Organization of Patient Care during the Ebola Hemorrhagic Fever Epidemic in Kikwit, Democratic Republic of the Congo, 1995

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In contrast with procedures in previous Ebola outbreaks, patient care during the 1995 outbreak in Kikwit, Democratic Republic of the Congo, was centralized for a large number of patients. On 4 May, before the diagnosis of Ebola hemorrhagic fever (EHF) was confirmed by the Centers for Disease Control and Prevention, an isolation ward was created at Kikwit General Hospital. On 11 May, an international scientific and technical committee established as a priority the improvement of hygienic conditions in the hospital and the protection of health care workers and family members; to this end, protective equipment was distributed and barrier-nursing techniques were implemented. For patients living far from Kikwit, home care was organized. Initially, hospitalized patients were given only oral treatments; however, toward the end of the epidemic, infusions and better nutritional support were given, and 8 patients received blood from convalescent EHF patients. Only 1 of the transfusion patients died (12.5%). It is expected that with improved medical care, the case fatality rate of EHF could be reduced.

During the 1995 Ebola (EBO) epidemic in Kikwit, Democratic Republic of the Congo (DRC), 316 persons were diagnosed as having EBO hemorrhagic fever (EHF), and 80% died [1]. It remains unclear when the EBO epidemic started in Kikwit, but in January 1995 a charcoal worker had already died with signs of EHF. For several months, the EHF cases remained undiagnosed. Initially, patients with hemorrhagic diarrhea were considered to have Shigella infection [2]. By 10 April, the number of EHF cases increased rapidly due to the nosocomial transmission of the infection after surgery was performed on a laboratory technician at Kikwit General Hospital [3]. On 11 May, an international scientific and technical committee was established to control the epidemic [2].

In previous EBO outbreaks, patient care was relatively unorganized. In 1976, in Yambuku, DRC, most patients had already died when the international team arrived [4]. During that epidemic, only 3 patients with EHF were followed closely in a hospital setting (at the Ngaliema clinic in Kinshasa, DRC) [5]. In 1976, during the Sudan outbreaks, most patients were isolated in their homes [6]. In Kikwit, for the first time, patient care for a large number of patients took place in a hospital. In the more recent EBO outbreaks in Gabon, relatively good patient care was organized, although on a smaller scale because fewer persons were infected [7].

Herein, we describe the care of case patients before the infection was diagnosed as EBO, from the arrival of the international support team until the end of the epidemic. Difficulties in organizing the care of patients are discussed.

Methods

Health care workers directly or indirectly involved in patient-care activities during the EBO epidemic were interviewed without the use of standardized questionnaires. Nearly all physicians involved in patient care activities during the epidemic are co-authors of this paper. In addition, World Health Organization (WHO) documents and travel and meeting reports were screened for information about EHF care issues.

Between 15 and 19 September 1995, focus-group discussions were conducted among 27 nurses who had worked with EBO patients in May 1995. Six (22%) of the 27 had been infected by the virus. There were 3–7 participants per group. The discussions lasted between 1 h 50 min to 3 h. Many topics were discussed; however, herein, we will report only on issues related to patient care. The discussions, which were led by the Congolese chaplain of Kikwit General Hospital, were recorded on tape.

Most of the EHF patients were hospitalized at Kikwit General Hospital, a 350-bed facility, which is the main hospital of Kikwit. Results

Patient Care before the Diagnosis of EBO Was Made

Initially, patients with bloody diarrhea were treated with antibiotics, such as chloramphenicol, cotrimoxazole, tetracycline, and nalidixic acid. Toward the end of the epidemic, ciprofloxacin was also used. Since the diagnosis of EHF was not suspected, adequate protective measures were not taken by health care workers.

