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Exposure of Health Care Workers to Crimean-Congo Hemorrhagic Fever in Senegal: An Investigation of Two Imported Cases

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Abstract

Introduction: Crimean Congo hemorrhagic fever (CCHF) is a potentially fatal arbovirus with a high risk for nosocomial transmission. The goals of this study were to describe two cases of imported CCHF in Senegal and to evaluate health care worker exposure during the hospitalization of these two cases.

Methodology: Exposed health care workers were identified, administered a questionnaire, and kept were under clinical surveillance for 9 days. The level of risk associated with exposure was determined using the French National Institute of Health Surveillance (InVS) classification system.

Results: Two cases of CCHF transferred to Senegal from Mauritania, were admitted to the Infectious Diseases Service at Fann Teaching Hospital. The first case was admitted with diffuse hemorrhage and coma; the second case was admitted with febrile gastroenteritis. Both cases were fatal. The length of hospitalization was 06 hours and 07 days respectively. A total of 60 health care workers were exposed, including 11 doctors, 13 medical students, 14 nurses, 11 support staff, 09 nursing students, and 2 administrative staff. The majority of health care workers had a high-risk exposure (n=43, 65.2%). Moderate-risk exposure occurred among 21.2% (n=14) and low-risk exposure occurred among 13.6% (n=9). The high- risk was particularly prevalent among physicians (91,7%), support staff (91.7%) and nurses (66.7%). None of the contacts had clinical signs of CCHF during the monitoring period and none received prophylaxis with ribavirin. There were no known cases of nosocomial transmission.

Conclusion: Despite high-risk exposure among the majority of health workers, no secondary cases were identified. Important strategies were identified to decrease the risk of nosocomial transmission for future cases of viral hemorrhagic fever in our hospital.

Keywords: Crimean-Congo hemorrhagic fever; Nosocomial exposure; Senegal

Abbreviations: CCHF: Crimean-Congo hemorrhagic fever

Introduction

Crimean-Congo hemorrhagic fever (CCHF) is a zoonotic disease caused by a Nairovirus from the Bunyaviridae family [1,2]. It was first described in the Crimea in 1944 and in the Congo in 1956 [3]. CCHF is endemic in many countries of Africa where sporadic outbreaks are reported [2]. The virus is transmitted to humans by bites from infected ticks or by direct contact with blood or tissue from infected animals. Human-to-human transmission occurs through contact with infectious blood or bodily fluids [2]. As a result of its epidemic potential, high case fatality rate (10-50%), difficulties in accessing treatment in developing countries and potential for nosocomial transmission, CCHF remains an important public health challenge [2,4]. We report two cases of imported Crimean Congo hemorrhagic fever in Senegal. We describe health care worker exposure and determine the level of risk associated with these exposures using the French National Institute of Health Surveillance classification system.

Methodology

In April and September of 2010, two patients infected with CCHF received care in the Department of Infectious and Tropical Diseases at the Fann teaching hospital located in Dakar, Senegal. Patient blood samples were sent to the Pasteur Institute of Dakar (IPD) where confirmation testing was performed using PCR and serology. The Pasteur Institute is a regional reference laboratory recognized by the World Health Organization (WHO) for the diagnosis of viral hemorrhagic fevers. After confirmation that the patients were infected with CCHF, a list of exposed health care workers was sent to the Ministry of Health and the authorities of the Fann teaching hospital. In September 2010, we administered a questionnaire to all exposed health care workers to determine the circumstances of their exposure, adherence to standard universal precautions (including hand washing and the use of personal protective equipment (PPE) such as gloves and masks), and whether they received post-exposition prophylaxis with ribavirin. The level of risk associated with the exposures was

determined using the French National Institute of Health Surveillance classification system (Institut National de Veille sanitaire) [5]. This classification system is used for all viral hemorrhagic fevers and distinguishes between three levels of risk:

- Low risk involves a contact who was in the same place as the patient, but did not approach the patient . This could apply to exposure on an airplane, in a hotel or in the work place.
- Moderate risk involves a contact who approached the patient but did not touch the patient or the patient's secretions. This could include family members, visitors, or caregivers.
- High risk involves close contact with the patient or exposure to the patient's fluids (blood or bodily fluids).

The presence of signs of suspected CCHF including fever, arthralgia, myalgia, jaundice, epistaxis, purpura, bleeding gums, diarrhea, vomiting, and abdominal pain, were recorded during a surveillance period of 9 days.

