ECDC TECHNICAL REPORT

Assessing and planning medical evacuation flights to Europe for patients with Ebola virus disease and people exposed to Ebola virus

21 October 2014

Background

The outbreak of Ebola virus disease (EVD) in West Africa is raising a number of questions related to the evacuation of people who have been exposed to, or infected with, Ebola virus.

Within the EU, there are currently no commonly agreed-upon criteria for deciding when medical evacuation by air is recommended, and there is no guidance on how such evacuations should be carried out. The technical capacity for medically evacuating EVD patients and people exposed to Ebola virus by air varies among Member States. All in all, the overall experience in this area, both in the civil and military sector, remains limited in the EU Member States.

Aim

The aim of this document is to guide decision-making when there is a perceived need for medical evacuation by air of an Ebola-infected or Ebola-exposed person from an Ebola-affected country to an EU Member State. The decision to evacuate must be based on:

- the likelihood of the person being infected with Ebola virus;
- the potential benefits of evacuation for the concerned person/patient;
- the risks associated with medical evacuation by air for the person/patient; and
- the risk of transmission to the crew and accompanying medical staff.

This document refers to the *Ebola virus disease case definition for reporting in [the] EU*, which is available on the ECDC website [2].

Erratum

On 12 March 2015 the following correction was made on Page 3: The words 'although this does not indicate a commercial flight' were deleted from the end of the first paragraph under the heading 'Exposed persons'.

Suggested citation: European Centre for Disease Prevention and Control. Assessing and planning medical evacuation flights to Europe for patients with Ebola virus disease and people exposed to Ebola virus, 21 October 2014. Stockholm: ECDC; 2014.

Likelihood of being infected with the Ebola virus

Exposed person

The term 'exposed person' refers to an asymptomatic person who has been in contact with a probable or confirmed case of EVD. An exposed person should be considered for medical evacuation by air on the basis of the risk associated with the exposure. An asymptomatic person with high-risk exposure should be considered for medical evacuation by air, while an asymptomatic person with low-risk exposure should not (lower probability of infection after low-risk exposure).

Probable case

A 'probable case' is a person who has been subjected to high-risk exposure and has symptoms consistent with EVD, as per the ECDC case definition. A probable case is therefore more likely to be infected with Ebola virus than an exposed person. Where possible, a probable case should be laboratory confirmed before being medically evacuated by air. If appropriate tests for Ebola are not available, evacuation should be considered for a probable case in accordance with the options listed for a confirmed case.

Confirmed case

A confirmed case should always be considered for medical evacuation by air.

Benefits for the patient

Exposed persons

A person subjected to high-risk exposure who is evacuated to the EU may benefit from post-exposure prophylactic treatment (currently experimental) that is not available in the countries affected by EVD (e.g. passive or active vaccination). If the exposed person develops EVD, supportive treatment to EU standards can be provided earlier than if the person had remained in the EVD-affected country.

Confirmed cases

The rationale for medical evacuation by air of confirmed cases is the assumption that better medical care can be offered to the person in the EU/EEA than that available in EVD-affected countries.

Risk for the patient

Exposed persons

For an exposed but asymptomatic person, the risk associated with medical evacuation by air is not considered higher than for comparable commercial air travel. Should the person develop symptoms during the flight, the probability that the condition would deteriorate to become life-threatening is very low. Medical evacuation by air does therefore not represent a significantly increased risk for the exposed person.

Confirmed cases

Medical evacuation by air represents a risk for an EVD patient who is not in a stable condition and for patients who are stable but require uninterrupted intensive supportive treatment during transportation. It is the responsibility of the medical team in the EVD-affected country – in close consultation with the experts in the receiving country – to assess the risks and benefits of medical evacuation by air for the individual patient.

The possible outcomes of the assessment are:

- The patient is unfit for medical evacuation by air because the risks of the evacuation outweigh the benefits.
- The patient is fit for medical evacuation by air but requires uninterrupted supportive treatment of intensive-care standard during the evacuation. In this case, the 'Open isolation' approach is recommended for the evacuation (Annex 1).

