CRIMEAN-CONGO HEMORRHAGIC FEVER OUTBREAK IN RAWALPINDI, PAKISTAN, FEBRUARY 2002: CONTACT TRACING AND RISK ASSESSMENT

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Abstract. A 25-year-old woman, later identified as index case of Crimean-Congo hemorrhagic fever (CCHF), presented to Holy Family Hospital in Rawalpindi, Pakistan with fever and generalized coagulopathy. A retrospective contact tracing was conducted to explore the modes of exposure possibly associated with transmission of CCHF infection among contacts. We traced 32 contacts of the index case and 158 contacts of secondary cases and tested them for IgG and IgM antibodies against CCHF virus by a enzyme-linked immunosorbent assay technique. According to the type of exposure, contacts were divided into five subsets: percutaneous contact with blood, blood contact to unbroken skin, cutaneous contact to non-sanguineous body fluids, physical contact with patients without body fluids contact, and close proximity without touching. Two out of four contacts who reported percutaneous exposure tested positive for antibodies to CCHF virus. We conclude that simple barrier methods and care in provision of CCHF cases may prevent transmission of this infection.

INTRODUCTION

Crimean-Congo hemorrhagic fever (CCHF) virus is known to be transmitted by Hyalomma ticks.1 The first case of CCHF was described in the former Soviet Union in 1944.2,3 Since then outbreaks have been reported from the USSR, Bulgaria, Saudi Arabia,4 the United Arab Emirates,5 Kuwait,6 Pakistan, and Iraq.7

Crimean-Congo hemorrhagic fever is endemic in Pakistan. The first case in this country occurred in 1976.8 Nosocomial outbreaks have been reported in recent years in Pakistan,9 Iraq,10 Dubai,11 and South Africa.12,13 Mortality is reported to be high (from 15% to 100%).10,11,14 It has been shown that the duration of contact determines the transmissibility of CCHF virus among humans; however, epidemiologic studies also indicate that infection is not readily transmitted via the aerial route.15

We conducted a retrospective contact tracing to explore modes of exposure possibly associated with transmission of CCHF virus infection among contacts.

CASE SUMMARY

A 25-year-old woman was referred to Holy Family Hospital in Rawalpindi, Pakistan with a one-week history of high-grade fever, rashes, myalgias, and generalized coagulopathy.16 Laboratory studies were consistent with disseminated intravascular coagulation (DIC). The patient identified as the index case of CCHF died 36 hours after presentation. No serum sample was saved for retrospective diagnosis because there was no suspicion of CCHF virus infection.

Five days after the death of the index case, one of the female interns involved in her care developed fever, chills, vomiting, and abdominal pain. A coagulopathy profile, the results of which was initially normal, showed marked deterioration on day 4 of the illness, consistent with DIC. Unfortunately, the intern died on day 8 of her illness. Antibodies (IgM and IgG) were detected in the serum sample taken on day 6 by an enzyme-linked immunosorbent assay (ELISA) technique.17 Virus was also isolated from the same serum sample by a reverse transcriptase-polymerase chain reaction (RT-PCR) assay.

RESULTS

Contact investigation of the index case. Eight relatives of the index case reported contact with blood and extensive physical contact with the patient (category B). None of them developed any symptom(s) or signs of CCHF. Their serum samples were all negative for antibodies against CCHF virus. Twelve HCWs provided care to the index case. Secondary case 1 had appreciable contact with the respiratory secretions and blood of the index case while changing intravenous infusions and performing gastric lavage. Later, she also gave mouth-to-mouth respiration to the index case. She may have acquired the virus either by blood spilling on her hand or by respiratory secretions coming in contact with her eyes or buccal mucosa. Because of the nature of her contact she was placed in category A.

Secondary case 2 reported appreciable exposure to respi-
ratory secretions of the index case while performing gastric lavage, during which the index case was coughing in his face. He wore latex gloves, but no face shields were used. He was also placed in category A.

Five HCWs, who reported contact with vomitus, respiratory secretions, and oozing serous fluid from the puncture site (category C) and another five, which had extensive physical contact with the index case (category D) did not report any symptoms of CCHF.

