Airline Imported Disease: a New Community Hazard

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Current estimates are that in 1978 there will be 600,000,000 airline passengers and that of these almost a third, i.e. approaching 200,000,000, will be intercontinental, not just international, travellers. As the world population is around 350,000,000,000, these figures indicate that approximately 1 in 600 of the world’s population currently makes an air journey each year and that 1 in every 1,700 or 1,800 makes an intercontinental journey. Through London Airport alone there pass some 23,000,000 passengers a year, of whom it is estimated that at least 4 million arrive in London from the tropics or subtropics including the Mediterranean. These figures for air travel have great implications for many aspects of human activity and economy, prominent among which are the medical aspects. The figures for London Airport indicate that 1 in 13–18 of the people in this country has been exposed in the recent past to disease in tropical or sub-tropical regions. It is, therefore, becoming increasingly important for practitioners wherever they may be within Britain to consider tropical disease as a possibility when confronted by a patient. Some of these patients will be suffering from a disease that could be transmitted to others and so present a community hazard. Others will have diseases that, though not transmissible to others in Britain, are dangerous to themselves.

The range of patients travelling through tropical and sub-tropical regions has increased enormously. Such travellers are no longer restricted to overseas civil servants, military and commercial personnel and their families. They include very large numbers of holiday travellers, many of them going to places where they will be exposed to much infective disease. Much alimentary infection is contracted in the Mediterranean region and one does not have to look very hard to see some of the reasons underlying this.

Travellers to the true tropics, including much of Africa, are exposed to an even greater range of diseases for which most of them are not prepared. The information given in the brochures issued by most tour operators is inadequate or misleading. They very commonly omit to warn that prophylactic measures should be taken and can readily be taken against malaria, trypanosomiasis and other diseases prevalent in the areas to which they will take their passengers. A result is that serious disease and death is encountered with significant frequency among those who travel to these regions.
Malaria heads the list of those diseases air travel is bringing in increasing numbers to this country but which present little or no hazard to persons other than the patient himself. The number of cases of malaria reported in Britain annually has risen markedly in recent years. In 1974 there were 662, in 1975 there were 749, in 1976 there were 1,220 and in 1977 reports of just under 1,700 were received by the Malaria Reference Centre, London School of Hygiene and Tropical Medicine. Of these cases much the most dangerous are those with *P. falciparum* infection contracted in Africa. Here it must be noted that increasingly tour operators are taking parties to tropical Africa to visit the game parks and other attractions. Several patients with malaria die each year in Britain, almost always as a result of *P. falciparum* infections being confused with influenza until it is too late for treatment to be effective. Other diseases which occasionally cause fatalities through being overlooked are trypanosomiasis and amoebic liver abscess.

Among the diseases that are transmissible within Britain and of which increasing numbers are being seen among air travellers, are infectious hepatitis, tuberculosis and salmonella infections, including typhoid fever. Smallpox, although almost eradicated, lingers on in the Horn of Africa, and it and the newly described virus infections, must be guarded against.

**THE NEWLY DESCRIBED VIRUS INFECTIONS**

These infections have aroused great interest and concern within recent years. Many cause severe illness with a high mortality rate when acquired by man.

*Dengue Haemorrhagic Fever*

Among the first of this new group to be described was dengue haemorrhagic fever, which was initially reported from Bangkok in 1953. Since that time there have been many outbreaks in Thailand, Vietnam, Malaysia, Burma and eastern India. Mortality has been considerable; in Thailand there have been 10,367 reported cases with 694 deaths (Gordon Smith, 1974). It seems to be transmitted principally by *Aedes aegypti* and there have been no records of transmission from person to person. The infection has been encountered chiefly among young persons but occurs also in older age groups. Many authorities consider that it is most likely to occur in a person who has previously recovered from dengue and is specially sensitised to further infection by certain strains of dengue virus.

*Lassa Fever*

This infection was first encountered at Lassa, Nigeria, in 1969. Among the new virus infections it is the one of greatest importance as far as air travel is concerned because (1) the initial symptoms are non-specific; (2) the infection occurs in small outbreaks so that those coming in contact with a patient have often not been alerted and put on their guard about the possibility of Lassa fever; (3) patients
with the disease often travel to large centres in order to obtain medical help. The known journeys of patients with Lassa fever have included one from Lassa to Lagos and then to the USA, one from Sierra Leone to Britain, one from Nigeria to Germany, and one from northern Nigeria to Britain via Brussels. Two symptom-free virus carriers came to Britain and one then went to the USA. Airlines do not carry patients who are suspected to be suffering from Lassa fever. There continues however, to be a risk of infection from those who, when feeling unwell, decide to take a journey by public transport.

