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Organisation of health care during an outbreak of Marburg haemorrhagic fever in the Democratic Republic of Congo, 1999

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Summary Organising health care was one of the tasks of the International Scientific and Technical Committee during the 1998–1999 outbreak in Durba/Watsa, in the north-eastern province (Province Orientale), Democratic Republic of Congo. With the logistical support of Médecins sans Frontières (MSF), two isolation units were created: one at the Durba Reference Health Centre and the other at the Okimo Hospital in Watsa. Between May 6th, the day the isolation unit was installed and May 19th, 15 patients were admitted to the Durba Health Centre. In only four of them were the diagnosis of Marburg haemorrhagic fever (MHF) confirmed by laboratory examination. Protective equipment was distributed to health care workers and family members caring for patients. Information about MHF, modes of transmission and the use of barrier nursing techniques was provided to health care workers and sterilisation procedures were reviewed. In contrast to Ebola outbreaks, there was little panic among health care workers and the general public in Durba and all health services remained operational.

Introduction

Marburg haemorrhagic fever (MHF) is caused by a filovirus, morphologically similar to the Ebola virus. The initial MHF outbreak took place in 1967 in

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Marburg (24 cases), Frankfurt (6 cases), Germany and Belgrade (2 cases), Yugoslavia.[1,2] Between this initial outbreak and the outbreak in Durba, Democratic Republic of Congo (DRC), only seven other MHF cases have been reported.[3-5] The clinical picture of MHF consists of fever, myalgia, vomiting, diarrhoea, conjunctival injection and haemorrhagic diathesis.[1-5] Mortality varied from 23% in Marburg, Germany to 85% (all suspected MHF cases) and 56% (confirmed MHF cases) in Durba, DRC. The natural reservoir of the virus is unknown.

The epicenter of the 1998–1999 MHF outbreak was situated in Durba, in the north-eastern province (Province Orientale), DRC.[1] Although the outbreak began in November 1998, it was the death of the Médecin Chef du Zone on April 23, 1999 that ultimately provoked the call for international assistance.

In order to control Marburg or Ebola outbreaks the organisation of patient care is an extremely important element. The provision of adequate supportive therapy may increase survival of patients, and proper isolation techniques and education will prevent the transmission of Marburg virus to healthcare workers and family members. It is important that the population has confidence in the healthcare system and that patients are stimulated to seek healthcare. This may improve early case detection and follow-up of patient contacts. Because this was the first MHF outbreak in an African setting, the International Committee based its recommendations concerning the organisation of patient care on experiences of other filovirus outbreaks (the Ebola haemorrhagic fever (EHF) outbreak in Kikwit, DRC[6-8] and Gabon[9]). In this paper we review the organisation of patient care during the 1998–1999 Marburg outbreak in Durba.

Setting

Durba, a village with approximately 16,000 inhabitants, is located in the Watsa health zone, situated in the north-eastern region of the district of Haut Uele, Province Orientale, DRC. The political situation and security in the area are precarious. The most important economic activity in the region is centred on the illicit exploitation of gold mines, owned by the Kilo Moto Mining Company. This enterprise is especially attractive to young men who represent about 60% of the population of Durba. Following the first civil war in 1996 and the deterioration of the socio-economic situation, an increasing number of men have been working illegally in these mines. The use of 'home-made' dynamite, lack of maintenance in the mines and the difficult working conditions are associated with a large number of accidents.

Watsa town, the administrative seat of the health zone, is located 15 km from Durba. There are two hospitals in Watsa: the Okimo Hospital, a 70 bed private hospital operated by the Kilo Moto Mining Company and the 56 bed General Reference Hospital operated by the health zone. The General Hospital is in a very poor condition and is poorly equipped. It was to the latter hospital that the majority of MHF cases were referred before the arrival of the international team.

Durba has 16 health clinics. Governmental employees in the medical facilities in this region had not been paid for over a year. Their only source of income was the fees collected from patients for consultation and medications. Medical equipment and essential drugs, including anti-tuberculous drugs, were often lacking. There were no reference laboratories nor qualified laboratory personnel.

The only rapid means of communication with the other regions is by a radio owned by the Kilo Moto mines. The deplorably rough dirt roads are even worse during the rainy season when they become virtually impassable by vehicle. Vaccination coverage is as low as 15%, due to lack of vaccines, absence of a cold chain and lack of reliable transport. Among the main causes of morbidity in the region are, malaria, respiratory infections, STDs (including AIDS), tuberculosis, schistosomiasis, onchocerciasis. Epidemics of meningitis, bacillary dysentery and cholera occur often and both plague and yellow fever are endemic in certain localities (information provided by Dr Olinda, Médecin Inspecteur du Province).

