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Original article

Epidemiological investigation, patient risk factors, and geographic association with Crimean-Congo hemorrhagic fever among patients in Thi-Qar Province, Iraq, 2021-2024

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ABSTRACT

Background: Crimean-Congo hemorrhagic fever (CCHF) is a tick-borne viral disease that is a major problem for international medical institutions due to the lack of a particular therapy or vaccine. Tick bites or contact with the tissues or the blood of infected livestock can spread the virus to people. This study aims to characterize the epidemiology of CCHF in Thi Qar, Iraq, during 2021 to 2024. **Methods:** This cross-sectional study was conducted using data from the Department of Public Health, Province of Thi Qar. We included all confirmed cases and analyzed the data using SPSS. **Results**: More than half of patients (57%) were males. Females represent 43% of patients. 32% of patients presented with the age group (35-50 years). The mean age of the patient was 35.28 ± 17.02. The patients were mostly housewives (39%), followed by livestock breeders (14%) and butchers (12%). They lived in rural (46.01%) and urban (33.88%) areas. The majority of patients get the infection in the year 2022 (44.7%), and the majority of them get the infection during May (19.9%) and June (21.9%). Death represents 19%, and patients get a complete cure (80.8%). The outcome of hemorrhagic fever patients was significantly correlated with the year of infection (P<0.001). **Conclusion**: The number of CCHF cases was 363 during the study. We suggest steps to strengthen tick control in Iraq, such as regulating livestock transportation, animals slaughter, and health promotion plans, particularly for high-risk people.

Introduction

Crimean-Congo hemorrhagic fever virus (CCHFV) is the most prevalent pathogen spread by ticks worldwide [1,2]. With a 50% or higher mortality rate, it is a potentially lethal virus. The disease occurs frequently in about thirty nations in the Middle East, Asia, Africa, and Southeast Europe, including Iraq [1 ,3]. One of the most prevalent viral hemorrhagic illnesses (CCHF) is caused by a virus member of the Bunyavirales order, Nairoviridae family, and *Orthonairovirus* genus. Ixodid ticks of the genus *Hyalomma* are the virus's vectors and hosts, allowing it to spread to humans and other animals [4,5]. CCHFV can be spread to humans by touching bodily fluids or tissues directly from infectious livestock or CCHF patients and biting an infested Ixodid tick [4 , 6]. Since it was initially discovered in 1979 in Ramadi (Anbar Province) and the surrounding area of Baghdad in 10 individuals (7 of whom died), CCHF has been endemic throughout Iraq. Additionally, CCHF is widespread in Iraq's neighbors, Saudi

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Arabia, Iran, and Turkey [7,8]. This study aimed to identify potential risk factors for this outbreak to evaluate the incidence of the CCHF in Thi-Qar, southern Iraq, between 2021 and 2024. In Iraq, very few studies have been done on this significant illness.

Materials and Methods

A cross-sectional study was conducted on 363 human CCH-FV cases reported in the Thi-Qar Province, Iraq. The medical records of every patient pertaining to this outbreak were retrieved and examined. The number and percentage of infected individuals during the four years 2021–2024 are documented.

All suspected patients displaying signs of CCHFV were admitted to isolated wards and Intensive Care units in Thi-Qar Hospitals. All patients throughout the epidemic had blood specimens taken. The gathered specimens were promptly sent to the Central Public Health Laboratory in Baghdad. Each verified situation identified by the Central Public Health Laboratory (CPHL), Baghdad, utilizing RT-PCR (Real Star® CCHFV RT-PCR Kit) or ELISA IgM (human Crimean Congo hemorrhagic fever virus IgM [CCHF-IgM] ELISA Kit/ abbexa) methods [7]. The serological identification of specific IgM and IgG is necessary for laboratory detection of CCHF. The presence of IgM indicates a recent infection. However, some IgM and IgG antibodies do not show up until five to seven days after the first sign of symptoms, and in many cases, they might not be found. Early diagnosis of CCHFV in a patient's blood can be achieved by RT-PCR detection of viral RNA [1].

SPSS (2019)[9] was used to analyze the data. Categorical variables were represented using percentages and frequencies. For continuous variables, means were shown together with standard deviations (SD). The Chi-Square Test was used to assess the relationship among categories of variables. By definition, a p-value of less than 0.05 was considered significant.

Results

Using RT-PCR or ELISA (IgM), 363 CCHF patients were identified. [Figure 1] illustrates the distribution of patients with hemorrhagic fever according to gender. More than half of the patients (N=207, 57%) were males, while females represented (N=156, 43%) the majority of patients.

The majority of patients get the infection in the year 2022 (N=162, 44.7%),and the majority of them get the infection during May (N=72.19.9%) and June (N=79, 21.9%) [Table 3] [Figure 2].

