Special Article**HOSPITAL STERILE SUPPLIES: EDINBURGH PRE-SET TRAY SYSTEM**

BY

J. H. BOWIE, M.B., Ch.B., F.R.C.P.Ed.
Senior Lecturer in Bacteriology

F. JOHN GILLINGHAM, M.B.E., M.B., B.S.
F.R.C.S., F.R.C.S.Ed.
Professor of Surgical Neurology

IAN D. CAMPBELL, M.B., Ch.B.
Deputy Senior Administrative Medical Officer,
South-Eastern Regional Hospital Board, Scotland

ANNA R. GORDON, R.G.N.
Theatre Superintendent, Royal Infirmary of Edinburgh

In well-run institutions, intestinal hospital infection and contact hospital infection are things of the past. However, the present high rates of pyogenic aerial infection cause great concern and must influence the design, method of ventilation, and system of supply for special centres such as operating rooms and intensive-care units.

Certain principles of hygiene have proved safe guides for those concerned with the design not only of theatre suites but of the several new forms of special isolation and treatment centres now recognized as essential for the safeguard of patients—for example, artificial kidney, kidney transplant, and assisted respiration units, and resuscitation and post-operative recovery suites. Experience has shown that any compromise which evades these principles leads to disappointing results for all concerned. Modern teams of surgeons, physicians, and nurses, backed by basic scientists and first-class hospital laboratory services, can often tide the dangerously ill patient over the critical phase immediately threatening life. Thereafter the main risk to these highly susceptible patients is serious hospital infection. In designing surgical suites and certain special treatment centres, therefore, no compromise circumventing the environmental requirements of asepsis should be accepted by either doctors or nurses.

Some of the Principles Concerned

Instruments, apparatus, materials, etc., can be rendered safe for surgical use by being either sterilized or sanitized—whichever is appropriate for a particular item. Sterilization renders the object totally free from all living micro-organisms, while sanitization means that the object has been exposed to suitable processes which ensure freedom from dirt and from any living micro-organism in vegetative form—that is, not necessarily spores. In either case, where appropriate, recontamination has been prevented by enclosure of the object in a suitable container or wrapping material until about to be used. For example, anaesthetic equipment such as masks, corrugated tubing, and rebreathing bags should be sanitized before re-use. This may be effected by cleaning, wrapping, and exposure to steam at 100° C. for an instant—or at some lower temperature for the appropriate time; the process can best be carried out in a high pre-vacuum sterilizer provided with a pyrometer, sensing temperature direct from the most dense package of fabrics inside the chamber (Bowie, 1960). Accommodation may be sanitized by appropriate means.

With all articles to be used in the surgical procedure thus rendered safe by sterilization or sanitization, and with properly designed, ventilated, and organized clean areas, people become the only source of pathogenic organisms. Exogenous contamination by pathogens can be eliminated in clean areas provided (1) that the movement of people, air, and things is effectively planned and processes of work are properly supervised; (2) that patients and staff are

properly decontaminated and clothed; and (3) that the staff conduct themselves according to acknowledged principles of asepsis.

Clean and Dirty Areas

The design, layout, and organization of the clean area in theatre suites, isolation units, and certain special treatment centres should facilitate movement of people, air, and supplies from "clean" towards "dirty" and should inhibit movement in the opposite direction. For instance, each operating-room or single-patient isolation-room should have recognizable clean and dirty ends. All sterile and sanitized equipment should be delivered at the clean end from a service centre—immediately adjacent if appropriate. When the patient has left the room, both the used and unused supplies delivered for the patient should be removed in safe cover via the soiled return end to a decontamination centre outside the suite.

The movement of air should be from clean to dirty, and, particularly in operating-rooms, it should be effected without detrimental turbulence. Outside the clean area air should move from clean to dirty, but people and things in the opposite direction; thus "things" should move through decontamination (against the direction of air movement) towards pass-through sterilizers and sanitizers delivering direct, if possible, to the theatre service centre on the clean side of the operating-rooms or isolation-rooms. If direct delivery from sterilizers and sanitizers is not convenient, the dust-covers of processed packages should be removed as they are delivered to the service centre; bottles, etc., should be damp-dusted, using a suitably formulated synthetic phenolic solution. Similarly, in changing-rooms and in pre-operation areas, the staff and patients respectively should move progressively from their undressing areas through decontamination (sprays and towelling) to the clean dressing areas (Jacobs, 1961). On going off duty the clean-area staff should be able to move direct through an air-lock to the undressing area where they had previously left their outdoor clothes, thus circumventing the clean dressing and spray areas.

