Update on oral tumours in bovine

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Abstract
Bovine tumour are of great concern as they may cause economic losses due to negative impact on productivity, animal health and thus may reduce profit to individual farmer and dairy industry. Tumours of odontogenic origin in domestic animals are rare but common in bovine and difficult for accurate diagnosis. Histopathology and immunohistochemistry is helpful to confirm the type of tumour and also to know the oncogene responsible for the cause. Unlike humans, evolution and application of advanced diagnostic techniques for early detection of tumour in animals have rarely been attempted except canine mammary gland tumour. Early diagnosis of tumours in bovine and research on molecular characterization of neoplastic cells will be of clinical help to take corrective or remedial measures for prevention and to find early assessment of cancer therapies in bovine.

Keywords: Ameloblastoma, bovine, oral tumour, vincristine sulphate

Introduction
A review of literature on bovine oral tumours reveals that there is paucity of literature particularly on incidence of oral tumours in bovines and application of advanced diagnostics techniques for detection of oral tumours in domestic animals and bovine in particular. A cancer or tumour is a tissue mass characterized by persistent, excessive and disorganized cell growth that is unresponsive to normal control mechanisms. Systematic study to find out the specific pattern of tumour occurrence and its effective treatment in animals is sparse in India. However, the occurrence of animal neoplasms such as squamous cell carcinoma including horn cancer, papilloma, fibroma, fibrosarcoma, Myxoma, leiomyoma, canine transmissible venereal tumour, chondrosarcoma, Odontoma and several others has been reported from the Haryana state [1]. The frequency of these tumours is in ascending tendency. Incidence of tumours in bovine is relatively increased and occupied second place after canine tumours [2]. Oral cancer appears as a growth or sore in the mouth that does not proliferate away from oral cavity. Oral cancer, which includes cancers of the lips, tongue, cheeks, floor of the mouth, hard and soft palate, sinuses and pharynx (throat) can be life threatening if not diagnosed and treated early. Tumours of odontogenic origin in domestic animals are rare and difficult for accurate diagnosis [3-4]. Epithelial odontogenic neoplasms account for <1% of oral neoplasm in many species [5]. Though rare in all species, they are the most common neoplasms in cattle. Tumours are seen as mass-like lesions interfering with mastication in young cattle [4]. These tumours have also been reported in human [6], cat [7], dog [8], horse [9], sheep [10] and non-human primates [11].

The most odontogenic tumours develop in cattle near two years of age and primarily in the mandibular incisor region [12]. These tumours interfere with normal mastication of feed because of their location and induced pain sensation in adjoining areas. At times animal tries to avoid taking feed. This causes production and economic losses to the farmers. The tumour may occupy a position anywhere in mandible or maxilla but mostly involves lower jaw [13]. Oral tumours in bovine are more common at mandible region and rostral mandible is the most affected part [14]. Ameloblastoma is a rare, clinically significant, benign, locally invasive epithelial odontogenic tumour reported both in animals and humans [15]. This odontogenic tumour occurs predominantly in the mandibular incisor region of bovine [16]. Ameloblastoma is the most common odontogenic neoplasm and arises from the epithelium of the dental lamina affecting mainly the posterior mandible (80%) and to a lesser extent the posterior maxilla (20%) [17]. Ameloblastoma displays a strong tendency to recur especially if not adequately removed [18] and even metastasize in rare conditions [19]. There are two basic histopathologic patterns; the follicular and plexiform without any clinical relevance [20].
Among domestic animals, it has been reported in cattle, horse, dog and cat; but most frequently in cattle. The tumour usually occurs in adults, but young animals may also be affected. Management of ameloblastoma has been controversial because of the unique biological behaviour of this tumour as it is slow-growing, locally invasive and have high rate of recurrence. Recurrence rates of ameloblastoma are reported as high as 15-25% after radical treatment and 75-90% after conservative treatment. Therefore, wide resection of the jaw in accordance with the treatment of malignant tumours is usually recommended for ameloblastoma. Typically, aggressive surgical treatments, such as marginal or segmental resection, have been implemented, but some conservative surgical methods are also being introduced, including decompression, enucleation or curettage.

Odontogenic myxoma is a rare benign tumour that may arise in the maxilla or mandible, and can be locally aggressive. It accounts for 3-6% of all odontogenic tumours but the third most common oral tumour found in cattle. Reports of surgical treatment of odontogenic myxoma vary from simple enucleation and curettage to segmental resection and hemimandibulectomy. Recurrence rates are reportedly high, at around 25%, especially when a more conservative approach is taken. Nonetheless, a more conservative approach exemplified by enucleation and curettage has several advantages over more radical treatments like segmental mandibulectomy and mandibular reconstruction with fibular microsurgical flap formation in odontogenic myxoma.

