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Bovine Herpesvirus Types 5 (BoHV5): A New and Emerging Threat in Indian Cattle

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ABSTRACT

Bovine herpesvirus 5 (BoHV-5) belongs to the genus varicellovirus family *herpesviridae* and is a causative agent of meningo-encephalitis in cattle. BoHV-5 can replicates in the central nervous system (CNS) to cause encephalitis and establishes latency in the trigeminal ganglion of either naturally infected cattle or experimentally inoculated laboratory animals. BoHV 5 was first time reported in Australia in 1962 and subsequently reported in Latin Ameican countries Argentina, Brazil and Uruguay. Few cases of BoHV5 infection has also been reported in USA and Europe. Recently, the BoHV5 infection was reported in Indian cattle for the first time. The BoHV5 was isolated from aborted cattle and characterized as BoHV5 subtype A and this finding may necessitate inclusion of BoHV5 test protocol in testing of semen for sexually transmitted diseases. Because BoHV5 infection in cattle recently reported in India so, it is needed to explore the similarity of the isolates with earlier reported isolates and to check it's pathogenicity to cause encephalitis in natural host and in experimental animals like rabbits, rat, guniea pig *etc*. Beside this, we have to explore the information about co-infection of BoHV5 with other viral, bacterial, fungal as well as parasitic agents.

Key words: Bovine herpesvirus types 5 (BoHV5), Latency, Meningo-encephalitis, Therapeutic intervention.

INTRODUCTION

Bovine herpes virus types 1 (BoHV1) and Bovine herpesvirus types 5 (BoHV5) are genetically and antigenically related alphaherpesviruses with 85% similar protein repertoire. BoHV1 is mainly associated with respiratory tract infections known as bovine infectious rinotracheitis (IBR), reproductive tract infections (vulvovaginitis or balanopostitis) and abortions (Engels *et al.*1996; Muylkens *et al.* 2007; Nandi *et al.*, 2009). The BoHV1 is prevalent all over the globe including India. The BoHV5 was reported first time in Australia in 1962 (Johnston *et al.* 1962) then frequently reported and restricted to South American countries (Perez *et al.* 2002, Vogel *et al.* 2003). The few cases have been reported from other countries (Abdelmagid *et al.* 1995, d'Offay *et al.* 1993, Ely *et al.* 1996).

BoHV5 usually infects young calves and exhibit 100% mortality (Schudel *et al.* 1986). BoHV5 is the main causative agent of fatal meningoencephalitis and establish latency in trigeminal ganglion in cattle. BoHV5 generally excreted in external body secretions such as ocular, nasal and genital. The BoHV5 infected cattle exhibit the symptoms like weakness, anorexia, neurological signs, blindness, muscular tremor, head pressing, circling, paddling, convulsions and finally death occurs and sometime associated with reproductive disorder (Zajac *et al.* 2010).

Recently, Naveen *et al.* (2020) first time reported BoHV5 infection in Indian cattle. Clinical investigations, detection of antiviral antibodies, virus isolation, BoHV1/ BoHV5 differential PCR, biotyping and sequence and phylogenetic analysis of UL27, UL44 and UL54 genes confirmed the association of BoHV5 subtype A in the aborted cattle. The isolated virus has ~99% genomic similarity with Brazilian BoHV5 strains. According to the report, *Campylobacter* spp, *Leptospira* spp, *Listeria* spp, *Trichomonasvaginalis*, *Brucella* spp and BoHV1, mainly associated in abortion but not detected in the outbreak. Agreeing with the report, the abortion cases occurred in 4-9 months of the pregnancy duration without any specific clinical signs of neurological disorder. The BoHV1 vaccine induces cross-protection against BoHV5 and confers protection against BoHV5 associated disease in BoHV1 endemic areas (d'Offay *et al.* 1993; Zajac *et al.* 2010). Vargas *et al.* (2016) determined the presence of Bovine herpesvirus - 1 (BoHV-1) and Bovine herpesvirus 5 (BoHV-5) neutralizing antibodies in cattle herds were on the Colombian high plains and their correlation with the level of cross-protection against both herpesviruses. They screened twenty-three farms; 488 sera samples were collected and virus neutralization test were performed for each serum and was evaluated independently for each virus. Results of the tests confirmed the presence of BoHV-1 and BoHV-5 infections in 100% and 73.9% or population, respectively.

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Lunardi *et al.* (2009) reported the outbreak in Brazil, where nine cattle calves having three potential forms of the neurological disease, subjectively classified as peracute, acute and subacute/chronic. BoHV-5 infection resulted in focal non-progressive caudal brainstem dysfunction (pontomedullary syndrome) in an animal presented with subacute/chronic BoHV-5 meningoencephalitis. The CNS tissues were examined by two test; histological examination and multiplex-PCR. CSF samples through PCR allowed ante-mortem BoHV-5 diagnosis during the outbreak, which enabled the implementation of several measures of control for the disease.

To minimize economic loses the animals should be vaccinated for BoHV1 and BoHV5 (Romera *et al.* 2014; Campos *et al.* 2011). Moreover, BoHV-5 gI/gE/US9 recombinant vaccine was tested and shown to reduce virus titter from nasal secretion and improve body condition (Anziliero *et al.* 2011). Since vaccine (BoHV1/BoHV5) was never used in the farm, demonstration of antiviral antibodies, together with virus isolation, strongly suggested an active BoHV5 infection in the herd. However, latently infected cattle may also develop antiviral antibodies, with infection occurring sometime before the abortion. The animals were regularly administrated with foot-and-mouth disease (FMD) and Brucellosis vaccine but still a substantial abortion indicates the failure of prevention against brucellosis and co-morbidity of brucella and BoHV5 subtype 'A' had been noticed (Kumar *et al.* 2020).

The study describes presence of BoHV5 subtype 'A' in vaginal secretion in aborted cattle. Whole genome sequencing of the isolate (BoHV5//India/2018/Bhilwara) and its ability to produce encephalitis in natural host and/ or in rabbits needs to be elucidated. In addition, Co-infection of BoHV5 isolates with other infectious agents (Viral/ bacterial/ Fungal/ parasitic) needs to be explored.

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