Hospital Topics

Isolating patients in hospital to control infection*

Part II—Who should be isolated, and where?

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Patients may need source isolation because they are infected and hazardous to others, or they may need protective isolation because their susceptibility to infection is increased.

The decision to isolate a patient is best taken as soon as it is recognised that the need may exist. For instance, in the emergency room or outpatient clinic it is often not possible to determine whether jaundice is viral or due to some other cause. If admission is indicated it is better to apply the appropriate isolation procedure for viral hepatitis pending the outcome of investigations than not to take isolation precautions meanwhile.

A list of diseases requiring the isolation of patients and the appropriate form of isolation is given in the table.

Source isolation and protective isolation

INFECTIVE PATIENTS

Patients do not need isolating merely because the disease from which they are suffering is caused by microbes. The need for isolation is determined by the ease with which the disease can be transmitted in hospital and, if it is transmissible, by its seriousness.

PATIENTS WITH INCREASED SUSCEPTIBILITY TO INFECTION

Patients whose susceptibility to infection is increased may require isolation for their own protection as an alternative to or as well as antibiotic treatment.¹⁻³ The decision to use isolation is influenced by the individual circumstances and by the available facilities, so that it is often a question of clinical judgment. The safety or lack of safety in normal wards is determined partly by ward cleanliness and the standard of housekeeping. Where the standards are low and bed density is high the need for isolation facilities is increased.

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A patient's risk of serious infection may be increased in the local sense. Thus patients with epithelial surfaces damaged by burns, eczema, or bullous erythemas may benefit by appropriate isolation techniques⁴⁻⁶; patients with chronic lung diseases and those in coma from respiratory depression may have increased susceptibility to pulmonary infection. There is always a risk of infection at the site of indwelling catheters, particularly in patients undergoing haemodialysis or peritoneal dialysis for renal failure and others requiring repeated intravascular infusions. During the period of immunosuppression after surgery under general anaesthesia^{7,8} it may be appropriate to isolate patients who are at special risk of infective complications, such as those with congenital or rheumatic heart disease.

A general impairment of the response to infections requires isolation only when the impairment is substantial. Many patients receive radiotherapy or immunosuppressive chemotherapy as outpatients without an unacceptable risk of infection. The hazards for such patients, particularly children, are often greater in hospital than in the home. It is not possible to relate risk directly to blood count indices; overwhelming infections may, of course, occur when the white-cell count is normal. In general, infections are not usually a serious hazard when the granulocyte count is over $1.5 \times 10^9/l$. When the granulocyte count is less than $1.00 \times 10^9/l$ the risk is high but is still influenced profoundly by associated factors such as the intactness of epithelial surfaces. A leucopenic patient who feels unwell is at much greater risk than one who does not. About 25% of adults with acute leukaemia died of infection during induction of chemotherapy.⁹

Evidence that protective isolation is effective is scarce. Controlled trials are difficult to devise for ethical reasons, and evaluation is complicated by the possibility of endogenous infection. The use of antibiotics tends to complicate evaluation still more. Nevertheless, patients in isolation probably have fewer infections than similar patients treated under conventional ward conditions^{10,11}; and isolation may also contribute to improved results of treatment in leukaemia¹² and after bone-marrow transplantations.^{13,14} Evaluating protective environments independently of the effect of specialised nursing is, however, particularly difficult, and part of the benefit of specialised units with facilities for protective isolation no doubt derives from factors other than control of infection.

INFECTED PATIENTS WITH INCREASED SUSCEPTIBILITY

Patients with infected burns; eczema and other skin lesions; acute and chronic pulmonary infections; meningitis; coma; influenza; and other debilitating diseases complicated by infections have an increased risk of additional infections. They may need isolation to prevent them infecting others and for their own protection. The difficulties of two-way isolation are best solved in an isolation unit, but individual isolation rooms

associated with general wards may sometimes provide an acceptable compromise.

