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Role of vector in transmission of viral hemorrhagic fever

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Abstract---Viral hemorrhagic fever is considered from zoonotic diseases which infect both human and animal, it is transmitted via vector (mosquito, tick) according to type of viral hemorrhagic fever, such as dengue fever and yellow fever are transmitted by bite of mosquito, but CCHF is transmitted by bite of tick, the viruses belong to four families include Arenaviridae, Bunyaviridae, Flaviviridae, and Filoviridae, can also be transmitted from human to human by direct contact with blood and body fluids. In severe cases of disease may be lead to threatening human life due to malfunction in immune system and failure in kidney and other organs. While in animal that cause in economic losses. To reduce severity of disease by control of vector and should be use vaccine to prevent disease.

Keywords---viral hemorrhagic fever, vector, tick, mosquito, transmission

Introduction

Viral hemorrhagic fevers (VHF) are groups present a range of disorders from relatively severe to threatening life of human entities whose reaches high levels of mortality, they belonged in 4 families: Arenaviridae, Bunyaviridae, Flaviviridae, and Filoviridae (1). Most of the viruses concerned in these diseases require vectors

for transmission to humans, given their zoonotic nature, with the majority being arthropod-borne or rodent-borne infections, these diseases are generally limited to the endemic regions where they live in hosts (2). Several VHF viruses are contagious, and some are highly infectious for example (arenavirus and filovirus), with person to person transmission from direct contact with bodily secretion and infected blood (3).

Symptoms of Viral hemorrhagic fevers are primarily non-specific and may consist of headache, fever, myalgia, and upper respiratory tract or gastrointestinal complaints (4,5). The World Health Organization (WHO) recorded sporadic cases of human and some epidemics of Crimean-Congo hemorrhagic fever virus in the Eastern Mediterranean region, chiefly in Iraq, Iran, Oman, Saudi Arabia, Kuwait, the United Arab Emirates and Pakistan. CCHF was increasing in these countries, in the recent years, and new cases are recorded in new regions in this area, with a more geographic postponement of this viral disease, that might be related to the distribution of ticks infected by the migratory birds and the employment in livestock. Many risk factors have been suggested to explain the development of Dengue hemorrhagic fever, these involve prior infection with other serotypes of dengue virus, virulence of the infecting dengue virus genotype, host factor, and immune enhancement (6). The aim of this study was conducted to assess the knowledge role of vector on transmission of viral hemorrhagic fever also its effects on public health.

Background

Many RNA viruses are zoonotic transmitted to human from arthropods or animals may cause a syndrome mentioned to as viral hemorrhagic fever (7). Crimean hemorrhagic fever was not until the early 1940's which called a disease, in the Western Crimea region of the former USSR it was medically considered for the first time after an outbreak (8). The first historically reported outbreaks due to viral agent's date to ancient times when the Roman armies were recurring from distant countries taking with them "exotic" infections. Certainly, the rise of a "new" virus is a very rare event, most often, in terms of appearance of pathogen, a virus adjusts through selection pressure and mutation to host of human causing disease (9). In (2002 and 2003) 12 patients in Turkey had proved Crimean-Congo hemorrhagic fever virus infection which resemble the genotypes of virus found in Kosovo and Russia very closely, and a various genotype from those which caused the CCHF outbreak in Iran in 2002 year, these data demonstrated that the disease in the affected parts in Turkey was not presented from Iran whether by a livestock or from a tick infected (10). In Iraq the first case was recorded in 1979, immediately from this time, ten cases were recorded, resulting in 7 deaths, many cases were also recorded in 1980 in Halabja city in Sulaimani province of Iraq (11). The history of Viral hemorrhagic fever in the Saudi Arabian Peninsula has been recognized since the 19th century, in which several outbreaks have been recorded from the south western area of Saudi Arabia (12).

Method

The most common viral hemorrhagic fever (VHF)-viruses which have been epidemic classify to 4 families; namely, Bunyaviridae (Crimean-Congo

hemorrhagic fever-CCHF, Rift Valley fever-RVF), Flaviviridae (Dengue fever and yellow fever and Alkhurma hemorrhagic fever-AHF) Filoviridae (Ebola fever) and Arenaviridae (Lassa fever) (2).