Scurf Dispersal of Organisms

When a swab is rubbed over intact but unwashed skin some of the scurf on the skin is removed together with adherent bacteria. In the same way, particles of scurf bearing bacteria are continually dislodged by friction between unwashed skin and overlying theatre whites. Duguid and Wallace (1948) showed that personal clothing was a major source of pyogenic airborne infection. Ultra-clean rooms are used in industry for the final cleaning and assembly of almost absolutely clean instruments such as gyroscopes. Where the clean-room staff do not bathe but change completely into nylon suits and caps and must walk through a blast of air in a wind-tunnel in order to reach the clean room, scurf constitutes more

than 90% of the solid matter found in samples of air taken from the ultra-clean room (G. Rigby, personal communication, 1961). Davies and Noble (1962), having confirmed the presence of airborne desquamated scales of skin in large numbers in occupied areas of hospitals, showed that the scales were contaminated by living bacteria.

Hare and Ridley (1958) found that some skin carriers of *Staphylococcus aureus* are active aerial dispersers of these organisms. Skin carriage can be temporary. The disperser state can be temporarily suppressed if the individual has a shower, changes completely, and conducts himself with self-imposed discipline—as everyone should within the clean area. Suppression may be reinforced where necessary by the application of suitable agents to the skin. When unsuppressed, the disperser state is particularly dangerous if it exists among staff working in artificially ventilated clean areas, and this danger is greatly increased in the absence of rationally designed undressing, decontamination, and clean dressing accommodation (Bowie and Tonkin, to be published). On these grounds, if an individual is said to be decontaminated this should indicate that his excess scurf has been removed by washing and towelling in properly designed accommodation before dressing to enter the clean area. It should go without saying that he must be free of any infection of the body surface or tracts. Provided that all the staff have been properly decontaminated, occupancy (including tea-making, talking, reading, writing, etc.) of properly constructed, furnished, and cleansed rest-rooms need not prove to be a contaminating experience—and, on grounds of asepsis, adequate rest-room accommodation is essential for all categories of staff within the clean area. W.C.s should not be provided within the clean area.

The limits of the clean area should be architecturally defined—for example, between the clean dressing area and the towelling area. Only the clean area should be maintained by the decontaminated domestic service staff, who should be dressed in theatre clothes after bathing—like everyone else within the clean areas. The routes for the supply of clean theatre whites, towels, etc., and for the return of soiled laundry boxes should be clearly defined during planning.

Plans for Clean Supply and Soiled Return

In June, 1961, Dr. S. G. M. Francis, medical superintendent of the Royal Infirmary, Edinburgh, convened a working party to draw up plans for the reconstruction of the surgical out-patient department. It was proposed that the main working area should consist of a row of minor operating-rooms and single-patient examination/treatment rooms, and that the row should be served by a system of clean supply from a service centre and soiled return to a decontamination centre; the decontamination centre would be linked to the service centre through double-ended sterilizers and sanitizers. All sterile and all sanitized supplies were to be provided for each individual patient in turn from the clean side of each room via pass-through cupboards from the service centre immediately adjacent to and running along the back of the row.

The concept of a simple type of pre-set, pre-sterilized tray system was proposed. Trays were preferred to composite packs as being more easily handled in transit, more easily uncovered, and, once uncovered, more easily used. Moreover, some composite packs cannot be dried in high pre-vacuum sterilizers, whereas metal trays can be made of suitable metal (aluminium) of adequate thickness to

provide sufficient residual heat to effect evaporation of excess condensate during the drying period—provided that hollow-ware is packed on its side or upside down where indicated. Gallipot and basin fluids were to be poured out in the pass-through cupboards by service centre personnel dressed in theatre whites after bathing. Gowns, gloves, supplementary sterile dressings, and infrequently used sterile equipment were to be supplied from the service centre in packaged form together with packaged steam-sanitized anaesthetic masks, etc.

