Recent outbreaks of crimean–congo hemorrhagic fever (CCHF) in Iraq

Dalal Al-Rubaye1*, Talib Saleh Al-Rubaye1, Marwa Shaker1 and Hassan M Naif2

1Department of Biotechnology, College of Science, University of Baghdad, Iraq
2Department of Molecular and Medical Biotechnology, College of Biotechnology, Al-Nahrain University, PO Box 64030 Baghdad, Iraq
*Corresponding author: dr.tbdalal@gmail.com
Received: June 7, 2022/ Revised: June 22, 2022 / Accepted: June 26, 2022

Abstract

Crimean-Congo haemorrhagic fever (CCHF) is an emerging zoonotic disease defined as a disease that passes from an animal or insect to a human. It is responsible for several deaths in humans, while the hosts, like cows, sheep, and goats are not affected. The CCHF was recognized for the first time in Iraq in 1979 where the virus was isolated from human cases and characterized. Since then, several small-scale outbreaks have been reported in 2019, 2021, and 2022. During this period, awareness workshops were conducted targeting government officials, veterinarians, medical doctors, and assistant staff. A strong collaboration strategy was put into place between these sectors together with the united nation office in Baghdad. These resulted in accelerating of the implementation of the amendment of the Veterinary Medical Progression Law 2021, establishing a supreme Committee for Epidemiological Disease Control supervised by the Council of Ministers and forming a collaboration crisis cell from Baghdad and other municipalities and ministries concerned, and placed detailed safety, one health and control measures for all parties involved. The current outbreak cases reached 90 cases with 18 deaths with the majority being in Thi-Qar Governorate. The current situation is difficult to deal with such a highly virulent virus due to the unavailability of an effective vaccine nor BSL-4 facility to safely deal/handle the virus in the country.

Keywords Arbovirus, Hemorrhagic fever, Tickborn viruses, Livestock, Iraq

Introduction

The first case was reported on 3 September 1979 and since then a further 9 patients have been investigated. Eight patients gave a history of the previous contact with sheep or cattle, while 2 patients, a resident doctor and an auxiliary nurse, acquired their infections in the hospital by direct contact with patients. Eight of the patients had no epidemiological relationship to one another and lived in widely separated areas around Baghdad and Ramadi. The virus was isolated from the blood of the patients and postmortem liver specimens. The isolated virus was closely related serologically to members of the Congo/Crimean haemorrhagic fever virus group but not identical. The outbreak in 2018, the Iraq ministry of health reported a total of 45 suspected cases with 15 laboratory-confirmed have been reported from April to November 2021. While, 22 March 2022, the WHO, in cooperation with the Ministry of Health in Iraq organized a three-day workshop, in collaboration with the Government of Japan, targeted 42 participants, including physicians, veterinarians, lab technicians, health workers, and zoonotic diseases investigators from 13 Iraqi governates to build rapid response team (RRT) in field investigation and outbreak response, with focusing on the new outbreak of CCHF. RRTs have contributed to containing outbreaks of the epidemic- and pandemic-prone diseases in Iraq and beyond. During this training, Dr. Ahmed Zouiten, WHO Representative in Iraq said: that the CCHF as a case study will further equip the RRT with knowledge and capacities to control any future outbreaks of this anthropo-zoonotic disease in Iraq and the regional. The disease has been endemic to Iraq since 1979, with few sporadic cases reported across the country. The fever started
reappearing again in Iraq last year, making fear among locals, where small outbreaks have been reported, with the last outbreak happening in 2021 with 18 cases confirmed in Thi-qar and Ninawa Governorates. The last report for the current epidemic, till mid of May 2022 showed that the total number of CCHF reached 70 cases with 22 death cases directly attributed to the CCHF viral disease symptoms (WHO, 2022). In Erbil/ Kurdistan Region - Iraq has taken measures to surround the recent CCHF outbreak that has spread in southern provinces. The CCHF virus is transmitted to people either by tick bites or through contact with infected animal blood or tissues during and immediately after slaughter. Most cases have occurred among people working in the livestock industry such as agricultural workers, slaughterhouse workers and veterinarians.

