

Brief Original Article

Seroprevalence of Crimean–Congo hemorrhagic fever among health care workers in a hospital in an endemic region of Turkey

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Abstract

Introduction: Crimean–Congo Hemorrhagic Fever (CCHF) can also be transmitted through unprotected contact directly with blood or body fluids as well as from laboratories. This study aimed to determine the seroprevalence of CCHF disease in the employees of the State Hospital of Yozgat Province, located in Central Anatolia of Turkey, and also to present the risk factors for healthcare workers.

Methodology: A total of 112 volunteer employees of Yozgat State Hospital were included in the study. The study volunteers were divided into two groups: one having had a contact with CCHF patients and patient's samples and the other a non-contact group.

Results: In the contact group, 2 (2.9%) out of 67 subjects tested positive for anti-CCHF IgG; however, in the non-contact group, none of the subjects tested positive (Fisher's exact test $p > 0.05$). Of the two employees who tested positive, one was working at the microbiology laboratory and the other was from the emergency department.

Conclusion: Although cases of nosocomial transmission of CCHF have been reported previously, questions on the mode of transmission of the disease are still unanswered. The risk factors for the disease should, therefore, be identified in order to take the necessary measures.

Key words: Crimean–Congo hemorrhagic fever; seroprevalence; healthcare workers.

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Introduction

Crimean–Congo Hemorrhagic Fever (CCHF) is an acute zoonotic infection that has the potential to cause death [1]. The disease has been described in more than 56 countries from northwest China, Central Asia, Southern Europe, Africa, Middle East, Indian peninsula, and particularly from former Soviet Union states and Eastern Europe [2–5]. The first case in Turkey was detected in 2002 in the Tokat province located in Kelkit Valley [6]. Till date, a total of 10,219 cases and 485 deaths have occurred in Turkey resulting from CCHF (as of 12/15/2016) [7].

In Turkey, ninety percent of the affected individuals are farmers and 60% of the patients presenting with the disease reported a history of tick bites. CCHF are potential occupational hazards among veterinarians and agricultural workers [8]. Similar risks are found in health care workers. Healthcare workers represent the second most commonly affected population [9,10]. A large number of nosocomial infections have been reported in the literature [11–13]. As the healthcare

workers represent an important occupational group in terms of individuals at risk for CCHF, this study aimed to determine the seroprevalence of CCHF disease in the employees of the State Hospital of Yozgat Province, where CCHF disease is endemic and a total of 963 cases (58 deaths) have been encountered till date. This study also aimed to perform a risk analysis for healthcare workers by discussing various measures for its prevention and control.

Methodology

Yozgat State Hospital is a secondary care hospital in Turkey, located in a region endemic to CCHF disease. On an average, 60 CCHF patients are being managed and followed in the hospital annually since 2002. A total of 112 volunteers among all the healthcare workers of Yozgat State Hospital from each age group and units were included in this cross-sectional study. This study was performed in June 2016 and the participants of the study enrolled themselves voluntarily. The participants were divided into two

groups, as one having had a contact with CCHF patients and a non-contact group. The contact group for CCHF included the healthcare workers who performed all invasive procedures such as bloodletting, intubation, aspiration in addition to the follow-up and treatment (monitoring vital signs, medication, intravenous blood-transfusion, etc.) of patients which puts them at a risk of contact with blood or body fluids of patients having either a definitive diagnosis of CCHF or suspected CCHF. The non-contact group for CCHF included healthcare workers in units, where they did not come in contact with patients having either a definitive diagnosis of CCHF or suspected CCHF. The demographics of participants, units where they worked, and their suspected contact histories were recorded on a form by conducting face-to-face interviews.

Serum samples were submitted to the National Reference Laboratory of Refik Saydam Hygiene Center (RSHC), by the Public Health Institution of Turkey. The specimens were tested for anti-CCHF IgG antibodies by ELISA (Vector-Best, Novosibirsk, Russia). The samples that revealed positive results were re-checked and were also tested for the virus-specific IgM and CCHF Polymerase Chain Reaction (PCR) so that any acute infections could be excluded. The demographics and anti-CCHF IgG results of the participants were recorded on forms and evaluated.

Statistical analyses were conducted using the Statistical Package for Social Sciences version 15.0 for Windows (SPSS, Inc, Chicago, IL, USA). Chi-square and Fisher's exact (for qualitative variables) and Mann-Whitney U (for quantitative variables) tests were used for comparing the characteristics of the study groups. Statistical significance was set at $p < 0.05$.

