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Short Communication

Short Communication on Infectious Ectromelia

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Abstract

Infectious ectromelia (ECTV) is an infectious viral disease caused by dsDNA virus of poxviridae family. It is an acute, systemic, highly lethal disease of mice. Highly susceptible strains of mice die without shedding the virus but the intermediate susceptible strains recover from infection and shed the virus. It is spread due to direct contact from animal to animal. The spread of disease through shipment of laboratory mice has been reported. It has genetic similarity with variola virus and other subspecies of poxviridae family. The ECTV mouse model is used by researchers to understand the virus–host relationship, elucidate mechanism of viral pathogenesis and modulate host response. It has also been used as a model for smallpox virus and for testing orthopoxvirus antivirals and vaccines. The mouse pox virus gained attention as super mouse pox virus, which is genomic alteration of mouse pox virus in the C57BL/6 strain of mice. The recombinant virus altered host immune response and caused lethal infection in exposed population as well as re-infected previously immunized population. It can pose threat to immunized population in nearby future if used as biological weapon.

Keywords: Infectious Ectromelia; dsDNA Virus; Poxviridae; C57BL/6 Strain

Etiology

Infectious ectromelia comes under viral disease and is known to caused by mouse pox virus. This name has been taken from the Greek word *ectro*, meaning abortion, and melia, which signifying limb. It was identified in 1930 in United Kingdom when the mice were first used for experiments in laboratory [4]. Young mice are highly susceptible to lethal infection as compared to adult mice. Also, immunodeficient mice have a high susceptibility to mouse pox virus. The mouse pox virus has genetic similarity with the variola virus. Due to this, they have been used as model for smallpox virus and testing orthopoxvirus antivirals and vaccines [2]. Various strains of ectromelia virus include Ishibashi I–III, NIH-79, Wash-U, Hampstead, Moscow, St. Louis-69 and Bejing-70. The original Hampstead strain of ECTV was first mouse pox virus isolated in a laboratory-mouse colony and ECTV Naval strain (Nav) was isolated from an outbreak in a United states navy research facility. It caused a highly severe disease in BALB/c strain of mice and a mild infection with low mortality and morbidity in CD-1 strain of mice [3]. Among all strains, ECTV strain Moscow (Mos) is the most virulent strain [1]. Disease pathogenicity is determined by virus strain but age of mice and host genetics also determine the severity of disease. BALB/c, SWR, C3H, DBA, A and CBA are most susceptible mouse strains. However certain strains such as AKR and C57BL/6 are resistant. The C57BL/6 strain gained attention after Australian research group created a recombinant virus for antibody mediated response but instead the ectromelia virus vector altered host

immune response and caused lethal infection in exposed population as well as re-infected previously immunized population. It is termed as super mouse pox virus and can be a potential biological weapon threat to immunized population.

Transmission and pathogenesis

The infection occurs naturally in mice and is transmitted directly through direct contact and skin abrasions (Horizontal transmission). Primary site of infection is skin. Virus enters the host through skin abrasion and replicate in the epidermis before releasing the viral progeny. It spreads to regional lymph nodes and cause severe viraemia. Liver and spleen are second predilection site for replication and release of progeny. Swelling of foot is the primary lesion with early rashes (papules) and severe rash (ulceration). However, in acute cases ruffled fur or prostration may take place before death. Skin lesions usually recovers within a few weeks, but hairless scars may remain. It is also often observed that in severe viral infection on the feet and tail can lead to necrosis and amputation in many cases. There is no vertical transmission of virus.

Clinical signs and gross pathology

Conjunctivitis, alopecia, cutaneous erythema, erosions (rash) and dry gangrene of extremities resulting in "ectromelia" are most commonly observed in affected mice. Liver is usually inflammed, friable, and mottled with several necrotic foci. Regeneration in nonfatal cases begins at the margins of dead tissue, however inflammation is variable. Spleen affected from ectromelia infection shows necrosis, scarring of red and white pulp creating a 'mosaic' pattern of white and brown. In acute form of splenic necrosis, disease commonly leads to hepatic necrosis with infarcts but is equally or more severe. Necrosis of lymph nodes, thymus, intestinal mucosa, peyer's patches and genital tract have also been seen during acute infection. Degeneration of peyer's patches can result in intestinal hemorrhage. Intrauterine infection and abortions have also been reported in some cases. Necrosis of dermal epithelium leads to a scab and recovers as a hairless and deep scar. Rashes develop 4 to 5 days after initial infection as a result of viraemia. They are multiple and usually widespread and can lead to conjunctivitis and blepharitis. The skin lesions can lead to deep ulcers and scab before finally scarring.

Microscopic lesions

Focal coagulative necrosis is seen in various organs like liver, Peyer's patches, lymph nodes, spleen and thymus. Skin lesions consists of hyperplastic and swollen epithelial cells. Virus propagates in the cellular cytoplasm and produces intracytoplasmic inclusion bodies. These inclusion bodies are of two types. Type A and Type B. The A type of inclusion bodies (Marchal body) are acidophilic in nature and well demarcated. They are typically observed in epithelial cells of dermis or serous membranes but can also be found in mucosa or submucosa of intestine. The B type of inclusions are basophilic in nature and are found in majority of ectromelia-infected cells.

Diagnosis

Mousepox can be diagnosed by clinical signs and gross lesions. Histologically, the presence of coagulative necrosis of multiple tissues with typical eosinophilic intracytoplasmic inclusions in epithelial cells serves as diagnostic. Electron microscopy also serves as an excellent technique for identification of infective cells with mouse pox virus. Distinctive viruses may be observed in infected tissue using this technique. Virus can also be isolated in mouse embryo cell culture and can be daignosed by immunological techniques. The BS-C-1 cell line is most sensitive to infectious ectromelia infection. They also produces hemagglutinin envelope and can be easily differentiated by serological test for mousepox.

Conclusion

Among the 40 genomes of different poxvirus genera, mouse pox virus has greatest resemblance to the smallpox virus. Smallpox was the most serious disease of mankind and after its eradication in 1977, no cases have been reported. However, the study of poxvirus is important due to protein repertoire and genetic similarity to each other which help us to understand the virus–host relationship and elucidate mechanism of viral pathogenesis and modulate host response. The Mouse pox (ECTV) infection is a valuable asset for researchers as model of smallpox and also serves as a model for testing orthopoxvirus antivirals and vaccines.

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