About 1 week after surgery was performed on an EHF-infected laboratory technician, several members of the surgical team and other health care workers involved in the care of the
technician became ill. Among the nurses was an Italian nun.
In the following 1 to 2 weeks, most of the sick health care
workers died [1–3]. The news about the death of the health
care workers at Kikwit General Hospital rapidly spread, not
only among patients and health care workers, but also among
the population of the Kikwit region. This created great panic
and mistrust in Kikwit General Hospital, and nearly all patients
fled. Some of them sought care in other hospitals, and others
returned to their homes or villages. Health care workers also
left their posts. Only very ill patients and some voluntary health
care workers remained in the hospital.

At the time of the nosocomial outbreak at Kikwit General
Hospital, the hygienic working conditions in the hospital were
far from ideal. There was no running water, no electricity, and
no functional waste disposal system or latrines. For nursing
care and for most invasive procedures, gloves were not used.
Most nursing care was done by family members, who often
slept in the same bed as the patient. On 4 May, before the
diagnosis of EBO was confirmed by the Centers for Disease
Control and Prevention (CDC), an isolation ward was created
at Kikwit General Hospital in pavilion 3. One doctor (M.
Bwaka) and 3 nurses volunteered to remain in isolation with
the patients. They used gloves, surgical gowns, and locally
made cotton masks, but a minimal amount of protective equip-
ment was available. Thirty patients were admitted to this iso-
lation ward; however, little care was given to them. During this
time, 1 of the 3 nurses became infected and died. One family
member per patient was allowed to enter the isolation unit, but
there was no strict control on the movement of family members
in and out of the unit. Some patients were visited by several
family members at the same time, and for other patients, the
family attendants changed over time. No protective equipment
was given to family members.

There were 164 cases of EBO reported before 11 May, of
which, 134 (82%) died. Included in the total number of cases
were 63 health care workers, of whom 47 (75%) died.

Patient Care after the Epidemic Was Recognized

Initial weeks of the epidemic. The first priority was to stop
the epidemic. To avoid further nosocomial spread of the epi-
demic, nearly all medical activities, except the care of the EBO
patients, were stopped at Kikwit General Hospital. At the hospi-
tal, only the emergency department continued functioning, and
a few patients with tuberculosis remained in the tuberculosis
ward. The maternity ward remained open in Kikwit II Hospital,
a 100-bed facility that is located 1 km from Kikwit General
Hospital, and some medical activity continued in private clinics.

The isolation unit. It was felt that in most cases, the iso-
lation of EBO patients at home would be impossible to organize
and supervise in Kikwit, a city of ~400,000 inhabitants. If
people died of EBO at home, it was feared that certain families
would continue to bury their family member in a traditional
way, which would risk further spread of the infection [2]. It
was therefore decided to continue isolating patients in the iso-
lation unit of Kikwit General Hospital. The hospitalization condi-
tions of the patients and the working conditions of the health
care workers had to be improved, however, in order to regain
the confidence of the population of Kikwit as well as the health
care workers at Kikwit General Hospital.

When the international team visited Kikwit General Hospital
for the first time, several dead bodies were found in the isolation ward.
Abandoned EHF cases were also found in other wards, such as in
the measles ward. The isolation ward was cleaned and disinfected
with calcium hypochlorite 2% [8]. Mattresses were covered
with plastic shields to facilitate disinfection. Bodies of the deceased were
disinfected, put in plastic bags, and buried. All EHF cases were
transferred to the isolation unit. With the logistic support of Médecins
sans Frontières (MSF), Belgium, the ward was reorganized and
separated from the rest of the hospital by a plastic shield [8].
MSF also provided and maintained the supply of water through 2
inflatable tanks. Inside the hospitalization ward, a room was used for
stocking drugs, disinfectants, and nursing and protective equipment.
Within the ward, most patients were in one room and often sepa-
rated by one or more empty beds. Only a few patients (some of
them health care workers of Kikwit General Hospital) were
hospitalized in a private room. On 20 May, a second quarantine
pavilion was opened because an increasing number of patients was
expected. This ward, however, was only occasionally used for a
few days.