Virus

The CCHF virus (Fig.1) is a member of the genus Orthobunyavirus, the family Nairoviridae which is related to the order Bunyavirales (Virus Taxonomy, 2018). The virions are 80–120 nanometers (nm) in diameter and are pleomorphic. The genome is circular, negative-sense RNA and consists of three distinct RNA sequences (small encodes the nucleocapsid protein, Medium encodes the envelope glycoproteins and Large encodes the RNA polymerase), with a filamentous and circular nucleocapsid. The single-layer envelope consists of a lipid bilayer with no external protrusions, while the protein envelope has small projections (Ergonul, 2006; Carroll et al., 2010; Carter et al., 2012).

**Fig 1.** CCHF viral genome structure (adapted from Hamidinejad et al., 2021).

Transmission

Transmission among vector

The distribution of CCHF cases is associated closely with the distribution of the tick as important reservoirs and vectors. The *Hyalomma* genus ticks are capable of passing the virus from larva to nymph to adult after feeding on a viremic host. Another passage of the virus is by trans-ovarian to offspring occurs within some of the species. Also, venereal transmission has been demonstrated among some vector species, which may contribute to maintaining the circulation of the virus in nature. Also, ticks can be infected by co-feeding with infected ticks on uninfected hosts (Wilson et al., 1991; Gordon et al., 1993; Nuttall and Labuda, 2003; 2004; Aslam et al., 2016).

Transmission among small animals

The larvae and nymphs of two-host ticks feed on hares and small birds feeding on the ground, while at the adult stage they obtain their nutritional requirements from cattle, sheep and certain large mammals. CCHFV do not rely on birds as a host for its replication because birds are commonly resistant to becoming viremic and there are no specific antibodies are detected in different species of birds infected with the virus (Shepherd et al., 1987).

Transmission to Humans

The virus is transmitted to humans (Fig 2), through tick bites or by direct contact of farmers, slaughterhouse workers, veterinarians, etc. with infected animal blood. Also, person-to-person transmission can occur due to direct or indirect contact with the skin, mucous membranes, or body fluids of infected patients. The virus may also be transmitted from human to human, primarily in the hospital setting. Climate may contribute to increased tick abundance because high temperatures, especially in the spring and summer, may accelerate the Hyalomma cycle (Shepherd et al., 1987).

**Fig 2.** Transmission pathway of Crimean-Congo hemorrhagic fever virus (CCHFV) and life cycle of the tick. After hatching, the larvae meal on the blood of a small animal, molting of the nymph into an adult occurs and they drop off from their host. Following this, these adult ticks find a large animal for feeding and mate while attached to their host. CCHFV is transmitted from infected ticks and animals to
Clinical Symptoms

There are 4 different phases that are involved in the infection/disease of the CCHFV (shayan et al., 2015):

1. Hemorrhagic period, severe symptoms start appearing including red spots on the skin (petechiae), extravasation of blood (ecchymosis), nose bleeding (epistaxis), gum bleeding, and emesis. Nausea, diarrhea, emesis, and neuropsychiatric and cardiovascular changes can be additional symptoms. When the disease is not treated, patients may succumb due to multiorgan failure.

2. The convalescent period begins in survivors after 10–20 days of illness. Full recovery can take a complete year for survivors of CCHF.

Diagnostic Approaches

Laboratory tests that are currently used to diagnose CCHF include: (Zivcec et al., 2018; Mazzola and Kelly-Cirino., 2019)

1. The diagnosis of CCHF is an important step in the management of patients and infection control. The critical diagnosis of CCHF is dependent on laboratory methods because the clinical signs are non-specific, especially in the early stages of the disease.

2. Serological methods are still considered as most diagnostic tools. The complexity of molecular tests, their relatively high expenses, and the need for well-trained personnel, especially in remote areas with poor infrastructure facilities, are other problems concerned with these techniques. The variability of the virus genome is about 20%, whereas that of the NP is about 8%, and that is why the serological tests are preferred to the molecular method, particularly in early-stage detection and Point of Care testing. Immunofluorescence assay (IFA), Antigen-capture enzyme-linked immunosorbent assay (ELISA), and detection of antibody by ELISA (IgG and IgM). Later in the course of the disease, in people surviving, antibodies can be found in the blood. But antigen, viral RNA, and virus are no more present and detectable.