The patient would enter and leave by the soiled-return end of the room. Between operations or treatments all used and unused equipment would be passed in safe cover via soiled return to a decontamination and clean tray-setting area outside the department. The pre-set trays would then be returned to the service centre via pass-through sterilizers. A special effort was to be made in designing and equipping the instrument-decontamination and tray-assembly line in order to ensure rapid turnover of the instrument sets, thus reducing to a minimum the number of sets required.

The rooms and service centre would be artificially ventilated and designed for easy cleaning between treatments of patients. Distinction between "septic" and "clean" elective operating-, treatment-, or dressing-rooms is inappropriate, since they should be occupied by single patients, should be designed and ventilated in such a way as to prevent contamination from other rooms, and should be decontaminated after occupation by each patient. Overt infection is less dangerous in the spread of hospital infection than, for instance, an unbathed skin carrier of *Staph. aureus* or an individual with a staphylococcal infection hidden by clothing (Howie and Timbury, 1956).

In the major section of an accident/emergency complex about 40% of the patients have to undergo operation soon after arrival and a few almost immediately; they would be admitted to the resuscitation area in the first instance before the necessary open or closed surgical procedures could be undertaken (W. McQuillan, personal communication, 1962). Decontamination of the patient may well be possible, but occasionally it may not. Further, the staff looking after them—particularly the surgeons, anaesthetists, and radiographers—have to be free to move as necessary from clean to dirty and back again—for example, from the operating-room to the resuscitation-room, back to the operating-room, into the plaster- or recovery-room, and back again to the operating-room. The immediate need to save life is more important than the exact practice of asepsis—which, in any case, becomes impracticable in the special circumstances. Here it would seem that a comprehensive and completely separate theatre suite and staff, including ancillary staff, might be advocated, but, if so, the label "septic" applied to such a suite would be incorrect.

Air pressures would be adjusted to preserve a higher pressure in the pass-through cupboards than in the service centre and the rooms; these in turn would have pressures greater than the remaining areas of the department. A sufficient flow rate and volume of air would be delivered to the operation-room and treatment-room in order to clear them rapidly between occupancy by patients.

Surgical Suites for the New Royal Infirmary

In September, 1961, a working party under the chairmanship of Mr. T. McW. Millar was set up by the South-Eastern Regional Hospital Board, Scotland, to advise on the planning of the operating-suites for the new Royal Infirmary of Edinburgh.

The main considerations influencing the working party were (1) the need to promote environmental asepsis through

effective design of the accommodation, (2) the desirability of reducing the time taken to set up the theatre in serious emergency and the time between operations in elective surgery, and (3) the necessity for economy in the use of skilled theatre staff. The development of the pre-set tray system seemed to satisfy these requirements. The use of trays was further supported by the difficulty experienced in drying some composite packs in high pre-vacuum sterilizers. The trays had to be suitable for all forms of surgery—unlike those designed for use with special delivery beds (Frankenberg, 1961). In preliminary trials primitive forms of tray proved to be remarkably effective for operating-room use. During further trials it was found convenient (a) to make the tray-covers large enough to drape the entire trolley when the tray was uncovered in the operating-room, and (b) to set within the tray-covers all the fabrics required for the operation—on top of the instruments before sterilization.

The scheme submitted was accepted as a basis for planning, subject to the further study of certain aspects. The scheme includes: (1) the present design (Fig. 1) of the trays (developed in collaboration with Mr. J. Dick, chief technician, and Mr. B. G. Summers, group superintendent engineer); (2) the decontamination and trolley-top setting-alley (Fig. 2); and (3) a clean supply and soiled-return system (Fig. 3).

Pre-set Trolley-top Trays

The larger trays are of three sizes to conform with the width (26 in.; 66 cm.) and depth (26 in.) of British Standard high pre-vacuum rectangular dressing sterilizers. The dimensions are: full size 2 by 2 ft. (61 by 61 cm.), half-size 2 by 1 ft. (61 by 30.5 cm.), and quarter-size 1 by 1 ft. (30.5 by 30.5 cm.) (Fig. 1). In order to provide adequate residual heat to vaporize condensate trapped during the steaming period within trays loaded with very large numbers of metal instruments, the two larger trays are constructed from 12 S.W.G. aluminium sheeting (99.5% aluminium and 0.5% manganese) and weigh 4 kg. and 2 kg. respectively. For the quarter-size tray, 14 S.W.G. aluminium is used and the tray weighs less than 1 kg. All joints are aluminium-welded.