Protective equipment was distributed according to the estimated
risk of infection [8]. Physicians and nurses used double gloves,
gowns, masks, goggles, and boots. Due to the hot climate, it was
nearly impossible to stay in the isolation unit for >2 h. Because
the supplies were provided by different organizations, the kind of
protective equipment changed continuously. Very few high-security
masks were available during the epidemic. HEPA masks were only
used by the medical personnel, and because of the limited supplies,
masks were reused. Goggles were difficult to wear because they
rapidly filled with perspiration; therefore, they were not always
used. To limit the number of gloves needed for patient care and
to decrease the risk of exposure to body fluids of EHF patients,
physicians and nurses did not change gloves between patients but
washed their gloved hands in calcium hypochlorite 0.2%. Cleaning
personnel used kitchen gloves. Calcium hypochlorite (0.02%) was
used for hand washing. Each day, different concentrations of cal-
cium hypochlorite were prepared in large tanks.

Initially, only 1 Congolese physician and 1 expatriate physi-
cian worked in the isolation ward. All health care workers
returned home after work.

After the establishment of the international committee, 93
persons with suspected EHF were admitted to Kikwit General
Hospital. After barrier-nursing techniques were initiated, only
3 health care workers developed EHF: 1 of them was an Italian
nun, who was probably infected because barrier-nursing meth-
ods were not always used, and 1 was a Congolese nurse, who
was infected by a needlestick injury during recapping. It is
possible that these 2 people became infected just prior to the
arrival of the international team. A second Congolese nurse,
involved in the care of the Italian nun with EHF, always worked
with protective equipment but probably became infected by
touching her eyes with a contaminated glove.
Only a minimum of care was given to patients. Symptomatic treatment included paracetamol for pain and fever; metoclopramide and haloperidol for nausea, vomiting, and hiccups; haloperidol and diazepam in cases of agitation; and diazepam for epilepsy. Intramuscular injections and salicylic acid were not given because of the potential risk of increased bleeding. Because laboratory tests were not available, patients with fever were often empirically treated with antibiotics and antimalaria drugs. Medical records were kept for every patient, but in general, little clinical information was noted in these records.

Initially, patients were given only oral treatments and did not receive infusions (with the exception of 2 Italian nuns, who were treated in isolation in their convent). Despite the fact that all of the Italian nuns received infusions and good nursing care, all 6 died (4 before and 2 after the arrival of the international team).

During the epidemic, all routine laboratory activities were stopped at Kikwit General Hospital, and patient management decisions were taken only on a clinical basis. Because laboratory techniques for virus inactivation were not available on site, blood was obtained only for research purposes to allow analysis of samples in high-security laboratories after the epidemic was over.

Essential nursing equipment (e.g., bedpans, urinals) were not initially available. Most of the nursing care was done by family members. Protective equipment was also given to family members who cared for the sick ("gardes malades"), but not enough equipment was available at the beginning of the epidemic. Family members often were given only one pair of disposable gloves every 2 days. From 17 May, a nurse who had recovered from EHF volunteered to provide extra assistance to family members and to train them in the proper use of protective equipment. Only 1 family member was allowed to stay with the patient. This person also had to remain in isolation. Family members slept in tents that were erected close to the isolation unit by MSF [8].

Food for patients and family members was provided by a charity organization. In general, it was the family member who helped feed the patient.

The emergency ward (triage center). Patients with obvious EBO symptoms and a history of contact with a known EHF patient were hospitalized immediately in the isolation unit. Patients with suspected EBO sometimes remained in the emergency department for observation for ≥24 h. Certain patients did not admit to having had a previous contact with an EBO patient or to experiencing certain symptoms, such as hemorrhagic manifestations, because they were afraid to be hospitalized in the isolation unit. When it became obvious that they were infected with EBO (i.e., when they developed hemorrhagic manifestations), they were transferred to the isolation unit (figure 1). Patients who vomited or presented with diarrhea were also more rapidly transferred to the isolation unit because they were considered more likely to transmit their infection to other patients, family members, or health care workers.

In the emergency department, it was difficult to separate suspected EBO cases from patients with other diseases, such as children with malaria or meningitis, because all diagnoses had to be made clinically since routine laboratory activities had been stopped. No rapid diagnostic test to diagnose EBO infection was available on site.

