

Food Animal Ophthalmology

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Normal Anatomy

- Cornea and pupil are oval in shape along the horizontal plane
- Swine have a circular pupil
- Granula iridica (corpora nigra) present- extension of the posterior pigmented epithelium of the iris and augment miosis
- Holangiomatic vascular pattern in the retina
- **Fundic exam-**
 - Cattle and sheep:
 - Superior artery and vein may twist on each other
 - “Stars of Winslow”- end-on capillaries of the tapetal fundus
 - Optic disc is typically within the non-tapetum
 - Optic disc is oval in cattle; sheep= kidney shaped
 - Cattle frequently have hyaloid remnants protruding from the center of the optic disc and extending into the vitreous body
 - Goats:
 - Rounder optic disc shape
 - Optic disc typically in the tapetal fundus and may be surrounded by a ring of pigment
 - Swine:
 - No tapetum
 - Higher number of cones
 - Optic disc shape is horizontal and the margins are sharply defined

Orbit

- Cattle, sheep and goats- enclosed orbit (globe is completely surrounded by bone)
- Swine- open orbit
- **Congenital disorders-**
 - Anophthalmos- rare
 - Microphthalmia
 - One of the more frequent eye abnormalities
 - Cattle, Sheep and Goats
 - Usually combined with other ocular defects
 - Concurrent posterior vertebral column disease can also be found in dairy and beef cattle
 - Unknown cause- suspected to be heritable
- **Teratogenic agents-** impair ophthalmic development

- *Veratrum californicum*- skunk cabbage, western hellebore, false hellebore, wild corn
 - Sheep>> cattle, goats
 - Alkaloids found in plant and concentrated in root (jervine, pseudojervine, veratrosine)
 - Globe abnormalities include anophthalmia, cyclopia, synophthalmos
 - Highly susceptible on gestational day 14
 - On days 11, 12, 13, 15 and 16- normally developed fetuses or embryos that die between 18th and 23rd day of development
- Selenium
 - “Blind Stagers” in sheep
 - Microphthalmia, multiple cysts, colobomas, cornea, lens, iris defects
 - Now felt to be sulfur-related polioencephalomalacia (PEM)
- Maternal vitamin A deficiency
 - Pigs- Primarily microphthalmia; anophthalmos, macrophthalmia, retinal dysplasia may also occur
- Others
 - Blue tongue virus- sheep; ocular lesions induced by Modified-live vaccines
 - Bovine viral diarrhea- cataracts, retinal degeneration and dysplasia, optic nerve gliosis and neuritis, microphthalmia

Globe

- **Position and Movement**
 - Bilateral convergent strabismus/exophthalmia
 - Autosomal recessive- Jersey +/- Shorthorn
 - Autosomal dominant- German Brown Swiss
 - Defect in the motor nucleus of the abducent nerve
 - Esotropia/Exophthalmia
 - Progressive- until maturity
 - Nystagmus and vision loss can be present
 - Holstein, Ayrshire, German Brown Swiss
 - Bilateral dorsomedial strabismus
 - Frequently blind and exhibit opisthotonus
 - Suggestive of PEM
 - Medial strabismus
 - Listeriosis
 - Ipsilateral neurological signs
 - Inflammation with secondary damage to the abducens nerve- lose function of the lateral rectus muscle
 - Bilateral exophthalmos
 - Lymphosarcoma is the most frequent cause

- Exophthalmos may be accompanied by strabismus
 - Prognosis with orbital LSA approximately 6 months
- Unilateral strabismus/exophthalmia
 - Space occupying lesions
 - Neoplasia: lymphosarcoma, SCC, adenocarcinoma
 - Orbital inflammation: trauma, frontal sinusitis, foreign body migration, actinobacillosis, panophthalmitis
 - Trauma
 - AV fistula- rare
 - Diagnosis: FNA, biopsy, radiographs, ultrasound
- Nystagmus
 - Congenital
 - Horizontal, rapid, pendular nystagmus in Holstein-Friesians (and other breeds)
 - Early postnatal- congenital blindness
 - Acquired
 - Brain lesions (tumors, abscesses), intoxication, vascular disease

Eyelids

- **Abnormalities occur in sheep >> cattle, goats, or pigs**
 - Entropion
 - Sheep
 - Bilateral commonly
 - As early as 2-3 days of age
 - Usually lower lid
 - May be inherited
 - Frequent- incidence from 1-80% between flocks
 - Pot-bellied pigs
 - Overweight
 - Cattle
 - Congenital- rare
 - Primarily spastic, cicatricial, young dehydrated calves
 - Treatment
 - Temporary tacking
 - Surgical correction
 - Ectropion
 - Not as common
 - Congenital rare: reported in Piebald sheep
 - Deformed or notched upper eyelid
 - Developmental, cicatricial, trauma, postoperative, neurological
 - Surgical repair if conjunctivitis, keratitis, epiphora present
 - Trauma
 - Lacerations- most common traumatic injury

