Ultra-clean Ward for Cancer Chemotherapy

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A ward unit that has been specifically designed to provide conditions approaching bacteriological sterility was opened in the Charing Cross Hospital Group at Fulham Hospital earlier this year.

The need for such a ward resulted from the treatment with cytotoxic agents of women with chorioepithelioma. So long as the treatment of a rapidly fatal disease is only palliative—as is the case with chemotherapy in most forms of cancer—a loss of life as a result of the treatment may have to be accepted. When, however, treatment can cure—as it can in choriocarci-

to eight patients. Its shape was determined by the limits of the site, and its planning, design, and construction were completed in 10 months.

The central block of patients' rooms is approached on one side by a perimeter corridor which provides access for visitors as well as for the removal of articles used in the rooms. On the other side the rooms open on to the nursing area. This can be reached only by going through the appropriate changing rooms. Staff strip completely in the outer changing room, then wash, and put on the clean clothing which is provided in packs in the inner changing room. Patients also enter and leave through these changing rooms, but in an emergency the visitors' corridor can be used.

The patients' rooms have an area of about 120 square feet. They are fitted with enclosed, wall-mounted lavatories and built-in wash-basins with foot-operated taps. Furniture is limited to a bed of simple design, a bed-table, an easily cleaned armchair, and a wall-mounted bedside fitting. This fitting is hinged and incorporates the nurse-call system, light switch, and remote controls for radio and T.V. Television sets are fitted behind glass screens and are technically outside the rooms. The television sets, electrical fittings, and plumbing are accessible for servicing either from the roof space or from an under-floor tunnel which runs the length of the building. Large windows on each side of the rooms are fitted with venetian blinds between the double glazing. The doors to both corridors have transparent plastic panels through which visitors and nurses can speak easily with the patients. They also enable chest radiographs to be taken without

bringing the apparatus or radiographer into the room.

Two of the rooms are divided only by a folding screen, so that when the unit is not fully occupied a single larger room is available for special procedures.

Air Conditioning

The unit is pressurized and is air conditioned by a central unit. Air filtration is accomplished in two stages, the final stage being through a 0.5-micron filter. The temperature is maintained at about 75° F. (23.9° C.) to minimize the need for clothing and bed linen. The pressure in the patient's room is positive with respect to both corridors and that in the nursing area is positive with respect to the perimeter corridor, from which there is extraction only. Half the air input to the patients' rooms is exhausted mechanically. Two alternative systems have been adopted for exhausting air from the lavatories to permit experimental evaluation of their efficiency.

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Lay-out of unit. (1) Standard room. (2) Patient's room or sitting-room. (3) Special procedure room or two separate rooms. (4) Lavatory. (5) Recessed wash-bowl. Television above. (6) Service and visitors' corridor. (7) Nursing area. (8) Wash-up kitchen. (9) Food-preparation kitchen. (10) Men's changing rooms. (11) Women's changing rooms. (12) Sister's desk. (13) Delivery hatch into linen store. (14) Sterilizing room. (15) Bath-room. (16) Store room fitted with washing and drying machine. (17) Sluice fitted with bed-pan washer and sterilizer. Sterilizer accessible both from dirty and clean sides. (18) Entrance from main hospital corridor. (Architects: Gore, Gibberd, and Saunders; consulting engineers: Donald, Smith, Seymour, and Rooley; main contractors: Marshall Andrew and Co. Ltd.)

noma—it is clear that any risks inherent in the therapy must be minimized and if possible eliminated.

In this unit the chemotherapy of metastasized chorioepithelioma consists of repeated courses with the antimetabolites 6-mercaptopurine and methotrexate. The toxic effects are variable and in some patients are slight, but in most patients severe stomatitis and leucopenia persist for up to two weeks after each course. As soon as the toxic effects have diminished a further course is started, and this continues until hormone studies indicate that complete tumour destruction is likely to have occurred. During leucopenic episodes the patients are susceptible to infection and the ward described here was designed to prevent infection occurring in patients with temporarily increased susceptibility (Bagshawe, 1963).

Plan of Unit

The building, the general lay-out of which is shown in the Figure, was planned to provide isolation accommodation for up

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Services and Finishes

Goods are passed into the linen store through a hatch where outer wrappings are removed, and when appropriate the articles are washed in an antibacterial fluid. Cooked food is prepared in the hospital diet-kitchen and passed through into the inner kitchen. Here it is reheated in a combined microwave and infra-red oven before serving.

Articles such as bed-pans, clothing, linen, and eating utensils used in the patients' rooms are removed through two-way cupboards which open on to the perimeter corridor. From here the various items are redistributed to the laundry bags or to the appropriate washing and sterilizing area.