Results

One-hundred and twelve healthcare workers were included in the study. The mean age of the participants was found to be 34.8 ± 9 years (range 18–56 years); out of 112, 61 subjects were females (54.4%). The contact group comprised of 67 participants, while the non-contact group comprised of 45 participants. The demographics of the healthcare workers are presented in Table 1. Both the groups were similar in terms of demographics.

In the contact group, 2 out of 67 participants (2.9%, Table 1) tested positive for anti-CCHF IgG; while in the non-contact group, none of the participants tested positive (Fisher's exact test $p > 0.05$, Table 1).

Of these seropositive subjects, one was working at the microbiology laboratory and the other was working in the emergency department; none of them gave a history of direct contact with ticks, or stock farming or a family history of CCHF (Table 2). A detailed inquiry revealed that the laboratory personnel are working on the blood samples of CCHF patients and the emergency personnel had participated in the emergency treatment of many CCHF patients (Table 2).

Discussion

The healthcare personnel providing care to CCHF patients are at a risk of acquiring the infection [14,15]. The first case of a healthcare worker acquiring CCHF infection was reported in Pakistan in 1976 [14]. Eighty cases of healthcare workers with nosocomial CCHF transmission were reported between the period of 1953–2005 [16]. Moreover, the nosocomial spread of CCHF may occur as a result of transmission of infection to the healthcare workers providing care to CCHF patients.

Table 1. Demographic data of healthcare workers participating in the study.

	All participants (n = 112)	Contact with CCHF patient (n = 67)*	No contact with CCHF patient (n = 45)*	P-value
Gender (Female/Male)	61/51	31/36	30/15	0.05
Mean age (years)	34.8 ± 9	36.4 ± 9.2	32.5 ± 8.2	0.031
Mean no. of working years	5.4 ± 5.1	7.17 ± 5.1	2.8 ± 3.75	0.00
Positive for anti- CCHF IgG	2 (1.78%)	2 (2.9%)	0 (0%)	0.51
Hospital section				
Emergency service	45 (40.2%)	43 (64.2%)	2 (4.4%)	
Infectious diseases	23 (20.5%)	21 (31.1%)	2 (4.4%)	
Intensive care	24 (21.4)	0 (0%)	24 (53.3%)	
Physical medicine	17 (15.2%)	0 (0%)	17 (37.8%)	
Laboratory	3 (2.7%)	3 (4.5%)	0 (0%)	
Job				
Physician	9 (8%)	5 (7.5%)	4 (8.9%)	
Nurse	49 (43.8%)	23 (34.3%)	26 (57.8%)	
Medical assistant	54 (48.2%)	39 (58.2%)	15 (33.3%)	

*And suspect patient.

Table 2. Characteristics of seropositive cases.

Case	Gender	Age (years)	Job	Section	Working years	Contact type	Symptoms**
No.1	Female	21	Nurse	Emergency service	3	Percutaneous	None
No.2	Male	55	Lab technician	Laboratory	20	Percutaneous*	None

*: Also reported intact skin contact with body fluids; **: Bleeding from multiple sites, fever, and myalgia.

In a study carried out at nine participating centers between 2002 and 2014 in Turkey, it was reported that 51 healthcare workers had been exposed to CCHF virus during that period. Out of these 51 subjects, 32 (62.7%) had needle injuries, 12 (23.5%) had contact with blood or body fluids of the patients and 7 (13.1%) had exposures of unknown origin [17]. It was reported that 7 out of the 51 healthcare workers with confirmation by the diagnosis of CCHF had an asymptomatic course, while four patients died [17].

The literature reports CCHF seroprevalence studies conducted on hospital employees in endemic regions. These studies are presented in Table 3 [18–23]. In the present study, 2.9% patients from the contact group and none from the non-contact group tested positive for anti-CCHF IgG. The p-value of 0.51 for this difference is below the assumed significance level, probably due to the limited number of seropositive cases (N = 2).