- The patient is fit for medical evacuation by air but requires limited supportive treatment during the evacuation. In this case, the 'Closed isolation' approach is recommended for the evacuation (Annex 1).

Risk to the crew and accompanying medical staff

Exposed persons

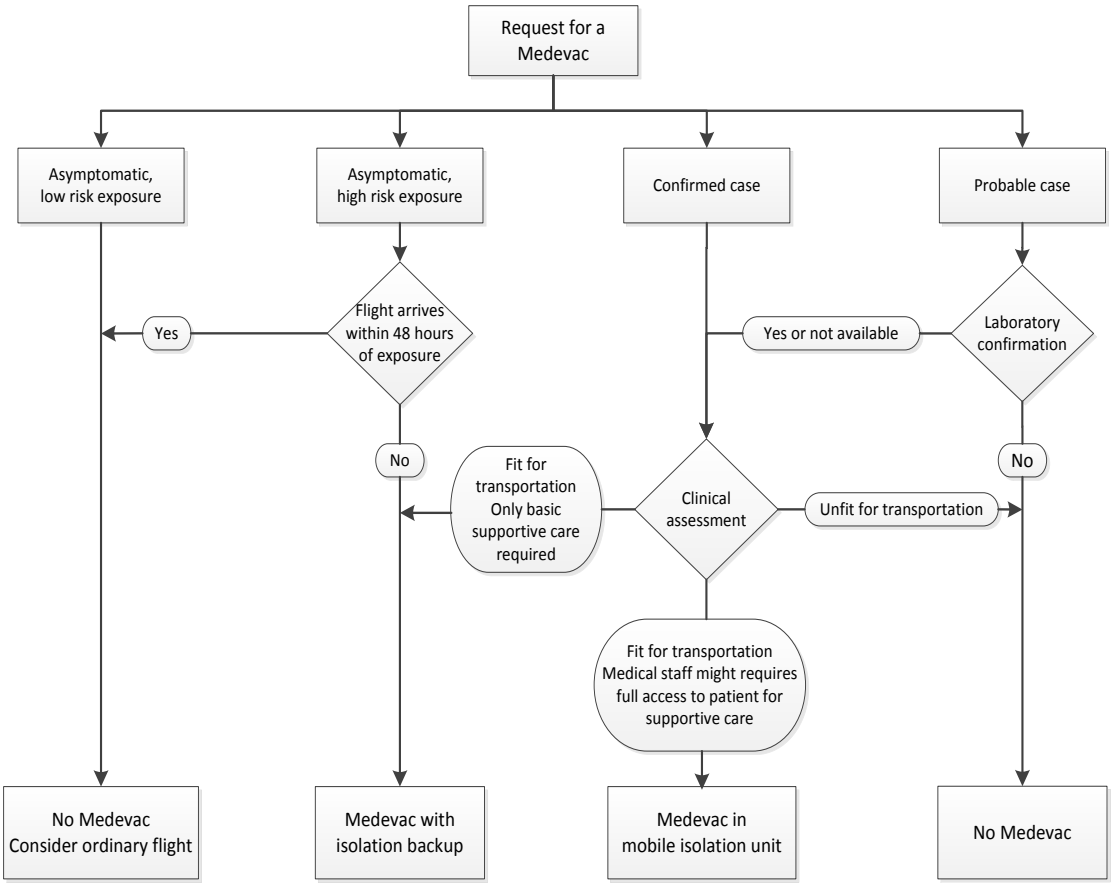
Exposed asymptomatic persons are not infectious and therefore do not represent an infection risk for crew, medical staff, or other passengers. Because the documented minimum incubation period for EVD is 48 hours, an exposed person who reaches the final destination within 48 hours after exposure to the virus does not pose a threat to other people during transportation and could, theoretically, travel in an ordinary aircraft without specific equipment.

A person whose high-risk exposure occurred more than 48 hours before the expected time of arrival at the final destination should be evacuated using a closed isolation approach because it cannot be excluded that symptoms may develop during the flight. If still asymptomatic at the time of departure, the person could be evacuated in a normal airplane seat, with the isolation stretcher ready in case he/she develops symptoms.