All of the physicians and nurses involved in patient care activities who were interviewed found the presence of conjunctivitis ("red eyes") to be highly predictive for EHF; however, no systematic study was done [9]. Conjunctivitis can be observed during other viral diseases but is generally not present during malaria, typhoid fever, shigellosis, bacterial pneumonia, or meningitis (the main causes of serious acute febrile illnesses in Africa). At the end of the epidemic, an algorithm using fever, conjunctivitis, and hemorrhagic manifestations as the

Figure 1. Admission and discharge process for patients suspected of having Ebola hemorrhagic fever (EHF) at Kikwit General Hospital, Kikwit, Democratic Republic of the Congo, 1995. HS = hemorrhagic signs (e.g., gum bleeding, hematemesis, melena or bloody stools, hematuria, petechia or hematoma, epistaxis, hemoptyisys, metrorrhagia); NHS = nonhemorrhagic signs and symptoms (asthenia, diarrhea, nausea or vomiting, anorexia, sore throat or dysphagia, abdominal pain, headache, arthralgia or myalgia, hiccups or cough, dyspnea or tachypnea).
key symptoms or signs to detect EHF cases was proposed (figure 2). However, this algorithm was never evaluated.

The emergency department consisted of 2 wards and a few consultation cubicles. One ward was used for suspected EBO cases and the other for suspected non-EBO cases (such as children with malaria or meningitis). Since the 2 emergency wards were located close to the entrance to the hospital, it was difficult to keep family members away from patients. Protective equipment was distributed to the health care workers in the emergency ward, and barrier-nursing techniques were used; however, they were applied less strictly than in the isolation unit. In addition, in the emergency ward, it was impossible to create “infected” and “clean” areas, as was done in the isolation unit [8]. Nevertheless, no cases of nosocomial-acquired EHF infection among patients or health care workers were identified. Initially, 2 Congolese and 1 expatriate physician worked in the emergency ward.

**Ward for convalescent patients.** When the clinical condition of patients improved (i.e., when fever had disappeared and patients began to eat normally), they were moved from the isolation ward to a ward for convalescent patients. In this ward, isolation rules were less strict and more contact with family members or friends was possible. Surviving EBO patients spent an average of 15 days in the isolation ward and 20 days in the convalescence ward. After discharge from the hospital, some patients returned to the convalescence ward because they were not well accepted at home or by neighbors. After discharge, many convalescent patients were followed as outpatients at Kikwit General Hospital.

**Home care.** When patients lived too far from Kikwit or when they refused to be transported to Kikwit General Hospital, they remained in their homes. It was explained to the family that only 1 family member should take care of the patient. The family was given 0.02% calcium hypochlorite solution and some gloves [9]. The team responsible for collecting regional EBO surveillance data organized patient care for 60 EBO patients in 29 villages; 47 of the patients (78%) died.

**Other health care.** Several hospitals in the region used the example of Kikwit General Hospital to organize the care of their EHF cases. At Mosango Hospital, a 600-bed hospital located 100 km from Kikwit, laboratory activities were reduced and performed with increased precautions. Other medical activities, including emergency surgical interventions, continued during the epidemic [10]. On 20 May, the International Scientific and Technical Committee decided to reopen the other hospital in Kikwit (Kikwit II) in order to provide care for surgical, obstetric, and non-EBO emergency cases. Disinfectant, waste disposal containers, and protective equipment were distributed in this hospital and also to 12 health centers in Kikwit and its surroundings [9].

**Burial of patients.** Red Cross volunteers were provided with full protective clothing and trained to transport patients
and to bury the dead. The procedure was to disinfect the bodies, put them in plastic bags, and bury them in an individual or common grave. All patients who had died in Kikwit since the establishment of the international committee were buried by a special team of Red Cross volunteers, with one exception. This exception was near the end of the epidemic, when the body of a woman who died of EBO after childbirth was removed by force and taken home by family members and buried according to local customs. This event was responsible for the last wave of EBO cases in Kikwit [1]. In the Mosango district, patients were buried by health care workers from Mosango Hospital.