The wall finishes were chosen to provide variety in colour and texture. Also taken into account were ease of cleaning, ability to withstand frequent washing, and, where appropriate, sound deadening characteristics. The perimeter corridor, changing rooms, kitchens, store, sterilizing room, and bathroom are finished with ceramic tiles fixed in a hard resinous grouting. The walls in the nursing area and in some of the patients' rooms are covered with lino, while other rooms are walled with vinyl sheeting or have a sprayed-on polyvinyl finish.

Comment

In this unit an attempt has been made to provide conditions under which the liability to bacterial infection of highly susceptible patients can be limited. The sources of potential infection were considered to be the skin, hair, and mucous membranes both of patients and staff; fomites carried into patients' rooms; air- and dust-borne bacteria; aerosol effects during defaecation and lavatory flushing; and food.

Within the unit it was expected that the highest air-borne counts of bacteria would be in the nursing area, where staff activity is greatest. The pressurization arrangements are therefore designed to prevent air entering patients' rooms from this area. It has been argued that there is a case for an additional barrier in the form of an ante-room between the nursing area and the patient's room. Ante-rooms are of course necessary where single rooms open off relatively dirty nursing areas (Shackman, 1963), but in a unit of the present type ante-rooms would inevitably increase the patient's sense of isolation and would probably complicate the nursing.

Other outstanding problems that require further study are the design of suitable clothing and especially of sterilizable

footwear, the use of showers, ultra-violet irradiation, and recirculating filters.

An alternative to the permanent type of unit described here may be the disposable "isolator" recently developed in the U.S.A. (Levenson *et al.*, 1964). These consist of a room-sized flexible plastic bag fitted to air-conditioning machinery. They have special ports for admitting and removing the patient's requisites. Clearly these plastic rooms will present their own bacteriological and nursing problems, so that a comparative study of the virtues and costs of permanent and disposable units is needed as a basis for future planning.

While it is theoretically possible to provide absolutely sterile accommodation for patients, this ideal is compromised once it is entered by a patient or by staff. Compromise is also imposed by psychological considerations, especially in the case of long-stay patients. Moreover, the physical accommodation can provide only the facilities and background within which sterile techniques are practised. The nursing staff therefore occupy a key position. Their training, morale, and discipline need the most careful consideration, for these ultimately determine the efficiency of the unit. The problem of where to compromise will have to be determined by each individual unit according to the type of treatment being given. It is to be hoped that the bacteriological studies now in progress will enable future designs for units of this kind to be based on experience and experiment as well as on untested theory.

Just how large a role this type of unit will play in the future ultimately depends on development in many fields of research. At present such units are needed principally so that the application of cytotoxic drugs and irradiation both for cancer therapy and for tissue transplantation can be fully exploited on an experimental scale. In addition, there is need for similar accommodation for patients who have severe leucopenia resulting from drug idiosyncrasies. It may also be advisable to take into account and cater for victims of accidental over-exposure to ionizing radiations now that these are being employed on an ever-increasing scale. In the surgical field those concerned with the treatment of extensive burns are already planning the construction of ultra-clean accommodation. It seems likely that this type of unit will become a permanent feature of the hospital scene.

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Doctors' Defence Societies

The annual reports of the medical defence societies again include some alarming reminders of how a single error by a doctor can have unfortunate consequences for himself as well as for his patient. Often enough, however, the doctor is blameless and is put to great trouble to defend himself against baseless accusations.

Indefensible Claims

Among claims held to be indefensible is one described by the Medical Defence Union in which a patient died from peritonitis due to aplastic anaemia following the administration of chloramphenicol. The patient was a man of 55 who had in all about 45 g. of chloramphenicol for the treatment of cystitis. An

action brought on behalf of the patient's widow and children was settled by payment of £7,564. Settlement of £40 was reached in a claim brought by a man who had an allergic reaction to streptomycin after being prescribed this drug in a mixture by a general practitioner whom the patient had warned about his special sensitivity.

Inadvertently applying trichloroacetic acid to the eye instead of cocaine led to another claim regarded as indefensible and settled for £100. The practitioner's prompt action on immediately realizing his mistake averted permanent injury, but the eye was painful and watery for about three weeks. A fourth indefensible claim arose because a doctor injected Imferon into the left arm of his patient, a pregnant woman, instead of into the buttock. Two permanent stains developed on

the upper arm, and the woman's claim was settled for £115 and costs.

Payment into Court

The procedure of "payment into court" is adopted in a number of cases against doctors, and the M.D.U. describes its purpose. The successful party to an action is usually awarded legal costs. They have to be paid by the unsuccessful party, and may be much higher than the damages. Before an action comes to court a plaintiff may sometimes refuse a reasonable offer of settlement if he thinks that the defendant's fear of liability for heavy costs will make him settle for more.

"If a defendant considers that judgment is likely to be given against him he may pay into