The coordination team of Medecins sans Frontieres (MSF) Belgium in Kisangani was informed by the Médecin Inspecteur du Province about an outbreak of haemorrhagic fever with high mortality at the end of April 1999. It was especially the news that the Médecin Chef de Zone was among the victims that caused the alarm. MSF Kisangani informed headquarters in Brussels. At the same time, the MSF Holland coordination in Goma, DRC, informed their headquarters in Amsterdam about the same event. The medical departments of both headquarters contacted each other and the decision was taken to send a combined team to Durba, with the necessary isolation equipment. Two medical doctors and one logistician arrived in Durba on May 2, in the company of the Médecin Inspecteur du Province and the provincial representative of WHO. At arrival this team met with all responsible personnel of the different health

centres of Durba to collect information. The next day health structures where suspected cases were hospitalised were visited, blood samples taken and an isolation unit installed. Hospital files in Watsa were reviewed to collect information about previously hospitalised haemorrhagic fever patients. The first blood samples were sent to the National Institute of Virology (NIV) in Johannesburg, South Africa on May 5th. By May 6th, the identification of the Marburg virus as the causal agent was confirmed. On May 7th, an international team coordinated by Prof. Muyembe, Director of the Institute of Biomedical Research, DRC, was established in Durba. MSF was responsible for patient care in the isolation unit, and organized training of the health staff about barrier nursing techniques. The main problems encountered were lack of laboratory facilities for diagnosis, lack of means of transport for surveillance activities and the insecurity in the region.

Between November 2, 1998 and May 28, 1999, a total of 75 cases of suspected or confirmed (9 cases) Marburg infections were detected, 62 of whom died (82%).[10]

Provision of health care during the outbreak

The main priorities were the organisation of an isolation unit for the treatment of cases, the development of an appropriate case definition, educating health workers regarding modes of transmission and protective measures to be adopted, including barrier nursing techniques.

The isolation unit in Durba

An isolation unit was organised at the Durba Reference Health Centre. This centre is a public facility and was therefore easily accessible and modifiable. The principal reason for choosing this centre was that it was the most suitable of the structures available, it was located near a water point, and it was situated in the centre of Durba. The centre consisted of a traditional mud-brick construction with a straw roof (Fig. 1). It was poorly equipped, lacking both running water and electricity. Within a few days, a supply of chlorinated water and a waste disposal system were in place. The isolation unit was organised into three areas: a clean area for the staff (nursing station) with a small pharmacy and stock, and area for probable MHF cases, with a capacity of six beds, and an isolation area for clinical MHF cases with a capacity of three beds (Fig. 2). Patients with MHF symptoms and signs came to the isolation unit spontaneously or were referred by the MHF surveillance team. For case definitions of probable and clinical MHF cases see Table 1. Each room had separate medical equipment (thermometers, stethoscope, otoscope, lamps and blood pressure instrument). Initially, petrol lamps were used as light source but these were later replaced by solar lamps. Showers and latrines were installed for each area.

A team of two nurses made patient rounds: one nurse examined the patients while a second nurse handled patient files to avoid contamination of files, which were kept in the nursing station. Additional nurses were recruited from other health centres in order to provide 24 h care, organised into three 8 h shifts of two nurses for each shift. Doctors from the international team made rounds and examined patients twice daily with the nursing staff. The nurses generally made patient rounds three times in 24 h, or more frequently if necessary. A checklist with clinical symptoms and signs was completed three times daily for each patient with the aim of further refining the MHF case definition. Blood samples were obtained from suspect and clinical cases, serum was separated and stored in liquid nitrogen and sent to NIV and the Centers for Disease Control (CDC) for analysis by ELISA (antigen, IgG and IgM), PCR and viral isolation.