The inner aspect of all four sides of each tray measures $1\frac{1}{4}$ in. (4 cm.) in height and the upper edge is turned outwards to form a $\frac{1}{2}$ -in. (1.3-cm.) flange lip. On the outer aspect of each side and at a distance of $\frac{1}{4}$ in. (1.6 cm.) below the flange a second $\frac{1}{2}$ -in. (1.3 cm.) wide flange is welded into position in order to provide a $\frac{1}{4}$ -in. (1.6-cm.)-wide gutter round the upper outer aspect of the tray. At the centre of the lower flange on each side and end of the tray a $3/16$ -in. (0.5-cm.) hole is bored and dressed. Two simple turn-down finger-tip handles protrude from the lower

flange on one end of the tray so that the overall dimensions of the trays are as follows:

	Length		Breadth	
Full size ..	25	in. (63.5 cm.)	24 $\frac{1}{2}$	in. (62.2 cm.)
Half-size ..	25	in. (63.5 cm.)	12	in. (30.5 cm.)
Quarter-size ..	12 $\frac{1}{2}$	in. (31.7 cm.)	12	in. (30.5 cm.)

The handles are needed to facilitate the unloading of the trays while still hot from the sterilizer. They also act as the guide in positioning the covered sterile tray upon the instrument trolley in the operating-room—the handles should point away from the scrubbed nurse.

The trays proved immediately acceptable in all forms of surgery. They are popular with the theatre staffs since they save 5 to 50 minutes trolley-setting time both in emergencies and between operation on elective lists. In any emergency—major or minor—everything required in a sterile state can be made available within seconds of need. Where the tray system is in use there is less tension among the nurses during operating sessions, since with experience they gain confidence in the certainty that everything will be ready as soon as the surgeons are ready to begin. A major difficulty experienced in trying out the system in the various surgical specialties has been the reluctance of both the surgeons and the nurses to give up using the trays after the trial, particularly in emergency theatres. The theatre staffs desire to continue to use the trays routinely for both emergency and elective surgery, and, since few theatres possess the necessary number of instrument sets, the central sterilization department is placed under excessive strain. The number of sterilizers and attendants required is probably almost doubled by the introduction of the tray system. However, the senior nurses who have already introduced the system for trial in their suites are quite sure that it would be a retrograde step to return to the pack system and the sterilization of instruments separately; in fact, they are apprehensive of doing so.

The general feeling is that surgical equipment should be decontaminated outside the clean area, and, provided that the trays and packs are delivered in sufficient numbers and exactly as standardized by the surgeons and nurses, the factory-like decontamination and assembly line for the trays should be assigned to trained domestic staff working under the direct day-to-day supervision of individuals with the necessary technical knowledge and with experience in production and supply organization. The senior nurse would, of course, continue to hold the overall responsibility of the entire suite, including the soiled return and clean supply system. Where the system has been introduced the senior nurses find that they have more time to attend to their professional duties, including the teaching of nurses. The theatre sister becomes a full and proper member of the surgical team.

As a central decontamination and trolley-top setting area is lacking, the trays are at present set within the user suites. The tray-covers used are large enough to cover both the tray and the particular sizes of trolley already found to be the most appropriate in the particular surgical specialty. When the trays have been covered, the instruments set out on the tray, and the drapes layered over the instruments, the retaining spring cords are inserted into the gutter round the outer aspect of the tray rim. The free ends of the inner drape are then folded over the fabrics and instruments, followed by the outer drape. Labels are attached and the trays are collected, sterilized, and returned by the sterilizer attendants. The drapes and covers hold the instruments in place—even during rough handling of the trays. The trays can be sterilized in any effectively designed high pre-

FIG. 1.—Tray (1 by 1 ft.) and cover-retaining spring cord.

vacuum sterilizer, provided that the apparatus is in proper working order; this condition of an autoclave can be readily confirmed by means of the simple Bowie and Dick autoclave tape test, for which only a bundle of 29 towels with strips of autoclave tape in the centre towel are required (Bowie, 1961; Bowie, Kelsey, and Thompson, 1963).