Transmission

Members of families (*Arenaviridae*, *Bunyaviridae*, *Filoviridae*, and *Flaviviridae*) are the HF viruses, these families have various transmission forms geographical distributions, however, the arthropod vectors or the reservoirs for them play a important role in determining the geographical area, furthermore, ecology and the features of the families as well play role in the transmission of the hemorrhagic fever viruses in natural course and nosocomial transmission, the reservoir for family of *Filoviridae* is still unknown, is also as common as human to human transmission, transmission between human generally by the contact with infected blood or body fluids (13). Dengue fever is transmitted to humans by the bite of infected mosquitoes (*Aedes aegypti* & *Aedes albopictus*), upon injection into the skin, mononuclear phagocytic cells, such as macrophages, monocytes, and dendritic cells are primarily targets of DENV (14). Adult mosquitoes housing indoors and bite during (1-2) hour periods in the morning and late afternoon, the virus replicates in the epithelial cell lining of the mid gut of the host and escapes into to infect the salivary glands after ingestion of the infected haemocoel blood meal and finally enters the saliva causing infection during penetrating, the virus may enter the fully developed eggs at the time of oviposition and the genital track is also infected. The incubation period lasts from (8 – 12) days and the mosquito residues infected for the rest of its life (15). Yellow fever virus is besides maintained vertically in populations of mosquito via transovarian transmission (13). CCHF is transmitted to human by hard ticks the bites' or crushing of engorged specimens and/or through direct contact with secretions, tissues or fluids of viraemic animals (animal abortion, farmers, animal husbandry, slaughtering activity, etc.) or with infected humans (fluids, blood, and other biological secretions) devoid of protective measures (16,17). The virus circulates in a tick, vertebrate, tick cycle, however can also be transmitted vertically and horizontally within population of tick, *Hyalomma* ticks invade a wide spectrum of various wild life species, such as hares and deer and, free-ranging livestock animals, for example cattle sheep, goat, and, many birds are unaffected by to infection, but ostriches occur to be more susceptible, viraemia is low intensity, and short-lived in livestock, these animals play a primary role in t ticks life cycle, and in the amplification and transmission of the virus and, therefore, in the attention of veterinary public health (18). Ebola hemorrhagic virus have two most significant routes for transmission from person to person appear to be direct contact and contact with fluids of body, it is very possible that aerosols or droplets play little or no role (19). Monkeys might be a vector in transmission to people (20).

Clinical feature

The incubation period of viral hemorrhagic fever is extremely variable depending on the route of virus appearance into patient's blood stream, the incubation period of CCHF after bite of an infected tick is about (1-5) days, while, if the virus is developed through the contact with infected body fluids or tissue, it is about (5-

7), up to thirteen days, incubation period of Ebola is about (2-21) days (21). Furthermore, incubation period of Lassa fever about 3-16 days, Yellow fever (3-6) days, and rift valley fever from 2-6 days (2). The clinical units are typical with fever course associated with high mortality rate and bleeding (22, 1). The pathological symptoms of the VHF caused by the replication of the viruses of the hemorrhagic fevers can be directly but the symptoms caused are the result of the malfunctioning of the innate immune system response of the host, deterioration of the dendritic cells and rapid infection, instant and release of cytokines from the infected cells and cryptic death of lymphocytes the collectively cause variations in the function and permeability of the vascular system, inducing complaints in coagulation pattern leading to the significant symptoms of VHF(23). Clinical symptoms consist of myalgia with abrupt onset fever followed by malaise, headache, prostration, dizziness, body aches, hyperesthesia, photophobia, vomiting, nausea, abdominal pain, or chest, conjunctival suffusion, flushing of the face and head, proteinuria and periorbital edema commonly accompany the clinical picture, bleeding into the mucus membranes and skin follows with hemorrhagic rashes and hemorrhage from openings of body especially the mucus membranes of the eye, mouth, nose, gastrointestinal and the genitourinary tract, patients often evident with combinations of these features, in severe cases blood pressure is often reduced and shock often interrupts (24). Hantavirus (family of *Bunyavirus*), unlike other viruses, is recognized to cause symptoms of respiratory, hantavirus includes two clinical appearances: hantavirus cardiopulmonary syndrome and hemorrhagic fever with renal syndrome (25).

