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Major Article

Epidemiologic characteristics, clinical manifestations, and risk factors of 139 patients with Ebola virus disease in western Sierra Leone

Zhe Xu MD, PhD [a], Bo Jin MD, PhD [j], Guangju Teng MD [b], Yihui Rong MD, PhD [c], Lijian Sun MD [d], Jian Zhang MD [e], Ning Du MD, PhD [f], Liming Liu MD [g], Haibin Su MD, PhD [h], Yue Yuan MD [i], Haoyang Chen MD [k,*]

[a] *Treatment and Research Center for Infectious Diseases, 302 Hospital of PLA, Beijing, China*
[b] *Treatment and Research Center for Non-Infectious Liver Diseases, 302 Hospital of PLA, Beijing, China*
[c] *Treatment and Research Center for Liver Tumor, 302 Hospital of PLA, Beijing, China*
[d] *Intensive Care Unit, 302 Hospital of PLA, Beijing, China*
[e] *Radiotherapy Center for Liver Tumor, 302 Hospital of PLA, Beijing, China*
[f] *Chinese and Western Medicine Combined for Liver Disease Diagnosis and Treatment Center, 302 Hospital of PLA, Beijing, China*
[g] *Center for Clinical Laboratory, 302 Hospital of PLA, Beijing, China*
[h] *Treatment and Research Center for Liver Failure, 302 Hospital of PLA, Beijing, China*
[i] *Department of Infection Control, 302 Hospital of PLA, Beijing, China*
[j] *Treatment and Research Center for Liver Cirrhosis, 302 Hospital of PLA, Beijing, China*
[k] *Department of Medical Affairs, 302 Hospital of PLA, Beijing, China*

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Objective: We aimed to fully describe epidemiologic characteristics, clinical manifestations, and clinical outcomes of Ebola virus disease (EVD), as well as detect independent factors significantly associated with mortality of the disease.

Methods: One hundred thirty-nine confirmed EVD patients enrolled at the JUI Holding and Treatment Centre in western Sierra Leone between November 15, 2014, and January 18, 2015, and demographic and clinical data were retrospectively collected and analyzed.

Results: The median age of investigated patients was 29 years and 55.4% were women. Of them, 76 patients (54.7%) died and 63 patients (45.3%) were cured. Case fatality rate among male patients was higher than in female patients (69.4% vs 42.9%). Fatigue (82.0%), anorexia (70.5%), abdominal pain (59.7%), diarrhea (58.3%), vomiting (56.1%), fever (55.4%), and muscle pain (54.0%) were the most common symptoms. In addition, 55.4% of investigated patients reported fever. Bleeding was seen in 10.8% of patients.

Conclusions: Our data show that mortality of EVD is associated with an older age, fever, and probably hiccups.

Ebola virus disease (EVD), also called Ebola hemorrhagic fever or simply Ebola, is a severe infectious disease that was first reported in 1976 near the Ebola River in the Democratic Republic of Congo from which it got its name.[1,2] EVD is caused by the Ebola virus, a member of the *Filoviridae* family.[2,3] Sporadic outbreaks of EVD have occurred dozens of times mainly in central Africa during the past 4 decades with limited infected populations.[4] For the latest outbreak, the first case of which was reported during March 2014, the World Health Organization (WHO) announced in August 2014 that this West African Ebola epidemic, a "public health emergency of international concern," was the largest outbreak in history.[5] Sierra Leone was among the most heavily effected countries,[5] and the first case in Sierra Leone was reported during May 2014.[6]

EVD can be transmitted among human populations through direct contact with dead bodies or body fluids such as blood, stool, and vomitus of EVD patients.[2,3,7] There is no solid evidence that saliva and tears contain enough virus for transmission.[3] It is worth noting that health care workers can be infected by contact with

* Address correspondence to Haoyang Chen, MD, PhD, 302 Hospital of PLA, 100 W Fourth Ring Rd, Beijing, 100039, China.
E-mail address: chenhaoyang302@126.com (H. Chen).

ZX, BJ, and GT contributed equally to this work as first authors.

Conflicts of Interest: None to report.

ZX performed the statistical analyses and drafted the manuscript. BJ, GT, YR, LS, JZ, ND, LL, HS, YY, and HC comprised the writing group that was responsible for the interpretation of the results and for critically reviewing the manuscript.

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contaminated medical equipment.[8] The incubation period of EVD lasts 2 to 21 days (median, 14 days).[3] EVD is commonly characterized by fever, fatigue, muscle pain, headache, and sore throat, as well as vomiting, diarrhea, rash, kidney, liver function failure, and sometimes bleeding.[2,3,5] The case fatality rate of EVD varied from 25% to 90% in previous outbreaks.[2] However, there is no approved treatment or vaccine against EVD.[9] Normal supportive care, such as rehydration with oral or intravenous fluids, treatment of specific symptoms, and use of antibiotics, are provided to EVD patients to improve their survival.[9]

Schieffelin et al,[10] Qin et al,[11] Lado et al,[12] Hunt et al,[13] and Bah et al[14] have reported on the epidemiologic, clinical, and laboratory characteristics of this outbreak. This study aimed to add further valuable evidence to the current literature.