**Contact investigation of the secondary case 1.** The sister of secondary case 1 was exposed to blood when cleaning hematemesis and changing vaginal pads. However, she reported no percutaneous contact (category B). Two other family members had extensive physical contact but no exposure to her secretions (category D). The sister of the intern tested negative for antibodies to CCHF virus. The female intern had 125 HCWs as contacts. Among them, two reported needle prick injury (category A), and 25 reported blood contact (category B). Antibodies to CCHF virus were not detected in their serum. Seventeen HCWs had cutaneous contact with nonsanguineous body fluids (vomitus and respiratory secretions-category C). Twenty-five HCWs were placed in category D and 56 in were placed in category E. None of them developed or reported any features of CCHF.

**Contact investigation of the secondary case 2.** The mother of secondary case 2 had blood contact on unbroken skin (category B). Three other family members had close physical contact but no contact with his body fluids (category D). None of the contacts developed any features suggestive of CCHF, or tested positive for antibodies to CCHF virus by ELISA. Nine HCWs were placed in category D and eight were placed in category E. They all remained asymptomatic.

**DISCUSSION**

Crimean-Congo hemorrhagic fever is reported to be highly contagious with mortality of approximately 15–100%.10,11,14 The recommended safety measures include barrier nursing, isolation of the patient, and gloves, gowns, face shields, and goggles with side shields when contacting the patient or the soiled environment. There is insufficient data to support transmission by an airborne mechanism.16–20 Airborne transmission in animals was noted in some studies and was used to justify the stringent precautionary methods.21–23 Concerns have also been raised about two nosocomial cases that occurred in South Africa without any documented evidence of direct exposure to infectious material.24,25 However, all other evidence ruled out airborne transmission. In our experience, none of the contacts developed the disease after sharing the same environment as the index or the secondary cases. Of the 190 listed contacts, 2 (1.05%) developed the disease; both were the contacts of index case.

Percutaneous exposure remained the highest risk of transmission.20 An attack rate of 50% was seen in contacts that had a percutaneous or equivalent exposure (category A) (Table 2). However, due to the fact that the number of contacts who had category A exposure was small (four), we recommend interpreting these findings with caution. The percutaneous exposure that occurred from the index case to secondary case 1 was either in the form of saliva or respiratory secretions coming in contact with buccal mucosa or blood contact with broken skin not evident by the naked eye. The risk of cutaneous transmission through unnoticed skin breach necessitates cautious handling of blood and blood products. The male intern noted appreciable contact of respiratory secretions of index case with his eyes and face. Recommendations demand use of face shields or surgical masks, and wearing eye protection by persons coming within approximately three feet of the patient to prevent contact with blood, other body fluids, secretions, or excretions.21

We conclude that the health care professional caring for CCHF patients should take all possible safety measures to avoid contact with blood or secretions, and simple barrier nursing effectively prevents the disease, as has been seen in Lassa fever cases.26 It also appears that CCHF is not spread by air. However, further studies are needed to elaborate the specific routes of transmission of the disease.

Experts from developed countries recommend expensive approach such as high-efficiency particulate air respirators for HCWs caring for the CCHF patients and negative pressure isolation rooms.26 Such approaches are costly and not feasible for a third-world country such as Pakistan.

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### TABLE 1

<table>
<thead>
<tr>
<th>Categories*</th>
<th>Index case</th>
<th>Secondary case 1</th>
<th>Secondary case 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Family contacts</td>
<td>Hospital contacts</td>
<td>Family contacts</td>
</tr>
<tr>
<td>A</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
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<td>5</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>6</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>E</td>
<td>6</td>
<td>0</td>
<td>5</td>
</tr>
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</table>

* A = percutaneous contact with blood, and contact of blood to broken skin or mucosa; B = cutaneous contact with blood; C = cutaneous contact with nonsanguineous body fluids; D = physical contact with patients without body fluids contact; E = close proximity without touching the patient.

### TABLE 2

<table>
<thead>
<tr>
<th>Categories*</th>
<th>Contacts exposed</th>
<th>Attack rate</th>
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<tbody>
<tr>
<td>A</td>
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<tr>
<td>B</td>
<td>35</td>
<td>0/35 0%</td>
</tr>
<tr>
<td>C</td>
<td>22</td>
<td>0/22 0%</td>
</tr>
<tr>
<td>D</td>
<td>50</td>
<td>0/50 0%</td>
</tr>
<tr>
<td>E</td>
<td>79</td>
<td>0/79 0%</td>
</tr>
</tbody>
</table>

* A = percutaneous contact with blood, and contact of blood to broken skin or mucosa; B = cutaneous contact with blood; C = cutaneous contact with nonsanguineous body fluids; D = physical contact with patients without body fluids contact; E = close proximity without touching the patient.
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