Protective equipment was distributed to health care workers consisting of two sets of gloves, a cotton scrub suit, a cotton gown, a rubber apron, a

Table 1 Case definitions of Marburg haemorrhagic fever (MHF) used for epidemiologic surveillance during the MHF outbreak in the Durba/Watsa area

Probable case
- A person at risk for MHF (gold miner) or a person who has been in contact with a clinical case during the past 3 weeks, with acute fever (<2 weeks) not responding to antimalarial and antibiotic treatment

Or
- A person who has been in contact with a clinical case presenting at least three of the following general symptoms

Headache	General pain
Nausea, vomiting	Dysphagia
Anorexia	Dyspnoea
Non-bloody diarrhoea	Cough
Asthenia	Thoracic pain
Abdominal pain	

Or
- Unexplained sudden death during a MHF epidemic

Clinical case
A person presenting or with a recent history of acute fever (<2 weeks) and 1 or more of the following haemorrhagic signs (gingival bleeding, bloody diarrhoea or melena, haematemesis) or a conjunctival injection (red eyes)

Figure 1 Isolation unit of the Durba Reference Health Centre.

surgical mask, protective goggles, a surgical cap and rubber boots. Reusable protective gowns were preferred because they fitted better than disposable ones. Gloves and a mask were provided to the family member caring for the patient. Two cleaners were engaged to disinfect latrines and showers, to clean the rooms, and spray boots, gloves and aprons of health care workers with a solution of 0.2% chlorine when they left the isolation area. Clothes were washed in a disinfecting solution of chlorine after use. Guards were engaged to watch the entrance to the isolation unit and all staff working in the isolation unit, were paid. Staff members were not quarantined.

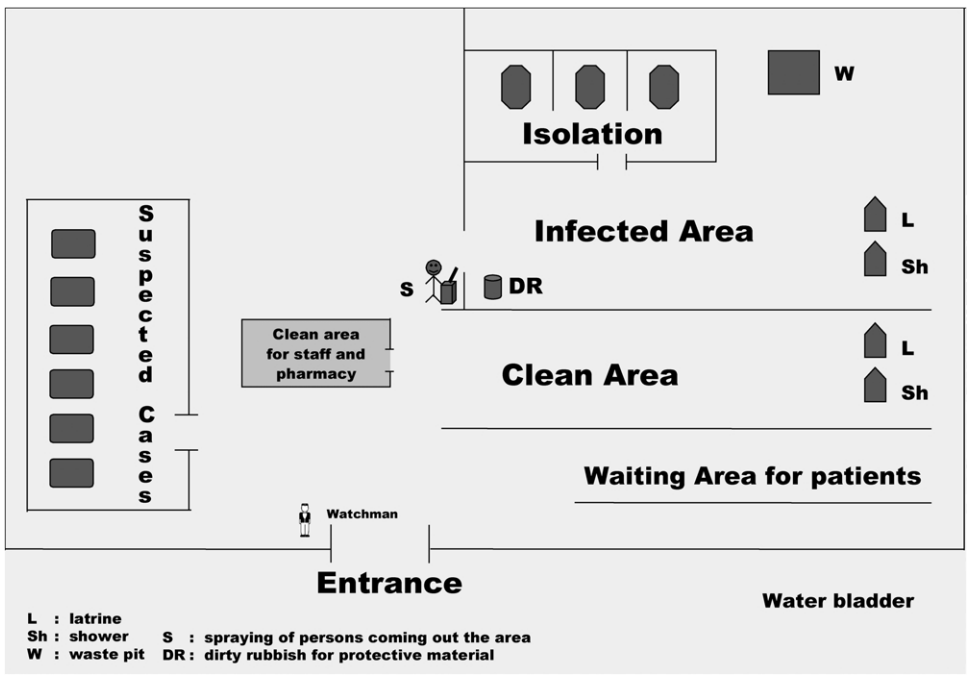

Figure 2 Isolation unit of the Durba Reference Health Centre.

Between May 6th, the day the isolation unit was installed, and May 19th, 15 patients were admitted to the centre. In only four of them, was the diagnosis of MHF confirmed by a laboratory test. The characteristics and clinical outcome of these patients will be described elsewhere. The clinical diagnosis (no laboratory tests available) of other patients included AIDS (2), tuberculosis (3), malaria (4), hepatitis (1), and amoebiasis (1). Treatment of the MHF cases was essentially symptomatic. Paracetamol was given to reduce fever or pain, since aspirin carries an increased risk of bleeding. Perfusions were given to patients with dehydration. Anti-emetics were given for vomiting. Because of the lack of diagnostic capacity and the need to restrict examinations of blood and body fluids in the setting of a MHF outbreak, anti-malarial treatment was given based on clinical symptoms only. Antibiotics were given for suspected bacterial infections.

