ADVISORY COMMITTEE ON DANGEROUS PATHOGENS

Ad-hoc subgroup to discuss airborne and aerosol transmission risks from patients with viral haemorrhagic fevers

Issue

There is evidence that viral haemorrhagic fevers (VHFs) are not naturally transmitted through the aerosol route. Epidemiological evidence suggests that person to person transmission occurs through direct contact with blood and body fluids or large particle inhalation and that viral aerosolisation is not seen. Yet they are considered to be highly infectious as respirable aerosols for certain animals under experimental laboratory conditions.

The categorisation of VHFs as Hazard Group 4 pathogens, and fear of potential transmission via the aerosol spread, has led to a requirement for the highest level of patient isolation and environmental controls to prevent airborne droplet and aerosol transmission to healthcare workers, other patients and the wider public. In revising and updating guidance for the assessment and care of patients who have, or are suspected of having, a VHF, a review of the current evidence of risks posed by such patients in the healthcare and wider setting is essential, and underpins and determines the options for patient care.

The key questions for Members to consider are:

- Do VHF patients pose a real risk of person to person spread by the aerosol transmission route or is the risk a theoretically potential one?

- To what extent, if any, should the evidence of aerosol transmission in animals under experimental conditions be used as evidence for potential person to person spread of infection of a VHF by aerosol transmission in the healthcare setting?

- What circumstances/care procedures, could increase the risk of human infection via aerosol transmission of a VHF, and what evidence is there to support such an increased risk assessment?

Summary

Isolation of VHF patients within a Trexlar in a high security infectious disease unit to prevent airborne and aerosol transmission presents a challenge for the delivery of modern clinical care by intensivists in the UK. On the other hand, VHF patients in Europe and in other countries are cared for without such stringent isolation. There is also evidence that less stringent precautions, strictly applied, are equally effective in controlling the spread of infection. This raises the question as to whether our precautions may be disproportionate to the risks of aerosol transmission of VHFs.

In the UK we had two cases of Lassa fever in 2009, both of whom were cared for without being isolated prior to their infection being recognised, and this led to healthcare workers being exposed to risk of infection. In one of these incidents several healthcare workers were identified as having had high risk exposure to infection, and many more would have been exposed to any airborne or aerosol infection risks. Despite those potential risks, none of those exposed became ill (Atkin 2009 and Kitching 2009).

Analysis of the risks of aerosol transmission from symptomatic patients on aircraft has demonstrated that there has been no transmission of infection due to exposures during flight or in community contacts of those cases. ECDC has concluded that there is negligible risk of aerosol transmission from symptomatic patients on aircraft (ECDC guidance 2010).

Evidence on risk of transmission

Lassa fever
Evidence from areas where Lassa fever is endemic shows that person to person transmission occurs through direct contact with blood and body fluids, such as blood, urine, faeces, semen, saliva or vomit and large particle inhalation. Without such direct contact, risk of transmission is considered negligible. The use of standard universal precautions stringently applied is usually sufficient to control spread of infection. Evidence from a recent case in the UK indicates that even where there have been high risk exposures amongst healthcare workers this has not resulted in any illness (Atkin 2009).

It is interesting to note that in the case of the patient from Liberia admitted to hospital in the USA in early 2010 (Amorosa 2010 and IHR Alert), despite the acknowledgement that transmission through the aerosol route is not seen, aerosol precautions were put in place against the theoretical potential for acquiring infection through that route, particularly from respiratory secretions and diarrhoea. This poses the question – to what extent does diarrhoea in patients create an aerosol transmission risk?

Ebola
Epidemiological evidence from outbreaks shows that there is no transmission without direct contact with a sick person or their body fluids or heavily contaminated fomites. Ebola virus has been detected in sweat and therefore any direct contact with a sick person poses a risk, although simple contact with a person appears to pose a low risk. Evidence from the 2000 Ugandan outbreak suggested that universal precautions did not prevent spread to a number of healthcare workers. Despite this, transmission via aerosol spread is considered negligible.

Marburg
Epidemiological evidence from outbreaks shows that direct contact with infectious body fluids is the main route of transmission. Marburg virus transmission through sweat cannot be ruled out. The extent of those risks appears to vary, with evidence from the outbreak in the Democratic Republic

of the Congo (1998) that health care workers working without stringent barrier nursing and with frequent high risk exposures were not infected.

Evidence on person to person transmission in flight

Imported travel-associated cases of Lassa fever are reported in the literature:

- Five cases imported from West Africa to the United States between 1969 and 2006;
- Twelve cases imported to the UK between 1971 and 2009;
- Nine cases imported into Europe between 2000 and 2010;
- Single imported cases to USA in 2010.

Recently published ECDC risk assessment guidelines for diseases transmitted on aircraft (ECDC 2010) reviewed the risks of person to person transmission to passengers on an aircraft from a symptomatic patient sitting close to them, and concludes the following:

- **For Lassa fever,** risk of aerosol transmission was considered to be negligible. This conclusion was based upon evidence in the literature that describes nine incidents of Lassa fever cases imported into Europe between 2000 and 2010 on aircraft. In seven of these incidents, the index cases were symptomatic whilst on board an aircraft and contact tracing was initiated. The evidence described indicates that the risk of transmission on an aircraft is low and remains low even if a high risk exposure occurs. This risk assessment is in line with epidemiological evidence from outbreaks. It should be noted that the degree of 'infectiousness' of the symptomatic patient on aircraft was not defined, and presence of any symptoms was taken as potentially infectious and presenting a risk that required contact tracing.

- **For Ebola infection**, evidence of risk of transmission of Ebola on flights is lacking, though one case of a symptomatic patient on a flight from Gabon to Johannesburg in 1996 is described, but the diagnosis of Ebola was reached some time after the flight and too late for contact tracing. Risk of aerosol transmission was considered to be negligible.

- **For Marburg fever** there is a published report of a Marburg fever patient travelling on a plane to the Netherlands in 2008. No transmission occurred in this incident. Aerosol transmission is considered negligible.

Ebola and Marburg aerosol transmission in animals

Filoviruses are known to be stable in aerosols. The evidence for aerosol transmission of Marburg and Ebola viruses in animals is well summarised in the 2004 paper by Leffel and Reed which concludes that low doses of

filoviruses can infect guinea pigs and non human primates via the aerosol route in laboratory conditions, producing different patterns of disease to that found in humans. Whereas the epidemiological data from natural outbreaks of Marburg and Ebola support the view that person to person transmission via the aerosol route does not occur. This could be because the infectious dose via the aerosol route needs to be much higher for humans than for macaques or guinea pigs, or that infectious patients do not expire infectious virus particles or that transmission via the aerosol route does not occur.

Discussion

Members are asked to consider the evidence and to assess the risks of airborne and aerosol transmission presented by a VHF patient in a healthcare setting.

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Selected references

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