Soft-tissue chondroma is a rare soft-tissue tumour also called extra-skeletal chondroma or chondroma of soft-tissue parts. Soft-tissue chondroma constitutes only 1.5% of benign soft-tissue tumours. Oral soft-tissue chondroma is uncommon. If it occurs intra-orally, then the most common intraoral site is tongue. In the oral cavity, only few cases of soft-tissue chondroma have been reported in the literature till date, with very few cases in the gingiva. Soft-tissue chondroma is characterized by benign clinical behaviour. Surgical excision is the treatment of choice and once excised adequately, would rarely recur.

A central odontogenic fibroma (COF) is a rare benign tumour accounting for only 0.1% of all odontogenic tumours, but most common oral tumour in bovine. It may evolve from the dental follicle, the dental papilla, or the periodontal membrane. The lesion appears both in the maxilla and mandible; in the maxilla, it appears in the anterior region whereas in the mandible, it involves the premolar and molar area. The treatment of fibroma in the literature mainly involves conservative surgery. Fibroma origin tumours are well managed by surgical excision followed by chemotherapy and small size tumour responds well to chemotherapy alone.

Histopathological studies

Histopathology is the gold standard for the confirmation and type of tumour. An oral tumour shows discrete islands of tall columnar, palisading basal cells with apical nuclei (reverse polarization), characteristics of ameloblastoma. Fibroma in oral cavity of cattle composed of spindle cells arranged in long, thick, interlacing streams and bundles and supported by an abundant collagenous matrix. Odontogenic myxoma in a cow is characterized by large, stellate or triangular fibroblast like cells with cytoplasmic process, vesicular nuclei and small nuclei. Ameloblastic fibro-odontoma in a cow showed long cords and discrete islands of odontogenic epithelium in a background of loose mesenchymal tissue reminiscent of dental pulp. Fibromatous epulis in a buffalo revealed eosinophilic osteoid tissue surrounded by collagen fibres and fibroblasts at margins, engorged blood vessels with erythrocytes, haemorrhage and focal areas of necrosis with marked mononuclear cells and growth appeared to originate from periodontal region. Fibro-odontoma in a cow shows odontogenic hard tissue in fibromatous areas, composed of enamel structures. Histologically, ameloblastic odontoma shows enamel organ of dental tooth germ, and accompanied by irregular, small amount of osteodentine and abundant enamel with fine prism. Ameloblastic fibro-odontoma is characterized by islands of epithelium with peripheral palisading of elongated columnar cells with reverse polarity and basal clearing. Centrally the islands contained loosely arranged stellate cells (stellate reticulum). Epithelial component are separated by fibrovascular stroma. Along the basilar aspect of odontogenic epithelium, dentin and enamel like material are deposited.
Molecular studies

Tumour markers are proteins produced by the tumour cells or by other cells of the body in response to cancer or certain benign (noncancerous) conditions. These substances can be found in the blood, urine, tumour tissue or in other tissues. Different tumour markers are found in different types of cancer and levels of the same tumour marker can be altered in more than one type of cancer [47]. p53 over-expression is seen in oral squamous cell carcinomas which is a significant marker of carcinogenesis and can be considered as an important marker for clinical evaluation, diagnosis as well as prognosis of disease [48]. Expression of anti-pancytokeratin and p53 was not detected in odontogenic myxoma in a cow [42]. All oral tumours shown negative immunoreactivity for p53 antibody which indicates p53 mutants may not play important aetiology in oncogenesis of bovine oral tumours [14]. Ameloblastoma in eight year old bullock diagnosed immunohistochemically positive for cytokeratin CK8, CK18 and Vimentin [39]. The significant expression of CK18, parenchymal MMP-2, stromal MMP-9, and Ki-67 could provide useful markers for differentiating Ameloblastic carcinoma from ameloblastoma [39]. Immunopositive reaction for CK14 was observed in ameloblastoma, papilloma and adenoma (epithelial tumours); however, no immunoreactivity was noticed in fibroma, myxoma and Chondroma (mesenchymal tumours) [14].

Treatment

Chemotherapeutic drugs can be administered as a sole treatment in small size of tumour, but larger tumours must be surgically debulked prior to drug treatment [40, 50, 51]. Mandibulectomy for treatment of oral tumours in cattle can result in acceptable cosmetic appearance without functional impairment; chemotherapy, radiation therapy, cryotherapy and thermocautery in conjunction have also been recommended [52]. Vincristine sulphate is currently the most commonly used chemotherapeutic drug now a day in canines but literature on bovine is very limited. Mechanism of action of vincristine sulphate has been related to the inhibition of microtubule formation in mitotic spindle, resulting in an arrest of dividing cells at the metaphase stage [53]. Vincristine sulphate is effective for the treatment of small size bovine oral tumours [40]; however, vincristine sulphate along with antimonaline have better results than vincristine sulphate alone [43]. Surgical excision is required for large size bovine oral tumours along with vincristine sulphate and antimonaline [43]. Surgical excision in odontoma in cattle at mandible region is successful with good recovery [84, 51].

Conclusion

The reporting of oral tumours in bovine will bring more awareness to prevent economic and productive losses, have better management and treatment regimen.

References