Organisation of isolation accommodation

There are considerable differences in the degree and methods of isolation needed for different clinical circumstances. In practice, some form of classification is desirable; Sherris (personal communication) has suggested four categories: strict isolation; standard isolation; stool-urine-needle isolation; protective isolation. To these can now be added high-security isolation. They are discussed in more detail in Part V of this paper.

Isolation procedures make increased demands on nursing staff. Isolation accommodation in one or two purpose-built multibed units is likely to be more economic of nurses' time than in the equivalent number of single rooms attached to general wards. The question of multiple versus single-bed

units has, however, to be considered in relation to other nursing skills required for the isolated patients.

It is advantageous to have staff specially trained in isolation procedures. Successful isolation cannot be achieved unless the nursing staff are authorised to insist that all visitors to the unit, medical and non-medical, conform to the agreed procedures.

AMOUNT OF ISOLATION ACCOMMODATION

The requirements for isolation accommodation in hospitals are influenced by the patterns of clinical work and type of specialist units. In a district general hospital of 750 beds and serving a community of about 200 000 a 19-bed unit had a bed occupancy of around 60%¹⁵ and would probably be adequate except during periods of unusually high demand.

When isolation facilities are limited effective patient care may require transfer of patients to better equipped hospitals.

Indications for isolation (adapted from Control of Infection Group recommendations,³² which should be consulted for more details). Source isolation should be used when any of the indicated diseases are diagnosed or suspected and for any case of unexplained pyrexia

