ADVISORY COMMITTEE ON DANGEROUS PATHOGENS
Meeting of *ad hoc* subgroup to discuss airborne and aerosol transmission risks from patients with viral haemorrhagic fevers

The meeting was held on 15th March 2011 at the Department of Health, London

1. Introduction

1.1. The Chairman welcomed Members and thanked them for attending the meeting. The meeting had been arranged to bring together relevant experts to assess the risks of airborne and aerosol transmission presented by a viral haemorrhagic fever (VHF) patient in a healthcare setting.

2. Current position and risk assessment overview

2.1. HSE provided an update for Members on the current position with regard to the revision of the ACDP guidance "Management and control of viral haemorrhagic fevers". Significant progress has been made in the last year, and sections of the draft guidance were presented to ACDP in February 2011. It is anticipated that a final draft will be presented to ACDP at their next meeting in June 2011. In order to finalise the guidance, an assessment of the risk of transmission of VHFs from aerosols is required, as this will inform the guidance on risk control and patient management. In considering the risk of aerosol transmission, members were asked to consider the type of VHF infection, the progress of the infection and the viral load of patient secretions at each stage and the scenarios in which infected airborne droplets and aerosols might be created.

3. Risks of transmission overview and discussion

3.1. The Department of Health (DH) had provided a summary paper of the issues and the current evidence. In the UK, patients with a confirmed VHF are managed at the highest level of patient isolation and environmental controls. Isolation of a VHF patient within a Trexlar tent presents a challenge for the delivery of modern clinical care, particularly intensive care procedures, and such patient containment is not used in Europe or other countries for the management of VHF patients. This level of patient containment is predicated on risks of VHF transmission by the aerosol route to healthcare workers, other patients and the wider public. However there is evidence that less stringent precautions, strictly applied, are equally effective in controlling spread of infection in the healthcare setting, and this leads us to review the risk of transmission of VHF through the aerosol route.

3.2. Most papers on VHF transmission conclude that aerosol transmission of VHFs cannot be ruled out, but compelling scientific or clinical evidence to support the assertion that aerosol transmission of VHFs occurs has not been found. Since the ACDP guidance was published, there has been further epidemiological evidence from outbreaks of VHF about transmission risks in the healthcare setting. Members were asked to consider and discuss the

body of evidence and, in the light of their knowledge, answer the following questions:

- 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? **(A)**

- 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? **(B)**

- 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? **(C)**

4. Discussion

4.1. The group debated whether evidence of aerosol transmission in animals under experimental conditions was relevant to the healthcare setting. Experimental aerosol transmission of VHFs to animals has predominantly occurred during weaponisation studies, where the very high concentration of virus used and the large amount of energy required to form the aerosol are unlikely to occur in the healthcare setting.

4.2. In addition, the transmission route observed in many animal VHF transmission studies cannot be truly verified as aerosol transmission, due to the possibility of concurrent oral transmission via preening. There was some discussion of a case where infected animals appeared to transmit infection to other animals in nearby cages without contact, but transmission by other routes could not be ruled out, for example transmission could have been facilitated by humans during cleaning of cages, direct contact with the animals or through food receptacles.

4.3. Animal transmission studies have demonstrated that filoviruses, and others, are stable in an aerosol form, and there is therefore potential for aerosol transmission if aerosols are created, and this has wider implications for the cleaning of the environment in which a patient is managed.

4.4. Members agreed that, though animal transmission studies are important, it was unrealistic to extrapolate animal studies of aerosol transmission of VHFs to person-to-person transmission in the healthcare setting. **(A)**

4.5. It was accepted that aerosol risks will be artificially created during the care of a VHF patient by medical procedures such as intubation or ventilation. These artificially created aerosols will present a potential risk of aerosol transmission. It is likely that aerosols will be produced for example by the patient coughing or sneezing, though it is accepted that these actions mainly create droplets, and that droplets can become aerosols through desiccation. The condition of the patient and the symptoms exhibited, such as projectile vomiting and bleeding will also increase the risk of infection via splashing and droplets. However, these patient care procedures and patient symptoms are not unique to VHF patients, and guidelines exist on reducing the risks of infection from droplets and splashes, and when undertaking aerosol-generating procedures. For these, the use of enhanced personal protective equipment (PPE) is routine.