All collected data were entered and analyzed in EPI-INFO software, version 7 (Centers for Diseases Control and Prevention, Atlanta, GA, USA).

Results

Case 1

A 43 year old woman, living in Mauritania, initially presented to the Emergency Department at the National Hospital in Nouakchott with a diffuse hemorrhagic syndrome characterized by epistaxis, gingival bleeding and multiple ecchymosis. Despite being admitted to the hospital with suspicion for viral hemorrhagic fever, and against all medical advice, the patient's parents decided to transfer her by plane to Senegal. The patient arrived in Senegal in April 2010, ten days after the onset of symptoms dominated by headaches, arthralgia, myalgia, and fever. She presented to the Fann teaching hospital in Dakar a cardiovascular collapse, with stage 2 coma, jaundice, diffuse bleeding and respiratory distress. She was admitted to the infectious disease service and isolated in the intensive care unit. Despite transfusion and intensive care, she died of cardio-respiratory failure 6 hours after admission. Samples of her blood were sent to the Pasteur Institute in Dakar, where results of serological studies returned positive for CCHF three days later.

Case 2

A 61 year old woman with obesity (BMI> 35 kg/m2) and hypertension arrived in Senegal by plane from the city of Aleg in September 2010. She had a fever, headache, diarrhea, vomiting and diffuse pains. Clinical examination revealed moderate dehydration and abdominal pain consistent with acalculous cholecystitis confirmed by ultrasound. Her condition transiently improved following rehydration and antibiotic therapy with ceftriaxone and metronidazole. However, on the 4th day of hospitalization her condition suddenly worsened. She developed jaundice, bleeding gums, large ecchymotic plaques on her bilateral lower extremities, increase of elevated liver enzymes (>10 × ULN) and thombocytopenia (14,000 platelets/mm3). Given the change in her clinical presentation, she was isolated on hospital day 4. Despite transfusion with concentrated platelets and whole blood, the patient suffered from disseminated intravascular coagulation and died from cataclysmic digestive and genital bleeding on hospital day 7. Samples of her blood were sent to the Pasteur Institute in Dakar where the diagnosis of CCHF was confirmed two days later by both PCR and serology.

Description health care worker exposure and risk of transmission

A total of 60 health care workers were in contact with the two cases during their hospitalization. There were 26 healthcare workers who had contact with case 1, 27 health care workers who had contact with case 2, and 7 health care workers who had contact with both case 1 and case 2. Among the 60 exposed health care workers, 23.3% (n=14) were nurses 21.7% (n=13) were medical students, 18.3% (n=11) were physicians, 18.3% (n=11) were support staff (stretcher-bearer, nurse's aid, cleaning staff, security agent), 15% (n=9) were nursing students, and 3.3% (n=2) were administrative staff (Table 1).

Health care worker role	Case 1	Case 2	Case 1&2	Total (%)
Physician	4	5	2	11 (18.3)
Medical student	10	3	0	13 (21.7)
Nurse	5	5	4	14 (23.3)
Nursing student	5	4	0	9 (15)
Support staff*	2	8	1	11 (18.3)
Administrative staff**	0	2	0	2 (3.3)
Total	26	27	7	60 (100)

%: percentage

*Support staff: stretcher-bearer, nurse's aid, cleaning staff, security agent

**Administrative agent: payment agent

Table 1: Role of health care workers exposed to two cases of Crimean Congo hemorrhagic fever at Fann teaching hospital in Dakar, Senegal.

The majority of the medical students (n=10, 76.9%) were exposed to case 1. The majority of support staff (n=8, 66.7%) were exposed to case 2, which may have been a result of her long hospital stay. Physician and nurses were exposed to both cases equally.

High-risk exposure occurred among 91.7% of physicians, 91.7% of support staff, and 66.7% of nurses.

Moderate-risk exposure occurred among 61.5% of medical students and low-risk exposure occurred among 55.5% of nurses and all of the administrative staff. All health care workers adhered to hand-washing after direct contact with patients and all who had direct patient contact or contact with a patient's bodily fluids wore gloves. However, masks were not used systematically (15%).

All exposed staff were evaluated clinically and remained under surveillance for 9 days. Temperature was taken daily. Prophylaxis with ribavirin was not administered. All exposed staff remained asymptomatic, therefore serologic testing was not performed. No secondary cases were identified (Table 2).