The total process time for sterilization can be reduced to 15 minutes for all sizes of pre-set tray, regardless of the number of instruments and the amount of fabric. Between trays loaded on shelves one above the other in the sterilizing chamber it has been found necessary to arrange a tent-like

waterproof or thin metal umbrella in order to deflect condensate dripping from the undersurface of the tray above into the contents of the tray below; no difficulty is now experienced in assuring dryness of the tray contents. So far no trays arriving at the central sterilization department have been greater than 5 in. (12.5 cm.) in height, so that the shelves together with the condensate deflectors should allow, say, 6 in. (15 cm.) free loading-space between them. This would permit at least five full-size trays to be sterilized at once in a British standard 26 by 26 by 36-in. (66 by 66 by 91-cm.) chamber.

Fig. 2.—Diagram to show circulation of supplies in the decontamination and trolley-top tray-packing area. —A, Decontamination truck. B, Tray-setting trolley. C, Trolley for anaesthetic equipment. D, Trolley for sterile packs and bottled fluids from Central Sterile Supply Department. 1, Lift from theatre floor. 2, Mortuary trolley to mortuary. 3, Large specimens to pathology department—tissue bank, etc. 4, Anaesthetic masks, etc., off-loaded. 5, Instruments off-loaded. 6, Utensils off-loaded. 7, Trays off-loaded. 8, Clean salvage (unused dressings, etc.). 9, To laundry. 10, To incinerator (dirty dressings, etc.). 11, Truck-sanitization bay. 12, Truck-parking. 13, Cleaning, drying, and testing of anaesthetic equipment. 14, Wrapping and labelling of anaesthetic equipment and sorting into pass-through shelving. 15, Minor repairs workshop. 16, Cleaning, drying, and examination of instruments and utensils. 17, Checking instruments in sets and sorting into pass-through shelving. 18, Cleaning of trays. 19, Trolley-top tray-setting alley. 20A, Pass-through storage shelving for anaesthetic equipment. 20B, Pass-through storage shelving for sets of instruments and utensils. 20C, Pass-through storage shelving for sets of fabrics. 20D, Pass-through storage cupboards for sterile packs and bottles from Central Sterile Supply Department. 21, Trolley park and issue of tray contents lists and labels. 22, Stacked clean trays. 23, Trolley-top covers from laundry. 24, Checking of set trays by supervisor. 25, Covering, tying, and labelling of set trays. 26, Loading trays into sterilizer transfer carriages. 27, Loading anaesthetic equipment into sanitizer transfer carriages. 28, Return of sanitizer transfer truck. 29, Return of sterilizer transfer carriages. 30, Lift to pass-through steam sterilizers and sanitizers on theatre floor. 31, Equipment from hospital central stores, pharmacy, regional C.S.S.D., and laundry. 32, Theatre fabrics arranged in sets and sorted into pass-through shelving. 33, C.S.S.D. sterile packs and bottles to pass-through cupboards.

Fig. 3.—Diagrammatic representation of the proposed circulation of supplies and differential air pressures for the new theatre suites.—PR, Peripheral Rooms; pre- and post-operation rooms; radiology equipment stores; blood bank; tissue bank; domestic services; anaesthetic stores; linen store; plaster stores; staff-changing; laboratories. EN and ACP, Entrance and asepsis control. EX and ACP, Exit and asepsis control. T, Operating theatres. TSRP, Theatre service receiving platform. TSC, Theatre service centre. ExR, Theatre exit room. A, Anaesthetic room. SU, Scrub-up room. G, Gowning-room. DEEIS, Double-ended emergency instrument sterilizer. DEHC, Double-ended hot cupboard for sterile bottled fluids. PT, Pass-through cupboards with interlocked doors. PSS, Pass-through sterilizers. PSSA, Pass-through sanitizers. CPC, Clean peripheral corridor. CL, Clean lift. SRL, Soiled return lift. S, Stairway. 5, 4, 3, 2, 1, 0, Degree of pressure above atmosphere: 5=highest positive pressure; 0=negative pressure. NOTE: This diagram does not dictate that either the theatre complex or the operation-room should be of any particular shape.