Last Weeks of the Epidemic

The last wave of the epidemic consisted of 25 patients. At that time, enough protective equipment was available and its distribution was well organized by MSF. Five Congolese physicians and 2 European physicians were involved at this point in the care of the last 9 patients hospitalized in the isolation unit of Kikwit General Hospital. By this time, physicians and nurses had acquired more experience. The management of the patients was discussed daily and medical information about patients was noted more rigorously, resulting in better patient care. Dehydrated patients were rehydrated by intravenous infusions, using butterfly needles. Patients were also better nourished. Some of them received protein-rich liquid, which was patiently spoon fed to them by relatives. Patients were examined twice daily by a physician. Blood pressure, however, was not taken systematically because it was not possible to disinfect the equipment properly. For the same reason, lung auscultation was performed only when there were clinical symptoms or signs suggesting a pulmonary or cardiac disorder.

When the nurse who had volunteered to take care of the last EBO-infected Italian nun also became infected, the Congolese physicians decided to transfuse her with blood from a convalescent patient. Because she recovered, it was decided to transfuse the remaining EBO patients as well. One less severely ill patient refused to be transfused. In total, 8 patients received a transfusion with the blood donated by convalescent patients. Only 1 patient (12.5%) died [11]. Six of them also received intravenous infusions [11]. The last EHF patient was rehydrated out of the isolation unit on 14 July and was discharged from Kikwit General Hospital on 31 July 1995. Of the last 25 patients with EHF, 14 (56%) died.

Focus-group discussions among nurses. It was revealed during discussions that most of the nurses who volunteered to care for EBO patients were very disappointed about the recognition they received for their actions. Most of them felt abandoned by the managers of the hospital and felt they received insufficient financial and psychologic support during the epidemic. They had a very difficult time during the epidemic: Salaries had not been paid over a long period, and the nurses felt stigmatized because people considered them to be possibly infected. Because their money was not accepted at the market, the nurses had to send other family members to obtain food. Some of them reported that neighbors had been throwing stones at them or their houses (or both). Others were chased from their houses, and some health care workers who had recovered from EHF had to return to Kikwit General Hospital because they were rejected by their community. The belongings (e.g., household furniture, clothes, linen, mattresses) of some convalescent nurses had been burned. They also suffered because they lost family members and colleagues during the epidemic.

Discussion

Overall, the organization of patient care during the EBO epidemic in Kikwit was quite successful. The organization of an isolation unit and of a triage center at the emergency ward of Kikwit General Hospital, together with the distribution of protective equipment among health care workers and family members, probably stopped the nosocomial EBO outbreak. Moreover, in the last phase of the epidemic, the case fatality rate was reduced to 12.5% because of the improved patient care.

Organizing patient care was not easy. First there was the panic in the city and the fear among health care workers. Many of their colleagues had died during the epidemic (of the 36 persons working in the emergency wards, 8 [22%] died). Hospital workers had not received any regular salary for several months prior to the start of the epidemic. Furthermore, the distribution of money and of goods brought in by international and national donors created feelings of ill will and required subsequent reappraisal by an advocacy group of nursing personnel. During the epidemic, there was also a brief strike by Red Cross volunteers. They too felt stigmatized by the population and complained of insufficient psychologic and financial support. The logistic support for the health care workers involved in care activities was not always ideal. Working with protective equipment in the tropics causes excessive perspiration and a rapid loss of calories. Drinks and food should therefore be provided on a regular basis at the work site. Good logistic support is essential to allow health care workers to work in optimal conditions. Personnel management during future large EHF outbreaks will certainly face similar problems.

