Bovine Ocular Squamous Cell Carcinoma

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KEYWORDS

• Bovine • Squamous cell carcinoma • Eye • Ocular neoplasia

Ocular squamous cell carcinoma (OSCC) in animals is a primary neoplasm of epithelial origin that may occur in different ocular and periocular tissues, especially the epithelial surfaces of conjunctiva, corneoscleral junction, nictitating membrane, and cornea and the eyelid skin. OSCC is a spontaneous tumor, which occurs with high frequency globally in bovines.

OSCC or "cancer eye" is the most common malignant tumor affecting cattle in North America and is responsible for significant economic losses.[1–5] The occurrence of OSCC has been reported worldwide, in Europe, Asia, Africa, Australia, and South America.[6–10] In Australia, 10% to 20% of animals in some herds have been diagnosed with OSCC.[11] In Zimbabwe, European breeds of cattle and their crosses, particularly those with unpigmented skin on the face, are commonly observed to have OSCC.[12] The incidence of OSCC in the United Kingdom and other European countries is lower than in Africa and the Americas; however, it is still a significant disease.[6,13,14] In the Netherlands, the incidence is 0.04% based on examination of 35,000 animals.[15] OSCC is found primarily in cattle, although it has been observed at a low incidence in sheep, swine, goats, and horses.[16]

In the United States, the prevalence of OSCC varies with geography and is higher in the southwestern region and in lower latitudes with higher levels of sunlight.[14,17,18] This pattern is similar to that observed with human skin-cancer cases.[4] Lightly pigmented human skin when chronically exposed to sunlight may undergo a series of changes, commencing with the development of keratoses and frequently progressing to basal cell epitheliomas or squamous cell carcinomas (SCCs). There have been some studies on the spontaneous development of similar lesions in animals exposed to intense sunlight.[4,19,20] Some breeds of cattle, especially the Hereford, are noted for their high incidence of carcinomas when kept in subtropical areas. Sheep develop

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carcinomas, apparently associated with exposure to sunlight, on areas of the integument unprotected by fleece, particularly the ears, muzzle, and perineal area.[20]

OSCC is the leading cause of whole-carcass condemnation at slaughter. The disease comprises 80% of all bovine tumors reported at slaughter.[14] High morbidity rates of 0.2% to 5.6% result in significant economic loss from culling and condemnation.[3,4,21,22] Control of this disease would be of considerable significance to the economics and profitability of the beef and dairy cattle industries.

Although a common tumor, the genesis of OSCC has not been fully investigated, and several theories have been advanced to explain its development, including breed susceptibility, influence of exposure to ultraviolet (UV) light, viral infection, age and gender, and nutritive conditions. Various treatment options for OSCC exist: surgery, cryosurgery, radiation therapy, immunotherapy, and hyperthermia have been recommended in many studies. This article reviews the characteristics of the most commonly affected animals, the factors that are believed to contribute to the development of OSCC and the treatment options that have been proposed.

ETIOLOGY

The cause of OSCC is still poorly understood; however, there are several factors including genetic susceptibility, nutrition levels, age, UV light, circumocular apigmentation, and viruses that may contribute to its development.

Breed Susceptibility

Cases of OSCC have been reported in Holstein-Friesian, Holstein, Hereford, Guernsey, Shorthorn, Ayrshire, Brahman, Brown Swiss, Hollandensa, Javanese-Mongolian, Jersey, and Normandy breeds of cattle, among others.[13,14,23] Although it has been reported in many different breeds, this invasive, chronically progressive neoplasm predominantly affects Hereford, Hereford cross, and Holstein cattle. At the University of Florida, the frequency of OSCC is particularly high in the white-faced Hereford. This breed is commonly kept in an environment favorable for the development of OSCC and has a hereditary inclination towards facial hypopigmentation. Holsteins with pink skin around the eyes are more susceptible to OSCC (**Fig. 1**).

Fig. 1. SCC lesion involving the lower eyelid, nictitating membrane, and conjunctiva in a Holstein cow with pink skin.