The isolation unit in Watsa

In the Okimo Hospital in Watsa, another isolation unit was established after two clinically suspected cases of MHF were identified by members of the international team in the city of Watsa. One of the suspected MHF cases was initially hospitalised at the Watsa General Hospital, but as this hospital was very poorly equipped, the plan was to transfer the patient to Okimo Hospital. However, upon further observation, it became apparent that the patient was suffering from a chronic illness and he was therefore not transferred. A blood sample later showed he was not infected. The second patient, a 22-year-old woman who had been in contact with her mother who had died with MHF symptoms had developed similar symptoms. Many members of the international team were not convinced that she had MHF because she was not severely ill. She was therefore treated at home. Because of vomiting and diarrhoea she received a perfusion from a private nurse. Her general condition improved and she was never transferred to the hospital. Serologic testing proved later that she had been infected with the Marburg virus.

Other health centres in Durba and Watsa

Most of the health centres in Durba and Watsa were visited by a member of the coordination team. Information about the clinical presentation, case definition, epidemiology and nursing barrier techniques as well as disinfection procedures and waste disposal were provided to healthcare workers during a training module on MHF. Each health centre was provided with a basic protective kit (see Table 2). Suspected cases arriving at health facilities were isolated and transferred to the isolation centre in Durba by ambulance. For suspected MHF in distant villages, patients remained at home and the local nurse provided instructions to the family on simple protective measures such as using gloves, washing hands with soap, abstaining from sex or from sleeping in the same bed with the patient. All suspected cases were reported to the coordination team, and nurses were asked to follow contacts of suspect cases for possible symptoms during the 3 weeks after the last date of contact with the case.

Discussion

Although the trigger to call for international assistance was similar in Kikwit and Durba, namely the fact the medical staff were among the victims, the situation in Durba was less dramatic than in Kikwit. The Kikwit epidemic was mainly caused by a large nosocomial outbreak at the Kikwit General Hospital.[6] The deaths of many healthcare workers caused panic among other healthcare workers and the general population. All health structures were closed and suspect EHF cases were initially abandoned, which was possibly one of the reasons for the high case fatality rate in Kikwit (80%).

In Durba/Watsa, all health structures continued to function during the epidemic. This can be explained by the fact that the disease was already familiar to the health care workers as the 'Durba syndrome' and that many of them had been in contact with MHF cases either in this or in previous epidemics without falling ill. In contrast with the

Table 2 List of equipment distributed to each health centre

Chlore 70%	500 g
Disinfecting soap	2 pieces
Soap	1 piece
Jerrycan 20 L	1
Thermometer	1
Plastic sheet 1.5 × 2 m	1
Plastic basin	1
Bucket	1
Apron (paper)	10
Apron (plastic)	1
Examination gloves	50
Protection masks	4
Protection glasses	1
Household gloves (pair)	1
Syringes 5 ml	20
Needles 21 G	20
Tourniquet	1

Kikwit epidemic, only three health care workers died; a nurse and a physician from the Watsa General Hospital in 1994 and the afore-mentioned physician from the same hospital in 1999. For a short time patients refused to come to either of the two hospitals in Watsa even though most of the staff continued to work at their posts. In fact, the population held some of the staff members responsible for the death of the physician from Watsa General Hospital and two of them had been imprisoned, accused of poisoning the doctor. After the arrival of the international team, who explained the cause of the epidemic to the population and the local authorities and who intervened to free the arrested health staff, the activities in the hospitals slowly resumed. The health centres in Durba and Watsa never stopped functioning.

Apart from a few isolated MHF cases[4,5] reported from the African continent in the past 30 years, the only documented MHF epidemic occurred among laboratory workers in Europe and totalled 32 patients. These patients were treated under strict isolation procedures, receiving supportive care with antibiotics, perfusions, and transfusions with blood/platelets. They were closely followed with appropriate laboratory investigations. The case fatality rate in Europe was 22%[11] compared with a case fatality rate in Durba/Watsa of 56% among confirmed MHF cases. This difference in case fatality rate can be explained by the lack of adequate healthcare that was offered to patients in Durba. An additional factor explaining this difference is that the majority of the MHF cases in Durba were diagnosed retrospectively and that cases with milder disease were therefore not reported. Although barrier-nursing techniques were not used before the arrival of the international team, the secondary transmission rate was low. This is in contrast with the high secondary transmission rates observed during EHF outbreaks. The reason for this difference is not clear. One explanation is that in Durba there is no large hospital facility and therefore no risk for a large nosocomial outbreak. It could also be that MHF is less infectious than EHF. During previous EHF outbreaks a lot of EHF transmission occurred during burial practices. In Durba, a family member became infected during burial rituals only occasionally. Although burial practices in Durba and Kikwit seem to be quite similar, anthropological studies in this field are certainly needed.

