

The most important herpesviral infections in animals and humans

Abstract

The most unique feature of herpesvirus is associated with the latency stage in the affected host and the subsequent reactivation of recurrent infection. Their oncogenic potential and viral integration into the host chromosomes also makes them unique among viruses. Malignant catarrhal fever (MCF) caused by ovine herpesvirus 2 (OvHV-2) was diagnosed in Egypt, 2012 by electron microscopy (EM) which detected herpes viral particles and it also excluded other viral diseases having the same symptoms. OvHV-2 is similar to Epstein-Barr virus (EBV) for encoding the homologous two cellular Bcl-2 proteins. ORF43 and ORF63 genes were found to be a homolog for herpes simplex virus (HSV) UL6 and UL37. EB viral particles were first noted by EM in a malignant burkit's lymphoma in 1964. Surveillance for possibility of humans to be infected with OvHV-2 is recommended due to a lot of conditions in addition to cases of pancreatitis especially for children who may result in pancreatic failure and diabetes myelitis as well in addition to testing of patients with autoimmune disorders, melasma and skin depigmentation for infection with OvHV-2. Also, sequencing of complete genome such as gB for OvHV-2, HSV and EBV must be performed and compared with reference OvHV-2, HSV and EBV to exclude misdiagnosis between them. Moreover, testing of poultry, aquatic species and pet animals for infection with OvHV-2 is recommended

Keywords: poultry, viruses, skin, eczema

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Abbreviations: MCF, malignant catarrhal fever; EM, electron microscopy; OvHV-2, ovine herpesvirus 2; EBV, Epstein-Barr virus

Introduction

Herpes is a word used for description of the disease which causes skin eczema and cancer in human medicine more than 2,600 years ago.¹ All herpes viruses share common features as well as structures of some proteins.² The most unique feature of herpes viruses is associated with the latency stage in the affected host and the subsequent reactivation to recurrent infection. Their oncogenic potential and viral integration into the host chromosomes also makes them unique among viruses. Due to a common origin of evolution, they also share a potential to infect new hosts.^{3,4} Malignant catarrhal fever (MCF) caused by ovine herpesvirus 2 (OvHV-2) was diagnosed in Egypt, 2012 by electron microscopy (EM), negative staining technique which detected herpes viral particles and it also excluded other viral diseases having the same symptoms⁵

The predominant lesions of MCF were shown to have CD8⁺ T lymphocytes and OvHV-2 was found in most of these cells. CD4⁺ T lymphocytes and B lymphocytes were not detected in MCF lesions although macrophages were observed in it.⁶ OvHV-2 is similar to Epstein-Barr virus (EBV) for encoding the homologous two cellular Bcl-2 proteins.⁷ ORF43 and ORF63 genes (which encode putative structural protein) were chosen to be studied. Due to sequence of the predicted amino acids of the ORF43 protein, it was found to be a homolog for herpes simplex virus (HSV) UL6 which by it, the portal for viral DNA entry into the performed capsid is constituted.⁸ In the same manner, ORF63 was found to be a tegument protein encoding gene which possesses homology with HSV UL37 protein.⁹

Histologically and ultra-structurally different lesions of MCF resemble those which was detected in the conditions of lymph reactive

ones like graphits, contact hypersensitivity, infectious mononucleosis, NZB mouse and Kawasaki disease as well as rheumatic diseases (Behcet's disease was included in them) in addition to systemic lupus erythematosus,¹⁰ where arthritis or synovitis is one of their manifestations. Arteriosclerosis lesions which are associated with MCF (mainly observed in the rete mirabile) resemble the healed lesions developed in polyarteritis nodosa¹¹ which is a human idiopathic disease where its acute and chronic conditions have the same characters of MCF.¹² A large numbers of genomic DNA of OvHV-2 were detected in the secretions of nostrils. This observation denotes that viral replication could occur in the nasopharyngeal epithelial cells such as other gamma herpes viruses like EBV.⁷

For OvHV-2 DNA specific detection, the technique of polymerase chain reaction (PCR) is specifying a segment of 238 bp using nested primers which are made from the nucleotide sequence of OvHV-2, homologous to the genes that are located terminally and encode the 140KD which is a tegument proteins of EBV.¹³ Ov2.5 gene of OvHV-2 is a gene which encodes the homologue interleukin-10 (IL-10). It keeps the structures of the exon which is similar to the cellular gene in spite of the reduction of intone sizes. Also, Ov 4.5 gene encodes a protein which is predicted to function as VBcl-2 (Viral B cell lymphoma-2) homolog of the EBV BALF1 anti - apoptosis protein which regulated death of cells.^{4,7} C500 and Wc11 strains of the wildebeest associated (WA) MCF which is caused by alcelaphine herpesvirus 1 (AIHV-1) gave cytopathic effect (CPE) that was typical and having some adaptations on their propagation in MRC-5 and Hela (human) cell lines in addition to human cells of embryonic tonsil¹⁴ Ovine herpesvirus 2 complete genome by sequencing is 135.621 bp.^{15,16,17} EBV antibodies were found among 76.4% of farmers and 23.0% of white-collars.¹⁸

EB viral particles was first noticed by EM in a malignant Burkitt's lymphoma in 1964,¹⁹ which is a B cell neoplasm that occur unusual

locations such as mandible, nasopharynx, orbit, kidney, adrenal glands and ovaries. EBV is worldwide spread in human and as 90% of population is being exposed to and produces antibodies to the virus's lytic and latent proteins. Recently, EBV is reported to be also associated with T-cell lymphoproliferative syndrome in case of teenagers and young adults with clinical signs of fever, mass in neck, hepatosplenomegaly, and pathologically patients reveal hemophagocytic lymph histiocytosis which is hematological disorders.²⁰

Severe complications of EBV infection are myocarditis, pericarditis, encephalitis and destruction of red blood cells (hemolytic anemia). T-cell lymphoma, extranodal NK type is caused by EBV.²¹ A lot of recent cases denote EBV presence in tumor cells of about 100% of them.^{16,22} EBV genome is 172kb long. Its genome is furtherly splits into s short as well as a long unique regions with direct sequence repeats (up to 12) of ~ 3kb.^{23,24} EBV genome is 135kb double stranded DNA which is herpesvirus that could transform human B lymphocytes into proliferating blasts.

Recommendations

Due to MCF causes a lot of conditions such as sudden death, thrombosis, lesions of respiratory and alimentary tracts, arteriosclerosis, hepatitis, hepatosplenomegaly, myocarditis, encephalitis, meningitis, impaired vision, blindness, leucomas, eye opaqueness, arteritis-plebitis, cystitis, renal infraction, lymph node enlargement, loss of weight, skin lesions (dermatitis, hyperpigmentation, alopecia, thickening, crusting and hyperkeratosis), arthritis, synovitis, reproductive disorders, in addition to nervous symptoms and also, the virus is widely distributed, strong suspicion to infect humans existed. Surveillance for possibility of humans to be infected with OvHV-2 is recommended because of the previous mentioned conditions in addition to cases of pancreatitis especially for children who may result in pancreatic failure and diabetes myelitis as well as testing of patients with autoimmune disorders, melasma and skin depigmentation for infection with OvHV-2. Moreover, sequencing of complete genome such as gB for OvHV-2, HSV and EBV must be performed and compared with reference OvHV-2, HSV and EBV to exclude misdiagnosis between them. Also, testing of animals having mass (es) of tumor poultry, aquatic species and pet animals showing any of mentioned symptoms for infection with OvHV-2 is recommended.

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Conflicts of interest

Author declares there is no conflict of interest.

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