Causion. The causative virus was found to be morphologically identical with members of the Arena group of viruses. These are all round or pyriform structures having projections from their outer surface and ribosomal granules within their interior. It is from these granules that the group takes its name; they have a sandy appearance, indicated by the word arena which is derived from the Latin for sand. They measure 110/130 nm in diameter. The classification of the virus in this group was important in that all other members of the group have rodents as their animal reservoirs and it was, therefore, primarily among rodents that a reservoir for Lassa fever was sought. The search was successful and from *Mastomys natalensis* collected in Sierra Leone, Monath *et al.* (1974) made the first isolation of the virus from an animal in its natural surroundings. These rats form ideal reservoir hosts, for it has been shown in laboratory studies that they tolerate infections very well. Those infected grow slightly less rapidly than controls but otherwise appear to be in perfect health.

Epidemiology. It appears likely that *Mastomys natalensis* is the most important animal reservoir of Lassa fever although more recently virus has been isolated from *Rattus rattus* and *Mus minutoides* in Northern Nigeria (Wulf *et al.*, 1975). It is probable that initial human cases arise when *Mastomys natalensis* enter dwellings and contaminate food. It has also been suggested (Monath, 1975) that direct infection with excreta from *Mastomys natalensis* may be important. The animals apparently crawl over rafters in dwellings during the night and excrete urine and faeces while doing so. Such excreta, falling on sleeping persons or producing an aerosol, may be a source of infection. Once primary human infection has occurred, man-to-man transmission is likely to take place, particularly by contamination with vomit, urine and faeces. Droplet transmission has been reported but appears to be unusual.

In practice it has been found that most man-to-man transmission takes place in hospitals, especially during that period shortly after the patient has been admitted and before suspicion of Lassa fever has been aroused. At that time isolation or the use of protective clothing and procedures may not have been put into effect. Contamination of medical and nursing staff by vomit, or by blood while performing venepunctures or taking blood films, constitutes one of the greatest potential hazards. Of the 150 proved cases of Lassa fever so far reported, a third
have been contracted in hospitals. In the outbreak at Zorzor, Liberia, in 1972, 26 hospital staff were exposed to infection from a single patient and 7 developed the disease (Monath, 1975). Clearly, prior to diagnosis, there should be strict limitation of the number of persons exposed to pyrexial patients who are in, or have recently come from Africa.

Clinical Features. The clinical features that should arouse suspicion of Lassa fever are pyrexia, occurring particularly in a person who has worked in or visited a hospital in West Africa during the preceding 17 days, severe prostration, and a membranous exudate or erosions on the pharynx. The clinical features of Lassa fever are not specific to it and include variable degrees of aching in the limbs and back, hypotension and bradycardia, particularly during the early phase of the disease. Tachycardia, resulting from myocardial damage, later replaces the bradycardia. Skin rashes are not usual, but a limited area of erythema, sometimes with haemorrhagic features, may be present.

Among those who are in West Africa or who have been there within the preceding 17 days, diagnostic features of particular importance are therefore—

(i) pyrexia associated with prostration more severe than that which would normally be expected;
(ii) a membranous exudate on the throat or pharyngeal erosions;
(iii) marked pains in the limbs or back;
(iv) the presence of such features in a person who had worked in a hospital.

Management. Patients fulfilling these criteria should, on arrival at a hospital, be examined in a separate cubicle. The examining physician should wear protective clothing including gown, gloves, mask, and a visor to protect the conjunctivae from droplet-borne infection. A blood film should be taken and immediately transported under secure conditions to a safety cabinet where it should be stained for malarial parasites. If the film contains parasites and the patient's condition is consistent with a diagnosis of malaria only, the patient can be admitted and nursed in the ordinary way. If no parasites are found, further investigations should be carried out in consultation with a microbiologist. Many such patients will have a salmonella infection and to set up an appropriate blood culture is the most important laboratory investigation. Fortunately, this procedure is not difficult to perform under secure conditions.