Disease or infecting agent	Type of isolation	Indications for ending isolation or precautions	Disease or infecting agent	Type of isolation	Indications for ending isolation or precautions
Actinomycosis	None (DP)	SD	Leptospirosis*	Stool-urine	DH
Agranulocytosis	Protective		Lymphoma	Protective	
Anthrax*:			Malaria*	None	
Pulmonary	Strict	CR	Marburg disease*	High-security	CR and NC
Cutaneous	Standard	NC	Measles*	Standard	7 days from start of rash
Ascariasis	None		Meningitis*:		
Aspergillosis	None		Meningococcal	Standard	24 hours' treatment
Bedsore:			Pneumococcal	None	
<i>Str pyogenes</i> or extensive sepsis	Standard	SD or NC	Haemophilus	None	
Other septic	None (DP)	SD or NC	<i>E coli</i>	None	
Bronchiolitis of infants	Standard	CR	Tuberculous	None	
Brucellosis	None		Viral	Standard	CR
Burns:			Meningoencephalitis (acute*)	Standard	CR
Extensive non-septic	Protective		Mononucleosis, infective	None	
<i>Str pyogenes</i> or extensive sepsis	Standard	SD or NC	Mycobacteria (atypical)	None (DP)	MN
Minor	None (DP)	SD or NC	Mycoplasma	None	
Candidiasis (moniliasis; thrush)	None		Nocardiosis	None	
Cat-scratch fever	None		Ophthalmia neonatorum*	Standard	24 hours' treatment
Chickenpox	Standard	7 days after start of eruption	Orf	None (DP)	SD
			Paratyphoid fever and carriers*	Stool-urine	NC or DH
Cholera*	Strict	NC	Plague*	Strict	NC
Common cold	Standard	CR	Pneumonia:		
Conjunctivitis:			Pneumococcal (lobar)	None	
Gonococcal	Standard	24 hours' treatment	Staphylococcal	Strict	CR
Other	None (DP)	SD	Broncho-, atypical, mycoplasma	None	
Cryptococcosis	None		Pneumocystis	None	
Cytotoxic therapy	Protective		Poliomyelitis, acute*	Stool-urine	7 days from onset
Diarrhoea of unknown cause (see dysentery and enteritis)	Stool-urine	NC or CR	Psittacosis	Standard	CR
Dermatitis:			Puerperal sepsis	Standard	NC or DH
Severe non-septic	Protective		Pyrexia, undiagnosed	Standard	
Severe septic	Strict	SD or NC	Q fever	None	
Dialysis, peritoneal	Protective		Rabies*	Standard	CR
Diphtheria*	Strict	NC	Relapsing fever*	Standard	Effective delousing
Dysentery*:			Respiratory syncytial virus	Standard	CR
Amoebic	Stool-urine	CR or DH	Rheumatic fever	None	
Shigella	Stool-urine	CR or DH	Ringworm	None (DP)	CR
Ebola fever	High-security	CR or NC	Rubella	Standard	7 days from onset of rash
Erysipelas	Standard	NC	Salmonella	Stool-urine	NC or DH
Encephalitis (acute*)	Standard	CR	Scabies	Standard	CR
Enteritis:			Schistosomiasis	None	
<i>E coli</i> (infants)	Strict	NC or DH	Scarlet fever*	Standard	24 hours' treatment
Staphylococcal	Strict	CR	Shigella	Stool-urine	NC or DH
Other	Stool-urine	NC or DH	Smallpox*	High-security	CR
Food poisoning*:			Staphylococcus:		
Salmonella	Stool-urine	NC or DH	Multi-resistant	Standard or strict (see disease)	
Staphylococcal	None		Other	See disease	
Clostridium	None		<i>Streptococcus pyogenes</i>	Standard	
Gas gangrene	None (DP)	SD or NC	Syphilis, primary or secondary	Standard	24 hours' treatment
German measles	Standard	7 days from start of rash	Tapeworm	None (DP for <i>Taenia solium</i>)	
Glandular fever	None		Tetanus*	None	
Gonorrhoea	Standard	24 hours' treatment	Threadworm	None	
Granuloma inguinale	None (DP)	SD	Tonsillitis, <i>Str pyogenes</i>	Standard	24 hours' treatment
Hand, foot, and mouth disease	None (DP)	SD	Toxocara	None	
Hepatitis*:			Toxoplasmosis	None	
Infectious	Stool-urine-needle	DH	Trichomonas	None	
Serum	Stool-urine-needle	DH	Tuberculosis*:		
Herpes simplex:			Urinary	Stool-urine	MN
Adults and children	None (DP)	SD	Other open	Standard	MN
Infants	Standard	CR	Closed	None	
Herpes zoster	Standard (DP)	SD	Typhoid fever and carriers*	Stool-urine	NC or DH
Histoplasmosis	None		Typhus fevers*	Standard	Effective delousing
Hookworm	None		Vaccinia, generalised	Strict	CR
Immune deficiency	Protective		Viral haemorrhagic fever*	High-security	CR
Immunosuppressive therapy	Protective		Whooping cough*	Standard	CR
Impetigo	Standard	SD or NC	Wounds:		
Influenza	Standard	CR	<i>Str pyogenes</i> or extensive sepsis	Standard	NC or SD
Lassa fever*	High-security	CR and NC	Minor	None (DP)	NC or SD
Leukaemia	Protective		Yellow fever*	None	
Leprosy*:					
Smear positive	Standard	MN			
Smear negative	None				

*Notifiable in United Kingdom.

DP = Precautions necessary when dealing with dressings and discharge in ward. CR = Clinical recovery. DH = Discharge from hospital. MN = When smears are microscopically negative. NC = When cultures are consistently negative. SD = When lesions stop discharging.

TYPE OF ISOLATION ACCOMMODATION

Open hospital ward

Effective isolation is difficult if not impossible to achieve in open hospital wards.^{16 17}

The current preference for patient rooms in general wards with four to six beds probably contributes little towards reducing cross-infection compared with the traditional larger ward. The nursing staff pass just as freely from patient to patient, and doors are usually open for much of the time.^{16 18} Major obstacles to providing more than a moderate degree of isolation in an open ward are the difficulty of segregating supplies and equipment and the difficulty of providing separate staff. If there is no alternative to the occasional use of an open ward for nursing infected or susceptible patients it is useful to make constructional or equipment modifications as outlined in Part III; nursing staff should be assigned and their responsibilities clearly defined; they should not be shared with the rest of the ward.