- Surgical repair indicated in most cases
 - Highly vascular
 - Minimal debridement
 - Needs primary apposition
 - Medial canthus involvement- evaluate the nasolacrimal system
- Blepharitis
 - Bacterial:
 - *Actinobacillus* (pyogranulomatous cutaneous nodules with draining tracts)
 - *Clostridium* (Bighead in sheep)
 - Fungal:
 - *Trichophyton*- cattle
 - *Microsporium*- goats> pigs, sheep
 - Viral:
 - Pox- sheep, goats
 - Papilloma- primarily young animals
 - Ulcerative dermatitis
 - Bluetongue- sheep, +/- cattle
 - Neoplasia:
 - SCC
 - Direct solar irritation
 - Photosensitization:
 - Ingestion of photodynamic agents
 - Primary- Hypericin (St. John's wort), fagopyrin (buckwheat), perloline (perennial ryegrass), phenothiazine (see corneal edema +/- blepharedema)
 - Secondary-Phylloerythrin which accumulates following obstruction of biliary secretion

Nasolacrimal System

- **Diseases of the lacrimal glands are rare**
- **Epiphora**
 - Usually secondary to irritation
 - Drainage abnormalities are uncommon
 - Dacryocystitis
 - Secondary to sinusitis, tooth root abscesses, nasal tumors
 - May also see with Thelazia infection
 - Congenital
 - Supranumerary openings of the nasolacrimal duct in Brown Swiss and Holstein-Friesian

Conjunctiva/Cornea

- **Congenital**
 - Dermoids
 - Rare in all food animals; cattle most commonly affected

- Most likely due to mesodermal metaplasia
 - Herefords- autosomal recessive
 - Cattle- limbus> third eyelid> canthus> eyelid> conjunctiva
 - Corneal dystrophy
 - Endothelial dystrophy is rare
 - Holsteins- autosomal recessive
- **Keratoconjunctivitis**
 - Sheep and Goats:
 - *Chlamydia* spp. – *psittaci* most common
 - Conjunctivitis and polyarthritis
 - Pathogenesis:
 - Multifactorial (immune status, secondary infections)
 - Outbreaks primarily during the lambing season
 - Immunity is short lived
 - Clinical signs:
 - Early- epiphora, chemosis, hyperemia
 - Progression: mucopurulent discharge, blepharospasm, lymphoid follicles and keratitis
 - Complications: permanent scarring, pigmentation
 - Diagnosis:
 - Cytology: cytoplasmic inclusion bodies of conjunctival epithelial cells
 - IFA
 - Culture
 - Treatment:
 - Disease can be self-limiting
 - Oxytetracycline can shorten the course and severity of disease
 - *Mycoplasma* spp.
 - Subclinical carrier states
 - Clinical signs:
 - Early- hyperemia, epiphora, blepharospasm
 - Advanced- mucopurulent discharge, follicles, keratitis, corneal ulcers, uveitis, hypopyon; blindness may result
 - Mastitis, arthritis and pleuropneumonia may occur
 - Diagnosis:
 - Cytology, culture, ELISA
 - Treatment: mild infection may be self-limiting; Oxytetracycline may shorten the course for severe disease

- **Infectious Bovine Keratoconjunctivitis**
 - Pink eye, contagious ophthalmia, New Forest disease
 - Worldwide distribution
 - Large economic impact
 - Millions lost due to decreased weight gain and milk production, cost of feeding, cost of treatment
 - *Moraxella bovis*: gram negative bacillus
 - Other pathogens may contribute to severity of disease including IBR and *Mycoplasma* sp.
 - Rough (hemagglutinate) and Smooth colonies found
 - Only rough form felt to be associated with clinical disease
 - Contain cell surface pili that promote cellular adhesion and enhance ability to overcome host defenses
 - Piliated form found in acute cases; non-piliated in convalescent carriers
 - Pathogenesis:
 - Occurs primarily during the summer months
 - Source of infection
 - New animal or previously affected one
 - Smooth form may transform to rough form with increased UV light
 - Transmitted by handlers, mechanical vectors (face fly, house fly, stable fly), fomites, contact with infected animals
 - All breeds susceptible
 - *Bos Taurus* >> than *Bos indicus*
 - Herefords and Hereford crosses- higher susceptibility
 - Younger > older
 - Increased exposure to UV light
 - Clinical signs:
 - 75% unilateral; eventual bilateral involvement is frequent
 - Younger animals develop most severe disease and have longer recovery times
 - Decreased feeding, milk production, weight gain
 - Early: epiphora, blepharospasm, photophobia, chemosis, hyperemia
 - Advanced: mucopurulent discharge, ulceration, corneal abscess, vascularization, uveitis, scarring, perforation, blindness
 - Treatment:
 - Large number of therapies reported
 - Goal is to alleviate pain and prevent further spread
 - Sensitive to most antibiotics