In countries where CCHF is uncommon and cases are encountered only in migrants, healthcare workers are at an increased risk due to the limited infection control measures; CCHF disease can prove to be fatal [24–27]. CCHF suspected patients should be kept isolated in a separate unit in the hospital and if possible, the patients with active bleeding and symptoms such as vomiting and cough, causing aerosol spread, must be treated and followed in negative pressure rooms. Infection control measures, barrier measures (gloves, masks, goggles, surgical aprons, etc.) and measures such as hand hygiene must be followed; also, entry to the patient’s room should be restricted [28,29]. Proper disposal of the equipment used for such patients, e.g., injectors and branules, is necessary and proper burial procedures must be followed for deceased patients [30]. CCHF virus is inactivated by 2% glutaraldehyde and 1% sodium hypochlorite and by storing at 56 °C for 30

minutes [31]. The most important risk factor for nosocomial transmission of infections is a percutaneous injury by contaminated needles. A few studies reporting transmission of CCHF infection by contact with infected body fluids with intact skin have been cited in the literature. Although the transmission of CCHF disease via blood or bodily secretions is well established, the requirement for air isolation is controversial. CCHFV was characterized as a BSL–4 pathogen in the United States by CDC [28]. Some epidemiological studies argued that transmission of viral hemorrhagic fevers from one human to the other does not occur via air [21,24]. However, the cases of transmission to healthcare workers via aerosols were reported to have occurred during procedures such as bronchoscopy and resuscitation [32]. Transmission may occur via aerosolization from highly viremic patients or during invasive procedures performed during the treatment and follow-up of patients. In two separate studies from Russia and Turkey, cases with nosocomial transmission via airway have been reported. [33,34]. During the follow-up of the CCHF patients, it must be remembered that the infectivity may be transmitted through the airway and during the aerosol-forming procedures; therefore, airway precautions must be undertaken in addition to the standard precautions.

Healthcare personnel working with infected materials in laboratories are also at risk. In an Iranian seroprevalence study on the healthcare workers, five healthcare workers were reported to be seropositive and one of them was a laboratory worker. The study reported that the transmission occurred via respiratory route [19]. Similar to the study in Iran, one of the healthcare workers in the present study, who was anti-CCHF IgG positive, was a laboratory worker. In a 23-centered study investigating the prevention and control

Table 3. Seroprevalence studies in healthcare workers working in hospitals in endemic regions.

Country	Year	No. of healthcare workers	Seroprevalence rate (%)	Reference
Turkey	2013	190	%0.53	[18]
Iran	2007	223	%3.87	[19]
Greece	2009	21	0	[20]
Turkey	2005	75	%1.3	[21]
South Africa	1992	128	%0.78	[22]
Pakistan	2002	190	%1.05	[23]

of CCHF infection, it was emphasized that all health personnel, including laboratory workers, are at a risk [15].

In a study conducted in Turkey, it was reported that although the nurses had a relatively adequate knowledge of CCHF nosocomial transmission, it is not yet at the level desired [35]. It is essential to increase the knowledge level of health workers and to organize repetitive training for them. Every healthcare worker must use all the protective measures during the management of CCHF patients, such as the use of surgical masks, eye protection, gloves and surgical aprons.

There are studies in the literature which report that simple barrier measures are adequate to prevent the transmission of infections [24,36]. In a study conducted in Sierra Leone, it was reported that the healthcare personnel, in spite of the proper use of barrier measures, were at the same level of Lassa fever risk as the normal population [30].

In a case report, all members of a surgical team operating a CCHF patient for a sudden onset acute appendicitis underwent tests and follow-up for CCHF disease. None of them tested positive or developed any clinical signs. This was attributed to the fact that the surgical team was careful during the operation; they did not have any contact with the patient until the 8th day of ribavirin treatment [37]. Moreover, in the healthcare workers providing care to CCHF patients, clinical symptoms, such as fever, must be taken seriously, and tests for CCHF disease including CBC, liver enzymes and coagulation parameters should be performed.

The present study was based on voluntary participation. For this reason, there is a difference between the groups in terms of working units and working time. Though this is a limitation of the study, yet any intervention in the distribution of groups was not possible.

Conclusion

To conclude, CCHF represents a health problem in Turkey since 2002. Despite cases with nosocomial transmission of CCHF, questions about the mode of transmission of the disease are still unanswered. Risk factors for the disease should, therefore, be identified so that the necessary measures for the protection of healthcare workers can be taken. Since there is no protective vaccine against the disease, the main measures for prevention of transmission to humans are to increase the awareness of the disease and to make sure the necessary contact measures are undertaken.

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