Epidemiology

In the 1930s, the concept of viral hemorrhagic fever (VHF) was initiated by Soviet investigators, who were studying hanta viral hemorrhagic fever (HF) with renal syndrome, these investigators later comprehensive the designation to include Omsk HF and Crimean-Congo HF, the concept of VHF involves diseases caused by 23 enveloped RNA viruses from four taxonomic families: Arenaviridae, Bunyaviridae, Filoviridae, and Flaviviridae (26). Dengue virus infection is a widespread emerging global epidemic, with a projected two-thirds of the world's population at risk of exposure to DENV, in the last 30 years, DENV has spread into over 100 countries, including the United States of America, leading to a four-fold increase of dengue disease (27). Of all *Ae. aegypti*-borne viruses, comprising chikungunya and yellow fever virus, DENV characterizes economic burden and the greatest epidemiological (28). Yellow fever virus is transmitted by mosquitoes in South America and tropical Africa, zoonotic cycles including sylvatic mosquitoes and nonhuman monkeys occur in on the edge of the African savanna and tropical forests (13). *Filoviridae* family involves (Ebola and Marburg viruses), again typical for west parts of Pacific region and Africa (29). Crimean-Congo hemorrhagic fever (CCHF) is a tick-borne caused by infection with virus (*Nairovirus*) in *Bunyaviridae* family, the disease was defined in Africa, Europe and Asia, (13). *Nairovirus* genus composed of seven species among tick-borne viruses, described as pathogens for human or animal (30). CCHF is first documented in (1944) in former Soviet Union and appeared in the close from geographic locations after years for example South Africa and Bulgaria, established cases of CCHF raised after 2000, recorded in Iran, Turkey, Greece, India, nation of Balkans and Georgia for the first time, also, similar species of ticks were also revealed in deer's

in Spain, around (6300) cases established in ten years after it was first seen in 2002 in Turkey, increase of occurrences can also be seen after its first respect in 1999 in Iran (8). CCHFV was reported for the first time in South-western Europe in 2010, when RNA viral was found from ticks of *Hyalomma lusitanicum* collected from deer in Spain (Caceres) (17). The incidence of Crimean-Congo hemorrhagic fever is increasing quickly in many countries of the middle east, with many sporadic and outbreaks cases of CCHF in human, which are recorded in many countries in this area (31). In Saudi Arabia has been recorded a broad variety of blood-sucking arthropods, involving several species of mosquitoes, categorized under the genera *Anopheles*, *Culex*, *Culista*, *Uranotaenia*, and *Aedes* (32). According to many different factors linked to the kind of the causative agent, clinical features and the host epidemiological lead to clinical presentation and the severity of VHFs can significantly change (33). The decrease in rainfall and rise in temperature in the Eastern Mediterranean area may lead to increase in habitats distribution which are suitable for ticks (*Hyalomma*), that results in increase of infection rates in the CCHF virus (34). Furthermore, the mean age was 51 of all the patients and there was no change between the severity groups of age distribution in terms, approximately half of the patients were male in totally severity groups (14).

Diagnosis

Diagnosis is often mentioned by history to travel to an endemic region within the incubation period (35). The diagnosed can be succeeded by the following methods consist of: the virus culture, detection of virus specific antibodies, detection of viral antigen, detection of viral nucleic acid, and examination of parameters hematological (36).

Treatment

Ribavirin is a broad spectrum antiviral drug, active against viruses of hemorrhagic fever (except of Ebola virus) in cell culture system, in classical infections with arenaviruses in monkeys and Guinea pigs, ribavirin has revealed both therapeutic and efficacy prophylactic (37). Compounds of pyrazinecarboxamide, for example T-705 (favipiravir), T-1105 and T-1106, are being studied in vitro and in vivo as candidate antiviral drugs for various VHFs, these compounds have revealed good action in models of animal for bunyaviruses, arenaviruses (Junin virus), Rift Valley Fever virus (RVF), yellow fever virus, and West Nile virus (33). Treatment is chiefly supportive and comprises in fluid resuscitation, management of hypotension by cardiogenic / vasopressors drugs and management of the complications of hemorrhagic by suitable transfusions of blood and blood product (fresh frozen plasma or cryoprecipitate, platelet concentrates) (22).

Prevention

Community is an important element of disease prevention and control, appropriate understanding of dengue may increase the consciousness of people around outbreak prevention (38). The management cases of VHF have been chiefly focused on the severe application control measures of infection to prevent

spread of vector. However, containment procedures and high-level isolation may disserve the employment of standard clinical interferences that would be presented to critically ill patients infected with other pathogens of life-threatening (33). Vaccines have been advanced for Junin virus, YFV, KFDV, RVFV, and hantaviruses (39). a live, recombinant, tetravalent, attenuated dengue vaccine for dengue has recently been revealed to be effective and safe after twenty-five months of active investigation in ten countries among various populations, over various seasons with levels of endemicity and different circulating serotypes (40).

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