Trolley-top Trays in Use

Before the patient is brought into the operating-room the sterilized trays are placed into position by the circulating nurse on trolleys with the tray handles pointing away from the user. She unties the outer cover and spreads it over the trolley top. When the patient has been wheeled into the room the scrubbed nurse unfolds and spreads the inner cover over the trolley, lifts the exposed sterile fabrics, and lays them down on the sterile cover to one side of the tray (Fig. 4). She places the utensils upright within the tray. The circulating-nurse dispenses the solutions, antiseptics, and non-autoclavable sutures, together with any extras required by the particular surgeon; she checks the count,

FIG. 4.—Thoracotomy instrument tray uncovered in operating-room. The fabrics are lifted from top of the instruments and set out on the trolley, to one side of the tray, in order of use.

by the scrubbed nurse, of the first bundle of swabs and the number of swab forceps prepared with swabs before the tray was sent for sterilization. The scrubbed nurse presents the skin-antiseptic bowl and loaded swab forceps to the surgeon. When the skin has been prepared and the patient draped, the scrubbed nurse draws her trolley towards the table and presents the scalpel. At a convenient moment thereafter the remaining bundles of swabs and packs are counted and the count checked as usual by the unscrubbed nurse. The upper metal surface of the tray is sterile under the two trolley-top covers and instruments, so that even if fluids are spilt from the utensils on the tray sterility is preserved; sterile waterproof sheets on the trolley top are therefore unnecessary.

In abdominal surgery a 2 by 2-ft. (61 by 61-cm.) tray on a 2 by 3-ft. (61 by 91-cm.) trolley appears to be adequate with supplementary 2 by 1-ft. (61 by 30.5-cm.) trays on other trolleys for gastrectomy, cholecystectomy, etc., and quarter-size trays for tracheotomy, cut-down, dressing, etc. In thoracic surgery, two full-size trays are used for thoracotomy—one on a 4 by 2-ft. (122 by 61-cm.) trolley and the other on an 18 by 24-in. (46 by 61-cm.) trolley. For open-heart surgery an additional half-size tray and a quarter-size tray are required for the cannulations. In neurosurgery, two full-size trays are used for the instruments and fabrics on a 6 by 2-ft. (183 by 61-cm.) trolley. A half-size tray is used for drapes and dressings and a quarter-size tray for

skin preparation and scalp infusion; a full-size tray is employed as a Mayo table, above the patient's chest, supported by a 2-ft. (61 cm.) square metal frame welded to uprights slotted into guides on each side of the operating-table. The drape covering the patient from scalp to the foot end of the table acts as the inner-tray-cover—just as the covers of the other trays act as trolley-top covers. A full-size tray has proved adequate for caesarean section, a half-size tray for delivery, and a quarter-size tray for stitching where required after delivery.

For prolonged storage—for example, open-cardiac-massage tray—a plastic cover is applied, after sterilization of the packed tray, over the usual covers and secured to the gutter round the rim as in covering a jam-jar.

For ward procedures the quarter-size tray appears to be the most appropriate, but the 12 by 6 in. (30.5 by 15.25 cm.) tray is proving acceptable.

Soiled Return

Before an operation ends, a porter from aseptic control (Fig. 3) on the periphery of the clean area will take a specially designed closed decontamination-truck from the clean-truck park to the soiled-return corridor of the operating-room. When the patient has left the operating-room the theatre staff will load the truck with everything introduced from the theatre service centre for the particular patient—and still left in the operating-room—separating used from unused equipment. The operating-room staff will park the closed truck in the soiled-return corridor upon an antiseptic-soaked mat; an attendant will take the truck to the soiled-return lift at aseptic control and dispatch it to the decontamination floor.

The unloading circuit for the truck arriving at the decontamination centre from the clean area of the suite is shown diagrammatically in Fig. 2. After decontamination the instruments and anaesthetic equipment will be examined; any articles requiring adjustment or minor repair will be sent to the minor repairs workshop. Instruments and other hard equipment will be sorted as complete sets into the pass-through shelving (20B) on one side of the trolley-top setting alley (19); anaesthetic equipment will be packaged. On the other side of the alley, trolley-top covers and standard sets of fabrics from the soft stores sorting area and laundry will be likewise arranged in pass-through shelving.

Clean Supply

Setting of Trolley-top Trays

The contents of the various trays (Fig. 2) will be standardized—for example, laparotomy, gastrectomy, thoracotomy, etc.—and additional instruments, sutures, fabrics, etc., required by individual surgeons will be made available as separate sterile packs to be stored in the theatre service centre and to be added to the trays in the operating-room.

