Isolation for high-risk patients

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Summary

Standard isolation accommodation provides adequate protection against the infectious diseases prevalent in the U.K. but higher standards are necessary for more dangerous infections imported from overseas. These may be provided reasonably cheaply by modifying existing wards but staff are still exposed to risk. By physically separating the patient from the attendants, the Trexler plastic isolator affords a greater degree of protection and is of particular value when dealing with a dangerous infection against which there is no form of immunization.

STANDARD isolation accommodation in single rooms without mechanical ventilation affords a high degree of protection against infectious diseases prevalent in the U.K. In an investigation of cross-infection in isolation wards of different design, McKendrick and Emond (1976) found the incidence of cross-infection with highly infectious air-borne diseases, such as chicken pox and measles, was very low although there was considerable variation related to ward structure, ward practice and availability of staff. Similarly, the incidence of cross-infection with *Staphylococcus aureus* in a cubicle ward was found to be minimal (Parker *et al.*, 1965).

Although these low rates of cross-infection may be tolerated with diseases carrying negligible risk of death they would be unacceptable with more virulent infections, such as smallpox with a mortality rate in excess of 40% or Lassa fever with a mortality rate between 50 and 60%.

The provision throughout the country of specially designed purpose-built units for isolation of the occasional patient with a dangerous exotic infectious disease would entail enormous expenditure not likely to be forthcoming in the present financial stringency. Fortunately much can be achieved by modifying the structure of existing isolation wards or by making use of plastic isolators to contain infection.

Over a five-year period one of the cubicle isolation wards in the Infectious Diseases Department of the Royal Free Hospital, London, was found to have six cases of cross-infection with chicken pox among 789

susceptible contacts, giving an incidence of 0.9 cases/1000 patient-days of exposure. There were no cases of cross-infection with measles among 471 susceptibles. The ward consists of four five-bedded wings each with a closed corridor. All rooms are ventilated directly to the outside in two directions, firstly from the main window and secondly above the service corridor. In addition, air circulates to the corridor when the door of a room is opened (Fig. 1). Since the basic design of this ward appeared to be sound and had been shown to provide a high degree of protection against transmission of air-borne virus infections and also against spread of *Staph. aureus* it was thought it would be possible to improve the facilities still further by modifying one wing to form a high-security unit.

The outer two rooms and the adjacent sanitary annexe were separated from the rest of the ward by doors across the corridor and a new entrance constructed to allow direct admission of patients without risk of contamination to others in the ward (Fig. 2). One of the rooms was divided into two, providing an air-lock (B) to the patient's room (C) and a separate pump room (D) for the air-extraction plant. The windows in the patient's room were completely sealed with double glazing and sole access is now through the air-lock. Mechanical extraction of air from the patient's room maintains a pressure gradient from atmospheric on the corridor through the air-lock to the lowest pressure in the patient's room. Air enters the room through gaps round the door but to avoid excessive draughts with such a large flow of air out of the room an additional air pipe connects to the outside atmosphere with a sensitive water-trap valve to prevent backflow. There are two extract points in the patient's room each fitted with a high quality filter which can readily be removed into a plastic bag and destroyed if necessary.

The velocity of flow at each extract point is 500 cu. ft/min, the filters were tested with sodium flame to BS 3928 and found to remove particles of mean size 0.6 μ m (0.02-2 μ m).

An internal telephone has been installed to enable medical and nursing staff to communicate with the

FIG. 1. General lay-out of ward showing wing before modification.

FIG. 2. Detailed plan of wing after modification to form high security area.

FIG. 3. Trexler plastic isolator.

central area of the ward without leaving the high-security area. This has proved of great value when taking case histories or examining potentially dangerous patients. All material from the unit is sealed in plastic bags and destroyed by incineration in the sluice room (1). A small extension has been added to the wing to provide space for a 'dirty' changing room (3), a shower room (4) and a 'clean' changing room (5) with an exit from the unit. High security accommodation of this type affords good protection for the community but staff are still in direct contact with the patient and exposed to risk although this can be diminished by wearing protective clothing, mask and goggles. Such conversions are comparatively economical and accommodation can be used for routine admissions until required.

When dealing with Lassa fever and other dangerous infections, against which immunization is not at present available to protect hospital staff, it is highly desirable to separate the patient by a physical barrier from the attendants in order to prevent airborne spread or contamination from blood, secretions and excreta. This can now be accomplished readily in the containment type of plastic isolator developed by Mr P. C. Trexler of The Royal Veterinary College, London (Fig. 3). In essence, this

consists of a large plastic tent with two compartments, one for the patient and one for supplies. When the patient has been placed in the isolator the two separate units are joined together to form an airtight tent which completely envelops the patient and all contaminated articles. Air pressure within the tent is maintained below atmospheric to reduce the risk of leakage in the event of a defect in the fabric. Extracted air is passed through a suitable filter to remove infectious particles. The patient is easily accessible to doctors and nurses wearing half-suits welded into the side of the isolator. Storage compartments within the patient's isolator and the supply isolator are stocked before the isolator is brought into use. Subsequently fresh supplies can be introduced through the entry port on the supply isolator without breaking the air-seal. All contaminated material is removed through the same port into plastic bags which are cut across between two seals and removed for incineration. Terminal disinfection is accomplished by spraying the interior of the tent with peracetic acid or strong hypochlorite in detergent solution. Should a dangerous infection be confirmed it would be advisable to dismantle the canopy and destroy it by incineration.

The tent has proved comfortable for patients and

has been acceptable to both nursing and medical staff who have expressed a preference for looking after dangerously infected patients in these isolators for the greater protection they provide. Although it is theoretically possible to nurse infectious patients in these plastic isolators installed in open wards it would be advisable to site them in rooms well separated from other patients in case of failure of isolation techniques or serious tears in the plastic walls of the tent. The necessary nursing skills are quickly acquired and damage causing tears to the tent has proved to be uncommon and of a trivial nature. A smaller isolator has been developed by Mr Trexler for transporting these patients over long distances if necessary. The entry ports of the two isolators are compatible so patients can be trans-

ferred from one to the other without a breach in safety precautions.

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