The JUI Holding and Treatment Centre, located in the western area of Sierra Leone, has been operated by the China Medical Team since October 2014. The center mainly offers medical diagnosis and supportive care to local suspected or confirmed EVD patients. We collected relevant data for 139 laboratory-confirmed EVD patients who were consecutively admitted to the center between November 15, 2014, and January 18, 2015, and retrospectively described their epidemiologic characteristics, clinical manifestations, and outcomes, as well as analyzed potential factors that were associated with mortality of EVD.

METHODS

Study design

This retrospective observational study included all laboratory-confirmed EVD patients who consecutively admitted to the JUI Holding and Treatment Centre from November 15, 2014, to January 18, 2015.

Patients were identified as suspected EVD cases with the use of a standardized definition that was recommended by the WHO: suspected patients were those who experienced illness with onset of fever and had no response to treatment for usual causes of fever in the area, and at least 1 of the following signs: bloody diarrhea, bleeding from gums, bleeding into skin (purpura), and bleeding into eyes and urine.[15] Blood samples were collected when suspected patients enrolled in the holding centre. Thereafter real-time quantitative reverse transcriptase polymerase-chain-reaction (qRT-PCR) tests were carried out to confirm the EVD cases by the China Center for Disease Control laboratory team. The viral loads were expressed as copies per milliliter serum. More details are described elsewhere.[16] The patients were offered supportive treatment based on their clinical presentations. Oral rehydration salts were given as a routine treatment; dose was dependent on the severity of dehydration. Patients were given intravenous administration of supplements under certain conditions. Acetaminophen or ibuprofen was given to patients with headache and/or muscle pain. Cefixime or anti-infective ciprofloxacin and antimalaria compound naphthoquine phosphate tablets were given to patients with fever. Antacid drugs such as ranitidine or omeprazole were given to patients with upper abdominal pain or burning sensation. Diazepam was given to patients who were fretful or had insomnia. Intravenous lactated Ringer's solution was given to correct electrolyte imbalance. All the treatments were performed in compliance with guidance provided by WHO.[17,18] Confirmed patients were reported to the National Emergency Response Centre and stayed in the Treatment Centre. Patients with 2 consecutive negative qRT-PCR results for Ebola virus were discharged. A patient admitted as an EVD suspect but found negative on repeated qRT-PCR tests was classified as a noncase. A total number of 139 EVD patients were enrolled in this study.

Ethics statement

This project was approved by the Institutional Review Board at Beijing 302 Hospital and the Sierra Leone Ethics and Scientific Review Committee. The requirement to obtain informed consent was waived by these committees during this West African Ebola outbreak.

Data collection

Demographic information, suspected EVD exposure, clinical symptoms, laboratory qRT-PCR results, and clinical outcomes were routinely collected for each patient. Moreover, incubation period, which is defined as the time between infection and onset of symptoms[5] (the date of EVD exposure by contacting with infected family members or neighbors, or attending an unsafe funeral was counted as possible infection), was also recorded. These data were then encoded into a database used for further analyses. Information on contacts was collected from the District Health Office in Sierra Leone. The EVD interventions were approved by the Ministry of Health and Sanitation of Sierra Leone. Oral informed consents were obtained from participants or their legal parents or guardians. We were exempt from requiring ethical approval due to delinking of personal identifiers from clinical and laboratory data. All data were analyzed anonymously.

Statistical analyses

Descriptive analyses were presented as frequencies, proportions, means with standard deviations, and medians with ranges. Proportions were compared using χ^2 test, and comparisons between continuous variables using t test or Wilcoxon rank-sum test, as appropriate. Univariate and multivariate logistic regression model were used to determine independent factors that were associated with mortality of EVD. Receiver operating characteristic curve and the area under the curve (AUC) were used to determine predicting disease outcome.

All statistical tests were 2-sided, and $P < .05$ indicated statistical significance. All statistical analyses were performed with the use of SPSS PASW Statistics software version 18.0.0 (IBM-SPSS Inc, Armonk, NY).

RESULTS

Epidemiologic characteristics

From November 15, 2014, to January 18, 2015, 374 patients visited the JUI Holding and Treatment Centre in western Sierra Leone. Of these, 139 patients had laboratory-confirmed EVD based on positive qRT-PCR tests.

Age and gender

The mean age ± standard deviation of the 139 patients was 30.1 ± 17.1 years, and their median age was 29 years (range, 0.5-75 years). Of them, 62 (44.6%) were men and 77 (55.4%) were women (Table 1).

Geographic origin

Of the 139 confirmed EVD patients, 57 patients (41.0%) geographically originated from the Western Rural district, 75 patients (54.0%) came from the Western Urban district, 5 patients (3.6%) came from Port Loko district, and 2 patients (1.4%) were from Moyamba district (Table 1).