Auxiliary workers will be trained to set the standardized packs and trays from lists and photographs. The trained setter will select a trolley with a top of the same dimensions as will be used in the operating-room. She will place a tray on the trolley with the handles away from her and to the right or left of the trolley top as shown in Fig. 4. She will cover both the tray and the trolley top with two sheets and set the instruments and small utensils in the tray. On the covered trolley and to the side of the covered tray she will arrange the standard set of fabrics—dressings, drapes, towels, suture book, etc. The fully set trolley will then be checked by a supervisor who will initial the label to be fixed to the outside of the outer cover. The retaining spring cord for the covers will be applied over the covers

into the gutter round the outer rim of the tray. The fabrics will be packed on top of the instruments in the tray. The outer and inner covers will then be folded over individually and the ties and label applied.

The trays will be loaded into autoclave carriages and dispatched by lift to the theatre service receiving platform (TSRP in Fig. 3).

Theatre Service Centre

On the theatre service receiving platform (Fig. 3) the sterilizer attendants will push the loaded tray carriages into the double-ended chambers and operate the sterilizers. They will also load and operate the sanitizers and load the pass-through cupboards—with sterile bottled fluids and packs from C.S.S.D.

Before an operation list begins all the sterile and sanitized anaesthetic equipment required and not already stored in the anaesthetic-room will be loaded from the service centre into the pass-through cupboards, and the operating-room staff will take it to the anaesthetic-room. Similarly, all the gowns, gloves, caps, and masks will be passed to the gowning-room before the session. An automatically operated door will be fitted between the gowning-room and the operating-room.

During a session all the trays, supplementary packs, bottled fluids, etc., required for the next operation will be loaded from the service centre into the pass-through cupboards to the operating-room.

Summary

A system is described for sterile supply and soiled-return services to operating-rooms, wards, and departments. Aluminium trolley-top trays are set, before sterilization, exactly as required for immediate use. The trays have proved particularly useful for major emergency operations during the night; but they are popular in elective surgery, since they save 5 to 50 minutes' sterile-trolley-setting time between operations on the list.

The contents of the various sizes of tray include sets of instruments, small utensils, and fabrics as standardized for each operation or aseptic procedure. Packs containing

large basins, extra fabrics, or one or two extra instruments required, for example, by particular surgeons are provided, and, when necessary, are added to the trays either after they have been uncovered for immediate use or during the course of an operation.

Where space and funds permit, the system lends itself to the sorting and cleaning of soiled surgical equipment by domestic staff outside the clean area of the suite—in a decontamination and trolley-top tray assembly line terminating at a bank of steam sterilizers and sanitizers.

The system probably entails the provision of approximately three times as many instruments as at present and twice as many sterilizers, but these aspects are now under investigation.

In the development of the tray system we were given a great deal of help and encouragement by those named in our text and from several clinicians, nurses, and administrators. In particular we wish to express our thanks to Mr. A. Logan; to Miss M. H. Cordiner, lady superintendent of nurses, and members of her staff in the Royal Infirmary, including Sister M. A. M. Gordon, Sister E. Lindsay, Sister S. Rathbone, Sister I. Brown, and Sister F. M. Rumbles; to Miss M. J. W. Taylor and members of her staff in the Simpson Memorial Maternity Pavilion, including Miss D. Coates and Sister A. Murray; to Sister A. Packham, Dr. C. A. Murison, and Mr. J. A. Dunn, of the Western General Hospital; and to Mr. T. W. Hurst, secretary and treasurer of the Royal Infirmary. To Mr. D. Ramsay, works manager, Scobie and McIntosh, Fountainbridge, Edinburgh, we owe thanks for his patience in manufacturing the four successive prototypes which led to the present tray design. We are grateful to the *Nursing Times* for permission to reproduce Fig. 4. For the drawings in Figs. 2 and 3 we have pleasure in thanking Mr. A. A. Dixon and Mrs. E. M. Farrell.