Another problem was the lack of sufficient protective equipment at different times during the epidemic. Initially, it was unclear which and how much protective equipment was needed. The quantity of previously ordered equipment was not known, and workers did not know when to expect the supplies. Protective equipment was supplied by different organizations. Despite the fact that the distribution of this equipment was coordinated by MSF, it remained difficult to monitor the use of the equipment and to foresee future needs. In general, these needs were always greater than estimated. There are several explanations for this. Because of their traumatic experience at the beginning of the epidemic, health care workers were afraid they were not protecting themselves enough, protective equipment was sometimes misused by persons who were not at risk, and some equipment disappeared. To avoid these problems in the future, a better coordination of donor activities is necessary. From the start of an epidemic, ample quantities of gloves and gowns should be supplied. Surplus material can always be used after the epidemic.

During the epidemic, only butterfly needles were available for infusions. These needles are potentially traumatic and may cause
bleeding, especially in patients who become agitated. Plastic catheters are better for use in patients with bleeding disorders. If possible, high-security needles and catheters should be used so that needlestick injuries can be avoided. Certainly, when no such needles are available, all needles should be disposed of immediately after use in solid sharp containers.

This epidemic has taught us a lot about the clinical management of EBO patients. The experience with the last 8 EHF patients, who were transfused with convalescent blood, suggests that, with adequate care, we should be able to decrease the case fatality rate of this infection. These 8 patients were all seriously ill and had clinical symptoms similar to those of other EHF cases seen during the epidemic [11]. Virus isolates obtained at different times during the epidemic were genetically identical [12], as has been observed in other epidemics [13]. It is therefore unlikely that these 8 patients were part of a cohort with more favorable survival characteristics. Oral or intravenous rehydration, provision of adequate calories and nutrition, and antimalarial drugs to prevent infections are probably the most important measures to improve survival among EBO patients.

During the February 1996 EHF outbreak in Gabon, patients were also treated with intravenous infusions (Le Guenno B, personal communication). This may explain the slightly lower case fatality rate in Gabon (56.8%) [14], compared with the overall case fatality rate during the Kikwit outbreak (80%). Both outbreaks were caused by closely related EHF viruses [13]. The potential beneficial effects of blood transfusions from convalescent patients should be studied in a future epidemic [11].

To improve the care of patients with EBO, we need to know much more about the pathogenesis of this infection. We need to know whether there is disseminated intravascular coagulation, thrombocytopenia, and immunodefiency and why patients die (i.e., because of dehydration, shock, renal insufficiency, or other factors). During a future outbreak, we should certainly try to carry out simple laboratory tests on site to measure parameters such as hematocrit, leukocyte, lymphocyte, and platelet counts; urea, creatinine, and electrolyte levels; liver tests; and thick smears to detect malaria parasites. Not only will this increase our knowledge of the disease, but it will also help us to improve patient care. In order to perform these tests safely, virus inactivation techniques should also be available on site.

The manner in which EBO virus is transmitted from person to person during patient care is still incompletely understood. A better knowledge of transmission routes is essential in order to develop recommendations about how health care workers should protect themselves. Studies should also be done to identify the protective equipment that is most practical for use in tropical conditions. The gloves used initially in the epidemic were not practical; face shields probably would have been better. Another important key question for research is the quantity of protective equipment needed per person for each per patient.

A rapid screening test for EBO antigens should be made available in the field. This will allow us to detect EBO cases earlier and to avoid the isolation of non-EBO cases together with EBO patients.

Good teamwork between physicians and nurses is essential to provide optimal care for patients and optimal adherence to safety precautions (e.g., clinical and treatment information should be recorded by 2 persons, 1 person examining the patient and the other taking notes, to avoid contamination of pencils and medical records with body fluids from patients). This will also lead to a better understanding of the disease.

A comprehensive plan of action to organize EHF patient care for future EBO outbreaks should be prepared. A manual about EHF isolation precautions has been compiled by the CDC and WHO [14]. Planning for treatment of EHF cases and psychosocial support for patients and their families is necessary for the future.

The most important conclusion to be drawn from this epidemic is that unless we change the current weakness of the health care system in DRC (i.e., the lack of hygiene, laboratory facilities, funds for health care workers, and epidemiologic surveillance activities), other nosocomial epidemics with EBO or other pathogens will undoubtedly occur.

References