The distribution of patients with hemorrhagic fever according to occupation showed that the majority of patients (N=142, 39%) were housewives. Livestock breeders represent (N=50, 14%), and Butcher represent (N=45, 12%) [Table 4].

[Table 5] showed the distribution of patients with hemorrhagic fever according to the outcome, including (Death, Cure and discharge on their family responsibility). Death represents (N=69,19%), patients get complete cure represent (N= 293, 80.8%), and patients discharged on their family responsibility represent only one patients (0.2%) of total patients recorded in 4 years periods of data collection. The association among year of infection and prognosis of hemorrhagic fever patients (Death, Cure, and discharge on their family responsibility) . The year of infection has a substantial impact on prognosis of hemorrhagic fever patients.

Table 1. Distribution among patients with hemorrhagic fever depending on age (N=363).

The geographic distribution of patients with hemorrhagic fever according to residence showed that the majority of patients (N=167, 46,01%) were rural [Table 2].

Age (years)	Number	Percentage
1-20	73	20%
20-35	104	29%
35-50	116	32%
50-65	55	15%
65-80	15	4%
Total	363	100%

Table 2. Geographic distribution of patients with hemorrhagic fever according to residence (N=363).

Residence	Number	Percentage
Rural	167	46.01%
Urban	123	33.88%
suburban	73	20.11%
Total	363	100%

Table 3. Shows the allocation of individuals suffering from hemorrhagic fever based on year of infection (N=363).

Year of diagnosis	Number	Percentage
2021	15	4.1%
2022	162	44.7%
2023	142	39.1%
2024	44	12.1%
Total	363	10 0 %

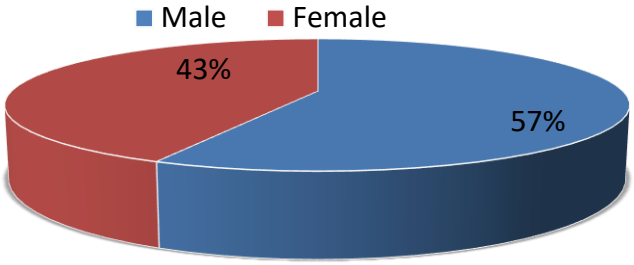
Table 4. Distribution of patients with hemorrhagic fever according to occupation (N=363).

Occupation	Number	Percentage
Housewife	142	39%
Livestock breeders	50	14%
Butcher	45	12%
Earner	59	16%
Student	31	9%
Employee	25	7%
Military	5	1%
Child	3	1%
Cooker	2	1%
Cleaning worker	1	0%
Total	363	100%

Table 5. The relationship between hemorrhagic fever patients' outcomes and year of infection.

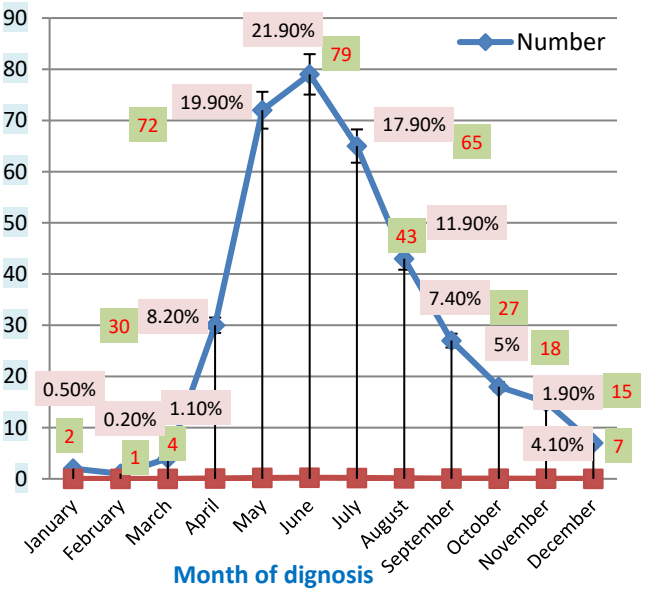
Year of infection	Outcome			Total	P-value
	Death	Cure	Discharge on their Family responsibility		
2021	7(46.7)	8(53.3)	0(0.0)	15(100.0)	0.0081 **
2022	40(24.7)	121(74.7)	1(0.6)	162(100.0)	0.0001 **
2023	16(11.27)	126(88.73)	0(0.0)	142(100.0)	0.0001 **
2024	6(13.7)	38(86.3)	0(0.0)	44(100.0)	0.0001 **
Total	69(19)	293(80.8)	1(0.2)	363(100.0)	0.0001 **
P-value	0.0001 **	0.0001 **	0.871 NS	0.0001 **	---
** (P≤0.01).					

Figure 1. Distribution of patients with hemorrhagic fever depending on gender (N=363).