Discussion

The two cases described in this study are the first cases of confirmed CCHF admitted to our hospital. Despite the fact that the diagnosis of viral hemorrhagic fever was suspected upon admission of case 1,

numerous health care personnel, particularly medical students, were exposed to the patient. These findings indicate the need for further education of medical staff, especially students, to minimize contact with patients suspected of infection with viral hemorrhagic fever. To minimize the risk of nosocomial transmission, staff who are not vital to patient care should avoid contact with patients suspected of viral hemorrhagic fever.

Health care worker role	Level of risk associated with exposure		
	High (%)	Moderate (%)	Low (%)
Physician (n=12)	11 (91.7)	1(8.3)	0
Medical student (n=13)	5 (38.5)	8 (61.5)	0
Nurse (n=18)	12 (66.7)	5 (27.8)	1 (5.5)
Nursing student (n=9)	4 (44.5)	0	5 (55.5)
Support staff* (n=12)	11 (91.7)	0	1 (8.3)
Administrative staff **(n=2)	0	0	2 (100)
Total (n=66)	43 (65.2)	14 (21.2)	9 (13.6)

n: number of contacts, %: percentage

*Support staff: stretcher-bearer, nurse's aid, cleaning staff, security agent

**Administrative agent: payment agent

Table 2: Distribution of exposed health care workers according to role and level of exposure to Crimean Congo hemorrhagic fever at Fann teaching hospital in Dakar, Senegal.

Case 2 was admitted with an atypical presentation thus her diagnosis was not immediately apparent. The need for further diagnostic evaluation and the delay in confirmation contributed to high-risk exposure, especially among support staff. This findings emphasizes the need for personnel to adhere to the practice of universal precautions at all times, even when the diagnosis is not yet confirmed. Furthermore, an appropriate supply of reliable PPE must be readily accessible.

The two cases described in this study were imported from Mauritania, however infection with CCHF has occurred locally [6,7]. In 2004, two French tourists were infected with CCHF while traveling in Senegal [6,7]. A follow-up investigation found that 181 people from 3 countries were exposed, including 2 German contacts from the flight crew, 71 Senegalese contacts and 108 French contacts. The majority of the contacts (85.1%) were health care workers. Among the 154 health care workers exposed, 55 were Senegalese and 99 were French. All of the contacts remained asymptomatic and serology performed on 50 of the contacts was negative [8].

We did not identify any cases of nosocomial transmission of CCHF in our study, although nosocomial transmission has been described among patients and health workers in numerous other countries in sub-Saharan Africa, including Sudan, Mauritania, and South Africa [4,9,10]. Previous studies have described the use of ribavarin for the prevention and treatment of CCHF [11,12]. Ribavarin was not provided to any of the contacts in our study as the drug was not available in Senegal during our study period. Further advocacy is necessary to support the availability and implementation of post-exposure prophylaxis by the Health Authorities in Senegal.

Conclusion

We describe the first confirmed cases of CCHF at Fann Teaching Hospital, in Dakar, Senegal. Despite high-risk exposure among many of the hospital personnel, there were no known cases of nosocomial transmission. This may reflect a high level of adherence to hand-washing and glove use. We identified important areas for improvement to further decrease the risk of nosocomial transmission for future cases. Personnel should be educated about the indications for using a face mask or eye shield when caring for patients, and appropriate PPE must be readily available. Early diagnosis of viral hemorrhagic fever aids in the early isolation of infected patients, however the isolation of suspected cases while awaiting confirmatory tests is important for reducing this risk. Post-exposure prophylaxis with ribavirin should be evaluated as a means to further reduce the risk of transmission. Importantly, in order to prevent transmission to community members and fellow travelers, patients and their families must be educated about the risks associated with transferring potentially infectious patients.

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Ethical Statement

The patient data used for this study was collected during routine diagnosis and treatment. All health care workers who participated in the study provided informed consent. Personal data from patients and study participants was kept strictly confidential.

Authors' Contributions

MNM* conceived the study and contributed to all steps of the study, F-DL, D-BNM and D-NSA participated in data collection, drafting and revising the manuscript, FO performed testing, and CTN, SM, NG and BNA gave important intellectual contributions to the revisions of the manuscript.

Competing Interests

The authors declare that they have no competing interests.

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