3. Molecular methods using viral RNA sequence (RT-PCR) in the blood or in tissues collected from a fatal case and virus isolation. Patients suspected of CCHF are primarily diagnosed by RT-PCR as these assays provide the highest detection sensitivity to active infection at the earliest time point. Lineage detection may be challenged by the high diversity and in situ evolution of CCHFV, particularly for RT-PCR assays which rely on a conserved genomic sequence for detection. Serological detection is less impacted by minor genomic variations. Given CCHFV strain variations, it is recommended that nucleic acid amplification tests (NAAT, eg. RT-PCR) be used in combination with immunological assays for the highest detection sensitivity; however, many low-resource settings may not have the capacity for PCR testing, especially at the early stages of an outbreak. Virus isolation is rarely used as a diagnostic tool because of the stringent biosafety containment level (BSL-4) required.

4. Immunohistochemical staining can also show evidence of viral antigen in formalin-fixed tissues.

Control Measures

Due to no vaccine available for CCHF, the only way to reduce the CCHF infection is by increasing public awareness regarding the risk factors of the disease and possible preventive measures, by reducing the exposure to the virus and controlling the spread of the disease. Control of CCHF infection in animals and ticks is difficult because the life cycle of the tick remains unnoticed in animals, and the infection is not usually apparent in animals, and only viremia happens. The risk of transmission from tick to human can be controlled by avoiding areas with a high prevalence of ticks and making special precautions in the season when the tick is active. Butchers, veterinarians, and shepherds should avoid exposure to virus-infected ticks or virus-contaminated animal blood and other tissues by wearing gloves and preventing the direct exposure of skin to fresh blood from the animal and other tissues. Treating the livestock with acaricides is effective in decreasing the population of infected ticks, the use of commercially available insect repellents like diethyl toluamide on naked skin is also protective against tick bites and clothes should be treated with permethrin spray to prevent tick bites. The risk of transmission from an infected human to human occurs among medical workers should adopt standard barrier nursing techniques and isolation of the patient (Whitehouse, 2004), avoid close physical contact with the infected person, and wash their Hands properly and regularly during visiting and caring for ill people (WHO, 2013), and health care workers must use high-efficiency air respirators, face shields, safety goggles, and surgical masks when coming into contact with the patient three feet away (CDC, 1995; Leblebicioglu et al., 2012). Disposable instruments and equipment, including needles, and syringes, and employing safe burial practices, should be used (Lloyd and Perry, 1998). Disinfectants, including 2% glutaraldehyde and 1% hypochlorite, can inactivate the CCHFV by heating at 56°C for 30 min (Appannanavar and Mishra, 2011). Unpasteurized milk should not be utilized and only properly cooked food should be consumed.
should be treated with pesticides regularly. In addition, using hygienic conditions during slaughtering in slaughterhouses or at home, butchering. Gloves should be worn during the handling of meat. Following the slaughter of an animal, the utensils and other equipment should be washed prior to reuse (WHO, 2013).

Conclusions

CCHF is a zoonotic disease caused by a highly virulent tick-borne virus. This disease is endemic in Iraq since 1979 with recurrent outbreaks in 2019, 2021, and 2022 with the current cases reached to more than 90 with 18 deaths. The slaughtering practices outside the abattoir is common. During the current crisis, veterinary measures were taken in all Iraqi governorates to conduct a spraying campaign and control measures using pesticides to combat ticks and to implement a national control policy measure considering the limited resources.

Conflict of Interest

The author hereby declares no conflict of interest.

Funding support

The author declares that they have no funding support for this study.

References


Epidemic and pandemic-prone diseases, WHO builds capacity of rapid response team in Iraq with a focus on Crimean-Congo haemorrhagic fever (a three-day workshop, Baghdad, Iraq, 22 March 2022).


How to cite this article


This work is licensed under a Creative Commons Attribution 4.0 International License

Publisher’s Note: MD International Publishing stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.