- Choice dependent on culture and sensitivity, administration of drug (frequency, handling of animals, etc.) and withdrawal times
 - Systemic, topical and subconjunctival applications available
 - Most common antibiotics include penicillin and tetracycline
 - Check appropriate application of antibiotics (ex. Tetracyclines can be irritating if given subconjunctival)
 - Consider atropine and nonsteroidal anti-inflammatory drugs for secondary uveitis
 - Corticosteroid use has been reported, but it is not recommended, especially in the presence of corneal ulceration or abscess
 - Third eyelid flaps and temporary tarsorrhaphies can be used as adjunct protection
 - Vaccinations have varying success
 - Separated affected animals
 - Control of face flies
- **Neoplasia**
 - Cattle most commonly affected
 - Primary tumors of any site rare in sheep, goats, pigs
 - Most common is squamous cell carcinoma
 - Squamous cell carcinoma
 - Clinical signs:
 - Occur most commonly on the bulbar conjunctiva and cornea with the limbus being the most common site
 - Other sites include: palpebral conjunctiva, third eyelid and skin
 - Can progress: plaque → papilloma → carcinoma in situ → invasive carcinoma
 - Extensive keratosis can occur in the eyelids-cutaneous horn
 - Can metastasize late in disease; more common with lid and third eyelid tumors
 - Diagnosis:
 - Confirmed by biopsy
 - Treatment:
 - Surgery combined with other modality offers good success rates
 - Surgery: local excision, enucleation, exenteration; with local lymphnode metastasis= enbloc resection

- Other modalities: cryotherapy, hyperthermia, radiation therapy (β irradiation), intralesional chemotherapy (cisplatin, 5-fluorouracil)
- Prevention:
 - Selective breeding

Uvea

- **Congenital**
 - Usually not clinically significant
 - PPM's, aniridia, iris hypoplasia, polycoria, cysts, coloboma
 - Heterochromia Irides
 - Most common defect- cattle
 - Dominant and recessive forms of inheritance present; Herefords-heterochromia with incomplete albinism= autosomal dominant
 - Most cases have no affect on vision; photophobia and nystagmus have been reported
 - Also seen in miniature swine (white coat color=higher occurrence)
- **Uveitis**
 - Cattle: neonatal infections, bacterial septicemia (mastitis, metritis, reticuloperitonitis), MCF, IBK, TEME, leptospirosis, toxoplasmosis, lymphoma
 - Sheep, goats: neonatal bacterial septicemia, Listeriosis, mycoplasmosis, toxoplasmosis, thiamine deficiency, toxins
 - Swine: bacterial, viral, parasitic
 - Treatment:
 - Treat the underlying cause
 - Anti-inflammatories (topical/systemic)
 - Atropine- topical
- **Tumors**
 - Primary= rare
 - Secondary= extension from the orbit, conjunctiva, cornea

Lens

- **Cataracts are rare**
- **Congenital cataracts reported in cattle, sheep, pigs, rare in goats**
 - Autosomal recessive in several breeds- Jersey, Hereford, Holstein-Friesian
 - Can be associated with microphthalmia and retinal lesions from *in utero* exposure to BVD
 - 76-150 days of gestation
- Secondary to inflammation, toxins, metabolic disease
 - Cattle: secondary to IBK, malignant catarrhal fever, IBR

- Sheep and goats: trauma, uveitis
- Swine: Hygromycin B

Fundus

- **Congenital**
 - Albinism/subalbinism- cattle and sheep
 - Colobomas
 - Cattle:
 - Common in the choroids
 - Optic disc with dominant form of incomplete albinism in Herefords
 - Retinal dysplasia
 - Cattle: BVD
 - Sheep: Bluetongue
 - Often associated with retinal detachment
- **Chorioretinitis**
 - Cattle: neonatal septicemia, TEME, rabies, toxoplasmosis, tuberculosis, listeriosis
 - Sheep: mycoplasmosis, listeriosis, elaeophorosis, toxoplasmosis, bluetongue, scrapie
 - Swine: pseudorabies, hog cholera, listeriosis, toxoplasmosis, Glasser's disease, ocular cysticercosis, erysipelas
 - Treatment involves diagnosis and management of underlying etiology
- **Retinal degenerations are more commonly acquired**
 - Vitamin A deficiency- cattle
 - Blindness, abnormal bone growth
 - Bracken fern (*Pteris aquilina*)- sheep
 - "Bright blind", "moon blind", "glass eyed"
 - PEM
 - Progressive retinal degeneration
 - Numerous other plants reported
- **Optic Nerve disease**
 - Vitamin A deficiency- cattle
 - Optic foramen stenosis
 - Male fern (*Dryopteris felix mas*) ingestion- cattle
 - Bilateral blindness
 - Retrobulbar optic nerve disease
 - Optic nerve atrophy leading to retinal degeneration
 - Blind grass (*Stypandra glauca*) ingestion- sheep/goats
 - Optic neuropathy and degeneration
 - Polioencephalomalacia (cerebral necrosis)
 - Thiamine deficiency
 - Ingestion of thiaminase containing plants or ad libitum access to sulfur
 - Papilledema

- Bilateral
- Hazy margins to the optic disc
- Deviation of the retinal artery/veins as they pass over the disc
 - Vitamin A deficiency
 - Hydrocephalus
 - Space-occupying brain lesions
 - Meningitis
 - Encephalitis
 - Toxins- hexachlorophene
- Primary demyelinating disorder
 - Limousin