4.6. It was agreed that evidence from outbreaks strongly indicates that the main routes of transmission of VHF infection are via splashes and droplets, direct contact with body fluids, particularly through needlestick, and with environments contaminated by splashes, droplets and spills of body fluids. **(C)**

4.7. Members considered the clinical evidence on exposure and transmission from follow up studies of contacts of imported VHF cases. Large studies in the UK and elsewhere of contacts, particularly of Lassa and Marburg cases, have found no evidence of transmission of infection, despite a number of high risk contacts and medical procedures that would have likely led to aerosolised material. This evidence indicates that aerosols, if produced, are not routinely transmitting infection to contacts of cases.

4.8. Members agreed that there is no circumstantial or epidemiological evidence that there is an aerosol transmission risk from VHF patients, but there remains a theoretical risk. **(B)**

5. Aerosol transmission risks associated with pandemic influenza

5.1. A short presentation on recent literature research on the aerosol transmission risks of influenza was given.

5.2. The transmission of influenza is a dynamic process depending on environmental factors, such as humidity and temperature, and host factors, such as the duration of shedding and titre of virus being shed.

5.3. Evidence from outbreak studies suggests that most influenza transmission occurs at close range to an infected patient, but the evidence is inconclusive in determining the relative importance of different modes of transmission (aerosol, droplet or contact). Coughing and sneezing produce a respiratory spray consisting of splashes, droplets and aerosols, and some patients produce more aerosol particles than others. Droplets can also turn into aerosols under the right conditions.

5.4. Research has shown that the vast majority of pathogens excreted during coughing and sneezing are contained within droplets. However, it is considered that it is both difficult and relatively rare for a droplet to land on a mucous membrane in the oropharynx in such a way as to achieve infection. This would suggest that transmission in the short range may be occurring more by the contact or aerosol routes than the droplet route. In addition, droplets will not penetrate as deeply as aerosol particles, and ‘flu data suggest that the lower respiratory tract is more susceptible to infection than the upper respiratory tract, indicating that deeper deposition of influenza virus may be more potent in initiating infection.

Discussion (cont’d)

5.5. However, for VHFs the epidemiological data indicates that aerosols are not playing a major role in infecting people even if they are produced, though the possibility of them occurring remains. It was agreed that any aerosols produced must be assumed to contaminate the whole environment in which the patient is contained. This has implications for all those in the same contained environment as the patient, and for those cleaning that environment. The importance of safe disposal of contaminated PPE and clinical waste was also raised, as inadequate procedures and failure to

adhere to stringent protocols for handling these can increase the risk of transmission.

5.6. Discussion moved on to what the implications were for clinical practice and the care of a VHF patient. It was agreed that all those in the contained environment of the patient were at the same level of risk, and thus a hierarchy of PPE dependant on distance from the patient was dismissed. Given that the main risks of transmission occurred through droplet and splash, members were of the view that environmental controls plus enhanced PPE (including EN 149 FFP3 respirator and face visor) would offer sufficient protection against the risk of transmission.

5.7. The following was proposed as enhanced PPE for those caring for a confirmed VHF patient:
- EN 149 FFP3 respirator
- Face visor
- Waterproof clothing
- Boots
- Gloves

5.8. It was agreed that a powered respirator was neither necessary nor practical for the protection of healthcare workers caring for a VHF patient. It was confirmed that surgical masks will not prevent droplet transmission and are not suitable for use in the care of a VHF patient.

5.9. Members noted that in some Trusts, the availability of PPE and respirators for routine use remained problematic, and were of the view that such failures of provision should be actioned by all clinicians.

6. Next steps

6.1. DH and HSE informed Members that they will prepare a final draft of the guidance for consultation in May 2011, taking account of the conclusions reached in this meeting and setting out the options for patient care. It is hoped that this document will be presented to ACDP in June 2011 for approval.

31st March 2011
ACDP Secretariat