuromuscular blocking agent such as d-turbocurarine or atracurium. Vision may be assessed in neurologically responsive patients, but may be difficult to assess when responsiveness is dull.

Pronounced or frequent blinking can be caused by a conjunctival foreign body such as plant material, dust, or granular bedding. Examples of bedding that frequently cause eye irritation include cypress mulch, orchid bark, and ground coconut hulls. Particulates such as sand, calcium sand, and ground walnut shell also cause problems, particularly when trauma to the eyelids is present. Periorbital swelling can occur with occlusion of the jugular veins, with trauma, or as a result of local infection. Blepharoealubdema often causes blepharospasm and the client reports that their reptile cannot open its eyes. This frequently leads to anorexia because most reptiles require visual stimuli to identify food. Swelling of the eyelids can be caused by squamous metaplasia of the nasolacrimal ducts (hypovitaminosis A), particularly in water turtles. Bacterial blepharitis can also cause edema, and can lead to granuloma formation. Parasites e.g., (Foleyella spp. in chameleons) and various neoplastic diseases (e.g., herpesvirus-associated papilloma in sea turtles and poxvirus in caimans) may also cause eyelid edema.

Buphthalmos is an enlarged globe and must be differentiated from exophthalmos and subspectacular disease, it is rare and is caused by intra-ocular disease. Congenital microphthalmia occurs, and may be more common in snakes. Other congenital abnormalities are more rare. Exophthalmos occurs when there is a space-occupying condition of the retrobulbar space; it is common in green iguanas when the jugular veins are occluded, and it reverses with release of the jugular vein obstruction. Ultrasound is useful to characterize the retrobulbar space to find cysts, tumors, and granulomas. Enophthalmos can occur with degenerative disease of or trauma to the orbit, but is more commonly caused by emaciation and severe dehydration. Pthisis bulbi and microphthalmia may be described as enophthalmos in some cases. Ocular discharge is frequently caused by foreign bodies in the conjunctiva and infectious diseases. Opportunistic bacterial infection, mycoplasmosis, hypovitaminosis A, and chlamydiosis should be considered. Leeches and other parasites can also cause ocular discharge. Reptiles that cannot open their eyes
may have conjunctivitis, and water turtles may have squamous metaplasia due to hypovitaminosis A.

Blindness can occur as a result of disease in the cornea, lens, eye chambers, retina, optic nerve, or brain. Cataracts occur in many species and can occur with low temperatures. Advanced imaging including computed tomography with contrast material or magnetic resonance may be needed to localize the lesion. Corneal diseases can be ulcerative, granulomatous, edematous, degenerative, or fibrous. Keratopathy can be caused by trauma, opportunistic bacterial infection, fungal infection, and viruses including herpesvirus. Snakes and many geckos have a spectacle. Diseases of the spectacle include retention with dysecdysis, direct abrasion, ulceration, loss (often iatrogenic), and dermal infection (fungal or bacterial). Subspectacular (sub-brillar) disease can be caused by obstruction of the nasolacrimal duct and impaired drainage of the space, which often occurs with stomatitis, but may be caused by local trauma, congenital malformation, tumors, or granulomas. Diseases of the aqueous chamber and uveal tract often cause gross changes in the anterior chamber of the eye. These can include hyphema, hypopyon, and flare. Uveitis can occur from trauma, systemic infection (bacterial, fungal, viral, or parasitic), or local/disseminated neoplasia. Septicemia should be considered with diseases of the anterior chamber. Diseases of the retina can be difficult to diagnose, particularly in very small eyes and few cases have been reported.

**Selected References**