Confirmed cases

A confirmed case must be isolated during medical evacuation by air in order to prevent transmission to the crew and accompanying medical staff.

Figure 1. Algorithm for air Medevac planning



Annex 1. Mitigation of transmission risks during air Medevac

During an air Medevac operation, medical staff and flight crew have to be seen as personnel at risk of transmission. This risk can be minimised by isolating the patient during transportation. Basically there are two possible isolation approaches:

Closed isolation approach

The patient is placed inside a physical containment device, normally an isolation stretcher. Depending on the type, it is equipped with integrated gloves with long gauntlets, which allow some basic patient handling from outside. Most models will have negative pressure inside, with the exhaust air being purified by an HEPA filter system. Medical staff will be outside the isolator and will not need further protection. The flight crew is protected by remaining separated in the cockpit.

Advantages

Excellent level of protection for the personnel involved and for the community; easy to implement.

Drawbacks

Any enhanced monitoring or treatment interventions for patients with unstable or deteriorating conditions are obstructed; cost-intensive.

Open isolation approach

The patient and the medical staff are placed within a mobile isolation unit (e.g. tent, container, ambulance) mounted inside the aircraft. The medical staff inside are protected by personal protective equipment. Most types of isolators will have negative pressure inside, with the exhaust air being purified by an HEPA filter system. The unit is equipped with all the medical equipment necessary for enhanced monitoring and treatment interventions, such as mechanical ventilation and fluid management. Additional medical staff will be located in the cabin outside the unit to replace the staff working in personal protective equipment according to a defined schedule. The isolation unit is connected to the exterior cabin by an airlock anteroom. Staff leaving the unit need to be decontaminated before taking off their personal protective equipment and entering the cabin.

Advantages

Full access to the patient throughout the flight makes it possible to provide seamless medical care until arrival at the target hospital.

Drawbacks

Highly complex logistics, labour-intensive, very cost-intensive.

Decontamination of aircraft used in air Medevac operations

There are no fully satisfying solutions to the problem of decontaminating an entire aircraft cabin which has been used to transport an EVD patient spreading bodily fluids without any further containment. The reason that aircraft decontamination remains a difficult area lies in the inherent risk that the aircraft's structures, in particular avionic systems, could get damaged by the chemical agents contained in the disinfectant [3].

Therefore, isolating the patient (open or closed isolation approach) is essential to both limiting the risk of transmission during an air Medevac and reducing the risk of contamination of the aircraft [4-6].

The actual need for disinfecting the inside of an aircraft used for Medevac depends on the chosen isolation approach [5,7,8].

Chemical disinfection: closed isolation procedure

After an air Medevac with an isolation stretcher, there is normally no need to disinfect the cabin of the aircraft: the isolation device is immediately disinfected on the outside as soon the patient has been transferred to the hospital ICU. Disinfection must be carried out by staff in appropriate PPE. Once disinfected, the isolation stretcher can be handled without further risk of cross-contamination. This includes moving the isolator into the aircraft, the flight to the destination airport, transfer from the aircraft to the receiving ambulance at the destination, and transport to the treatment centre.

If, however, the isolation structure was damaged and bodily fluids were released outside the containment area, targeted surface disinfection is required. In such an emergency situation, accompanying medical personnel follows the same infection prevention and control measures as applied in a ground healthcare setting.

Chemical disinfection: open isolation approach

Due to its size, a mobile isolation unit is usually not removed from the aircraft while the patient is still inside. There are different methods for transferring the patient to and from the isolation unit in the aircraft:

- 'Walk in, walk out': Patient wears PPE (including an FFP [filtering facepiece] respirator *without* exhalation valve) while entering and exiting the aircraft. Once inside the isolation unit, the PPE is taken off for the flight. Before leaving the airplane at destination, the patient puts on a new set of PPE and wears it until arrival in the treatment centre. This approach requires the patient to be able to walk and to perform assisted donning of PPE in the airlock anteroom of the mobile isolation unit.
- 'Carry in, carry out': The stretcher used inside the mobile isolation unit is moved outside the aircraft to receive the patient. The patient is placed on the stretcher by the transport team. The patient is provided with an FFP respirator *without* exhalation valve. If the patient receives mechanical breathing support, the ventilator exhaust valve needs to be equipped with an HEPA filter.
  Next, the patient is covered with a clean, liquid-proof blanket such as used during surgical interventions. The receiving transport team (inflight medical staff) places the stretcher with the patient inside the mobile isolation unit in the aircraft. Meanwhile, the distance between the aircraft door and the entrance of the mobile isolation unit should be disinfected.
  Depending on the clinical condition of the patient, the medical team remains with the patient until they are replaced by a second team outside the mobile isolation unit. If the patient is in a stable condition, the team leaves the mobile isolation unit and decontaminates in the air-lock anteroom, assisting each other.
  After removal of the PPE, the team moves to the clean part of the cabin.
  Upon arrival, the patient is moved out following the reverse order: before leaving the mobile isolation unit, the patient is provided with a fresh FFP respirator and body cover. The receiving transport team (ambulance) is taking over the stretcher outside the mobile isolation unit and carries it to the ambulance. Again, the distance between the isolation unit and the aircraft door is disinfected. The inflight medical staff decontaminate and take off their PPE in the airlock anteroom, helping each other. Finally, the isolation unit is decontaminated on the inside and detached from the support frame. Afterwards, the liner is removed from the aircraft and incinerated.

Figure 1. Open isolation approach: mobile isolation unit 'Aeromedical Biological Containment System – ABCS' as used by Phoenix Air

Inside the patient room

Aeromedical Biological Containment System, usually mounted inside the aircraft

Source: Center for Infectious Disease Research and Policy (CIDRAP), University of Minnesota. Available: http://www.cidrap.umn.edu/news-perspective/2014/09/very-few-aircraft-equipped-evacuate-ebola-patients

Annex 2. Surface decontamination of aircraft cabin following air Medevac

Appropriate decontamination ensures that all signs of visible contamination are removed and infectious virus particles are inactivated on all surfaces inside the cabin so that any subsequent use does not pose a risk for transmitting EVD.

After every air Medevac operation, contamination with virus particles cannot be ruled out. Possible sources of contamination include containment leaks (closed isolation approach), leaks in the airlock area (open isolation approach), or safety breaches in the preventive procedures, e.g. violation of secure fluid management.

General considerations for decontaminating surfaces in airplanes

- The cabin of an aircraft should be manually cleaned with cleansing agents and liquid chemical disinfectants; liquid chemical disinfections are suitable to decontaminate surfaces contaminated with Ebola virus or Ebola virus particles.
- Surfaces should be resistant to the use of chemical disinfectants to avoid damage to the interior or avionic equipment. Flat, smooth surfaces can be disinfected relatively easily using traditional liquid chemical disinfectants.
- Liquid chemical disinfectants should be applied by manually wiping the respective surfaces. The effects take place immediately while the surface is drying.
- Some chemical disinfectants evaporate quickly and should be used with caution. If applied improperly, they could pose a fire hazard or damage avionic equipment [3,9].
- Visible contaminations and spillages should be immediately removed with a tissue moistened with disinfectant. Used tissues should be discarded in closed waste containers.

Chemical disinfectants suitable for cabin surfaces

- Currently, there are no registries listing chemical disinfectants which are approved for the safe decontamination of aircraft cabin surfaces [3,9].
- Chemical disinfectants used for cabin surfaces need to be approved by the aircraft manufacturer. In addition, all chemical disinfectants used to clean aircraft interiors should be approved by all relevant national regulatory bodies in the country where the aircraft is being decontaminated [3,9-11].
- Chemical disinfectants used against Ebola virus contaminations should be approved by regulatory bodies, with a label claim for a non-enveloped virus and proven virucidal activity because disinfectants against non-enveloped viruses are considered to have a higher virucidal activity. (Incidentally, non-enveloped viruses are more resistant to disinfectants; the Ebola virus belongs to the group of enveloped viruses) [11,12].
- Standards for chemical disinfectants are defined both at the national [11] and at the EU level; the US Food and Drug Administration and the US Environmental Protection Agency also released a set of testing and quality standards [12].

References and further reading

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