During the Kikwit outbreak, it was relatively easy to recognise EHF cases clinically because, in most cases, a history of contact with another EHF case could be established and haemorrhagic manifestations were highly predictive for EHF.[6,12,13] In Durba, the situation was different. For the majority of patients, the mode of infection with the Marburg virus was unclear. Often there was no history of contact with another MHF case. Infections occurred primarily in mine workers, but because a large percentage of men living in Durba are mine workers, it was unclear whether being a mine worker was a risk factor which should have been included in the case definition.

It quickly became clear that the use of the simple case definition of MHF, a version adapted from the case definition of EHF, was not specific enough to identify suspected cases. Initially, patients with haemoptysis were accepted, as suspected MHF cases but it subsequently appeared that these patients were suffering from pathologies of the respiratory tract, very probably tuberculosis. Some patients referred by the surveillance teams, which met the case definition proposed by the international committee in fact had other diseases. They often were chronically ill but presented with sudden haemorrhagic manifestations: e.g. one patient was icteric and presented with haematemesis, probably related to oesophageal varices due to portal hypertension. Another patient presented with haemoptysis, chronic diarrhoea, oral candidiasis and a herpes zoster infection. This patient probably had AIDS associated with pulmonary tuberculosis. The diagnosis of mild cases was also difficult since the initial symptoms are often non-specific and compatible with other febrile illnesses.

One of the nurses working during the night shift in the Durba isolation unit sustained a needle-stick injury from an infusion that had been placed in the vein of patient who later died of MHF. An infusion had been placed in this patient because he was severely ill and was vomiting blood. During the night he became confused and very agitated. He pulled out the infusion while it was still running. Two nurses tried to control the patient but one of the nurses stuck her colleague with the infusion needle. The nurse never became ill and he never developed antibodies to Marburg virus infection. Lack of adequate training of the night shift nursing staff, and insufficient lighting in the patient rooms were thought to have contributed to the circumstances surrounding this accident. The reason why the nurse never became infected is probably because the blood inside the needle was washed out because the infusion was still running when it was removed by the patient.

It was very difficult to ensure that family member care-givers wore protective equipment all the time and to limit the number of visitors per patient. Fortunately, no secondary infections occurred

either among the health personnel or family members of patients.

During the EHF outbreak in Kikwit, one of the major interventions to control the outbreak was the burying of all persons who died during the epidemic by trained Red Cross volunteers, wearing protective equipment. During the health education campaign in Kikwit, a great deal of attention was given to cautioning the population not to touch a dead body without using gloves. In Durba, no attempt was made to systematically bury all deceased, also those not suspected of haemorrhagic fever, by a specialised team as was done during the Kikwit EHF outbreak. The bodies of patients who died at the reference health centre in Durba were disinfected with a 2% solution of calcium hypochlorite by the health centre staff and placed in a body bag, which was then handed over to the family for burial. Family members were instructed not to open the body bag and to touch the bag only if wearing gloves (supplied by the health centre). The homes of the deceased were also disinfected with calcium hypochlorite. Although, no secondary cases of MHF occurred in these families, it is important to supervise burials of suspect cases, because it is difficult to rely on compliance of mourning relatives.

From June 1999 to December 2000, 30 laboratory confirmed new cases of MHF plus 45 suspected MHF cases were reported from the Durba/Watsa area. MHF seems to be endemic in this region and as long as the reservoir of the infection remains unknown, MHF will remain a threat for the population in general and healthcare workers in particular. It is important to continue epidemiological surveillance and to provide regular supervision of healthcare workers. Refresher courses on nursing barrier techniques, waste disposal and sterilisation of needles should be given and protective equipment should remain available in the area.

Health facilities in the region should be reinforced. This region needs at least one district laboratory with qualified personnel to perform 'essential microbiological tests' such as Ziehl–Neelsen staining of sputum smears, thick smears, parasitological stool examination, blood and stool cultures. The armed conflict in the region should not be a reason to abandon it and stop providing essential drugs, including anti-tuberculosis drugs and vaccines. Otherwise, new epidemics, not only of Marburg infection, are to be expected.

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