REFERENCES

- Bowie, J. H. (1961). *Sterilization of Surgical Materials: Symposium*. Pharmaceutical Press, London.
- Kelsey, J. C., and Thompson, G. R. (1963). *Lancet*, 1, 586.
- Davies, R. R., and Noble, W. C. (1962). *Ibid.*, 2, 1295.
- Duguid, J. P., and Wallace, A. T. (1948). *Ibid.*, 2, 845.
- Frankenberg, J. (1961). *Ibid.*, 2, 867.
- Hare, R., and Ridley, M. (1958). *Brit. med. J.*, 1, 69.
- Howie, J. W., and Timbury, M. C. (1956). *Lancet*, 2, 669.
- Jacobs, R. H., jun. (1961). "Surgical Suite Locker Room Design and Procedure." U.S.P.H.S. Grant No. W 170. Office of Hospital Research, N.Y. Chapter A.I.A., 111 W. 57th Street, New York, N.Y., U.S.A.

APPROVED NAMES

The last supplement to the consolidated list of "approved names" was published in the *Journal* of September 14 (p. 676). A new supplement, dated October, 1963, is printed below. Communications relating to "approved names" should be addressed to the Secretary, British Pharmacopoeia Commission, General Medical Council, 44 Hallam Street, London W.1.

Approved Name	Other Names	Action and Use	Approved Name	Other Names	Action and Use
Azathioprine ..	6-(1-Methyl-4-nitroimidazol-5-ylthio)purine "Imuran"	Anti-metabolite	Isoetharine ..	1-(3,4-Dihydroxyphenyl)-2-isopropyl-aminobutan-1-ol	Bronchodilator
Carbenoxolone ..	3 β -(3-Carboxypropionyloxy)-11-oxo-olean-12-en-30-oic acid "Biogastrone" is the disodium salt	Treatment of gastric ulcers	Medroxyprogesterone	17 α -Hydroxy-6 α -methylpregn-4-ene-3,20-dione "Provera" is the acetate	Progestational steroid
Chlormadinone ..	6-Chloro-17 α -hydroxypregna-4,6-diene-3,20-dione "Clordion" is the acetate	Progestational steroid	Mepenzolate bromide	1-Methyl-3-piperidyl benzilate methobromide "Canil"	Parasympatholytic agent
Clidinium bromide	3-Benziloyloxy-1-methylquinuclidinium bromide Present in "libraxin"	Anticholinergic	Oestriol sodium succinate	Oestra-1,3,5(10)-triene-3,16 α ,17 β -triol 16,17-di(sodium succinate)	Treatment of thrombocytopaenic haemorrhage
Clorexolone	5-Chloro-2 cyclohexyl-6-sulphamoylisoindolin-1-one "Nefrolan"	Diuretic	Oestriol succinate	Oestra-1,3,5(10)-triene-3,16 α ,17 β -triol 16,17-di(hydrogen succinate)	" "
Dehydroemetine ..	3-Ethyl-1,6,7,11b-tetrahydro-9,10-dimethoxy-2-(1,2,3,4-tetrahydro-6,7-dimethoxyisoquinol-1-yl-methyl)-4H-benzo[a]quinolizine 2,3-Dehydroemetine "Mebadin"	Treatment of amoebiasis	Panthenol ..	2,4-Dihydroxy-N-(3-hydroxypropyl)-3,3-dimethylbutyramide Pantothenyl alcohol "Bepanthen"	Treatment of paralytic ileus and post-operative distension
Dimethindene ..	2-[1-(2-(2-Dimethylaminoethyl)-inden-3-yl)ethyl]-pyridine "Fenostil" is the hydrogen maleate	Antihistamine	Pericyazine ..	2-Cyano-10-[3-(4-hydroxypiperidino)-propyl]phenothiazine "Neulactil"	Tranquillizer
Enoxolone ..	3 β -Hydroxy-11-oxo-olean-12-en-30-oic acid "Biosone"	Treatment of skin diseases	Piperidolate ..	1-Ethyl-3-piperidyl diphenylacetate "Dactil" is the hydrochloride	Parasympatholytic agent
Fentanyl ..	1-Phenethyl-4-(N-propionylanilino)-piperidine	Narcotic; analgesic	Quinestradiol ..	3-Cyclopentylxyoestra-1,3,5(10)-triene-16 α ,17 β -diol "Pentovis"	Oestrogen
			Sodium apolate ..	Poly(sodium ethylenesulphonate) "Pergalen"	Anticoagulant
			Vincristine ..	An alkaloid obtained from <i>Vinca rosea</i> "Oncovin" is the sulphate	Treatment of neoplastic disease