Single rooms

Probably the biggest single factor in effecting isolation is nursing the patient in a single room. But the isolation potentialities of single rooms are probably more a result of the possibilities they offer for controlling the patient's environment by special ventilation and using nurses who are not looking after other patients than a result of the spatial separation. Without these special procedures, single rooms attached to general wards seem to have little value for control of infection.¹⁹

Single rooms attached to ward—The design and construction of such rooms are considered in Part III. Isolation rooms make it possible to limit access to the patient. The nursing staff responsible for patients in source isolation should not look after highly susceptible patients. This may be expensive in terms of nursing requirements, and a nurse-to-patient ratio of not less than 3:1 is likely to be required to provide care round the clock. Where special nursing skills need to be combined with occasional requirements for isolation this arrangement may provide an acceptable compromise between a special unit and no isolation facilities at all.

Single rooms in isolation unit—When there is a regular requirement for isolating several patients, and this is probably the case in most hospitals, nurses skilled in isolation techniques can be used more economically by grouping the isolation rooms into one or more nursing units. Staff training and continuity of practice are facilitated in a way rarely possible with dispersed isolation rooms. Such units may be in separate buildings, but with modern ventilation and control of air movement this is not essential. A nurse-to-patient ratio of about 1.5-2.0:1 is likely to be required.

It is inadvisable to mix accommodation for infected patients (source isolation) with that for highly-susceptible patients (protective isolation); physically separate units should be provided for these purposes, and separate nursing and ancillary staff are essential.

Special units for protective isolation

In hospitals that provide specialised treatment, such as for burns or cancer, specialised isolation units provide the most economical means of combining nursing skills in protective isolation and other techniques. Again, much of the advantage stems from the establishment of a nucleus of trained nurses to assure continuity of care and techniques. A nurse-to-patient ratio of 1.5:1 is likely to be required here also, but will vary according to the type of patient.

Isolators

Plastic isolators are devices that may be used in open wards or, preferably, in rooms with one or only a few beds and provide a ready-made solution to the mechanics of effective isolation. They are relatively heavy in their requirement for skilled nursing staff, because of the inconvenience of performing nursing procedures through a plastic wall. Nurse-to-patient ratios of 3:1 may be adequate but have been higher in some units in the USA. Where several isolators are grouped together in an open ward a lower nurse-to-patient ratio may be possible.

Theoretically some types of plastic isolator could be used for either source or protective isolation, but they are generally designed and are more useful for protective isolation. Moreover, these tend to be less well tolerated than conventional isolation and laminar-airflow systems because the patient may feel a strong sense of artificiality and confinement, but they may be used to achieve high standards of bacteriological control.^{6 20 21} Isolators have the advantage that they can be dismantled and stored for emergency use; but it seems improbable that they will ever provide more than a small part of the isolation requirements.

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It is widely held that decongestants given in a linctus are effective. Is there any evidence from double-blind trials that this is true?

Although there have been no good controlled studies with objective measurements of the efficacy of decongestants given as linctuses, there are several controlled studies of their action as tablets. For example, Benson¹ has shown in a double-blind trial that 60 mg pseudoephedrine increases nasal air flow as compared with placebo. Empey *et al*² carried out a double-blind cross-over trial of pseudoephedrine and triprolidine, alone and in combination, for the treatment of allergic rhinitis. This again showed that pseudoephedrine was effective as a decongestant as judged by symptom score cards. In a more recent study Britton *et al*³ measured nasal airway resistance by a non-invasive method and showed that pseudoephedrine partly inhibited the increase in resistance produced by instillation of small doses of histamine. Therefore at least one decongestant (pseudoephedrine) has been shown to be effective alone or in mixtures under controlled conditions, though this has not been in linctus form.

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