In cases of this kind a clinical decision has always to be taken on the possibility of Lassa fever being a probable diagnosis and, when aware of the possibility, the exercise of care, knowledge and skill usually enables a clinical diagnosis to be made with a high degree of accuracy. Thus, among patients in this category who have recently been encountered at the Hospital for Tropical Diseases, correct clinical diagnoses have been made of typhoid fever and other salmonella infections, bacillary dysentery, amoebic abscess of the liver, chickenpox, meningococcal meningitis, influenza, and other upper respiratory infections.
Points of particular importance in assessing the probability of Lassa fever in a traveller from Africa include the period that has elapsed since possible exposure to the infection, and the places recently visited by the traveller. Although the longest known incubation period is 17 days, the great majority of infections declare themselves between 6 and 12 days after exposure. Those who have visited only large cities in tropical Africa are unlikely to have acquired the infection unless they have been in contact with pyrexial patients in hospitals or with their blood or secretions in laboratories.

Further advice regarding the management and disposal of patients suspected of having Lassa fever may be obtained at all times from the staff on duty at the Hospital for Tropical Diseases, London, the School of Tropical Medicine, Liverpool, and the Tropical Unit, Eastern General Hospital, Birmingham.

It is, of course, appreciated that physicians in Africa encounter large numbers of patients with pyrexia and that it is not practicable to take the precautions just outlined when examining them. If, however, it is kept in mind that Lassa fever may occasionally present, a technique can be developed whereby the risk of nosocomial infection can be reduced to a minimum. Thus particular care should be taken routinely to avoid droplet infection from such patients and, when taking blood films, to avoid contamination of fingers, bench, and so on, with blood.

Marburg/Ebola Infections
These infections are produced by morphologically identical viruses but immuno-logically they are distinct. The virus is long and worm-like in appearance and often has hooked or twisted extremities, contrasting markedly with the small round Lassa virus. Agreement has not yet been reached on a classification for these viruses, but they are clearly quite different from those of the Arena group.

Epidemiology. The natural reservoir of the infections is not yet known, though rodents are strongly suspected. The first human infections were described in 1967, when vervet monkeys imported from Africa to European laboratories caused infections almost simultaneously in laboratory staff in Marburg, Frankfurt and Yugoslavia. Vervet monkeys are, however, not regarded as reservoir animals. They, like man, are probably infected by the reservoir hosts. Once it has occurred in man the infection is transmitted in much the same way as is Lassa fever. There is also a similar tendency for the infection to be transmitted in hospitals.

Pathology. The pathological changes in the organs are similar to those in Lassa fever, there being widespread necrotic foci. In infected cells there may be intra-cytoplasmic inclusions in which masses of virus have been detected by electronmicroscopy.

Clinical Features. These viruses cause a severe febrile illness, often initially associated with bradycardia and later with tachycardia. Vomiting and diarrhoea are common, and a rash often develops between the fifth and seventh days. It is most marked on the buttocks, trunk and outer aspects of the arms. The gums may bleed and there may be bleeding from needle punctures. Occasionally there may
be haematemesis or melaena, but the rash itself is seldom haemorrhagic. There is marked thrombocytopenia during the latter part of the febrile course. Tonsillar inflammation may develop, but a membrane on the pharynx and pharyngeal erosions are less common than in Lassa fever.

**Diagnosis.** Marburg or Ebola infections might be suspected in persons who within the preceding 14 days have been in tropical Africa, more particularly the central and eastern parts of the continent, and who have a severe febrile illness for which malaria has been excluded as a cause. Antibodies become detectable by complement fixing or fluorescent techniques during the second or third week of the illness.

**Management.** The patient and all specimens taken from him should be handled with maximum security, as for Lassa fever. Similarly, supportive treatment is important and plasma from a patient who has recovered from the disease should, if possible, be administered. Treatment with interferon has been used and is possibly of benefit.

**CONCLUSION**

It must be remembered that malaria could cause more severe morbidity and more deaths in temperate regions than the newly described and much publicised viral infections. It must also be borne in mind that there are viral infections other than those here described which can cause severe illness; most of them, however, are transmitted by insects, and are unlikely to constitute a public health hazard in temperate regions. The possibility of salmonella infections being encountered should be constantly kept in mind and amoebic abscess of the liver should be remembered as a not uncommon cause of pyrexia of undetermined origin. It must also be remembered that tuberculosis is much more common among those who have lived in developing countries than it is in residents of developed countries.

Awareness of the possibility of tropically acquired viral and other infections is the keynote to combating the hazards of airline imported disease. Once these viral, protozoal and bacterial diseases of tropical origin are considered, it is almost always possible to reach a diagnosis fairly readily, to carry out effective management of the patient and to protect the community.

**References**

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