Large than one-quarter of patients (N=116, 32%) presented with age group (35-50) years, while the 20-35 years group accounts for 29 % as show in [Table 1]. The mean age of the patient was (35.28±17.02) .

Figure 2. Patients' distribution with hemorrhagic fever by month of infection (N=363).



Discussion

There were 363 verified instances of Crimean-Congo hemorrhagic fever in Thi-Qar, southern Iraq, between 2021 and 2024. RT-PCR revealed a remarkable increase in CCHFV infections in several Iraqi districts, which is concerning. In Iraq, CCHF is endemic. The first reports of CCHF in Iraq date back to 1979. According to a seroprevalence survey conducted in 1980, animals in distinct regions of Iraq had previously been exposed to CCHFV: 57.6% of sheep, 29.28% of cattle, 49.64% of goats, 58.73% of horses, and 23.23% of camels tested positive for the virus. Research has shown that these livestock are often infected by tick species, particularly Hylomma species, the primary carriers of CCHFV [10]. Between 1998 and 2009, the number of reported cases of CCHF ranged from zero to six per year. There were 28 suspected cases and 11 confirmed infections in 2010. Iraq has recorded a thirty-six percent case mortality rate among confirmed instances [11]. The biggest problem with this endemic is the lack of collaboration between the human and animal sectors regarding illness prevention. The outbreak is made worse by a lack of tick control initiatives. Additionally, laboratory kits for CCHF diagnosis are absent, particularly at the district level, which may result in delayed therapy or inaccurate diagnosis, raising the number of case mortality [12]. In this study, death represents (N=69, 19%), patients who get complete cure represent (N= 293, 80.8%), and patients discharged on their family responsibility represent only one patient (0.2%) of total patients recorded in 4years periods of data collection. Therefore, more than half of the patients (N=207, 57%) were males. Females represent (N=156, 43%) of patients. The larger percentage of infection cases in men may have something to do with population culture. The risk of contracting CCHF is increased by interaction with animals because men are

primarily in charge of occupations like farming and animal grooming. Men are, therefore, more likely than women to come into contact with ticks that spread CCHF [4 , 13].

In our study, the majority of patients contracted the infection in 2022 (N=162, 44.7%), and the majority of them contracted it in May (N=72.19.9%) and June (N=79, 21.9%).

The spread of the virus's vector could cause a rise in CCHFV infections in Iraq. Additional variables, such as climate change and rising temperatures, may have caused the increased incidence of CCHF in Iraq. There have been notable changes in the climate and temperature in Iraq. Compared to other secondary hosts, H.marginatum typically feeds on people with high aggression and affinity. Low humidity and high temperatures (>40°C) intensify this behavior. People typically get their necessities from private livestock breeders that engage in unregulated, private slaughter because of the strong demand for animal sacrifices during Adha Eid. This practice is nearly universal in Iraq and might have contributed to the increased occurrences of CCHF cases [14,15]. The results of our research's seasonal distribution, which peaks in the summer and extends from spring to autumn, correlate with the nation's historical distribution data. The higher tick activity and infestation levels during the warmer months could help to explain this [7,16].

The study also found that rural, urban, and suburban distributions were (46.01%, 33.88%, and 20.11%) respectively. The incidence of Crimean-Congo hemorrhagic fever virus is increasing in rural areas due to the large number of livestock breeders. Additionally, sheep wool is sheared during spring without utilizing personal protective equipment or safety precautions to avoid direct infection from ticks or tick-infected livestock. In recent decades, there has been an overlap between rural and urban areas, which has led to an increase in cases in urban areas. In addition, the increasing number of livestock breeders in urban areas [7].

Over thirty percent of the patients in the current investigation had jobs unrelated to the identified risk groups for CCHF. The patient's false reporting or the slaughter of animals for sacrifice, such as on religious days, could be to blame for this. Homemakers represented (39%) of the patients, whereas 14% and 12% of the patients were livestock breeders and butchers, respectively. This high percentage of homemakers may be because, historically, Iraqi homemakers frequently handle raw meat, particularly after it has been slaughtered, and they breed animals in rural regions.

Conclusion

CCHF is a dangerous condition that can cause serious health problems. Iraq is presently classified as a CCHF hyper-endemic nation. Targeted public health actions are necessary to lower the death rate, prevent infection, and safeguard public health in Iraq and around the world. First, by making certain that there are enough Public Health Labs with complete PCR testing capabilities established nationwide. Second, strict regulation of slaughterhouses and tick control. Third, controlling the movement of animals both inside and outside of Iraq, particularly in the province of Thi-Qar. Lastly, enhancing health education and promotion plans, particularly for high-risk people.

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Conflict of interest

None.

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Data availability

Data available on request / reasonable request.

Authors' contributions

All authors contributed significantly to the work. All authors reviewed and approved the final version of the manuscript.

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