

Design of a Recovery Room and Intensive Care Unit

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OVER a twenty-five year period of the development of Anesthesiology in Sweden the number of anesthesiologists has increased to the point where the speciality now ranks fourth among the specialities of medicine. Anesthesiology has become an indispensable part of Swedish medicine.

As in other countries the anesthesiologist's main functions are: (1) preoperative evaluation of the surgical patient and evaluation of the patient who requires intensive care, (2) administration of anesthesia for surgery and obstetrics, (3) responsibility for the care of the patient in the immediate postoperative period, (4) responsibility for intensive care, (5) responsibility for respirator treatment in pulmonary insufficiency, and (6) 24-hour coverage for resuscitation.

In the construction of hospitals or alteration of existing areas the anesthesiologist has taken an active part in creating better facilities to meet the demands of his activities. Interest is now concentrated on the planning of recovery rooms and intensive care units. The present report is an account of such planning at Danderyds Sjukhus, a general hospital in the county of Stockholm.

Background and Requirements

Based upon experience in the United States and the experience in a few Swedish hospitals, Danderyds Sjukhus constructed a small unit with six to nine beds for the treatment of patients during the immediate postoperative period, and for intensive care. This was done in 1959. The experience obtained during subsequent years provided the basis for design of a larger unit in a completely new hospital.

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It seemed reasonable to divide the new treatment area into two sections: one for patients staying for a short time, that is, post-anesthetic patients in a recovery room, and another for patients remaining for a longer period of time in an intensive care unit.

Since supervision of the postoperative patient is largely that of respiratory and circulatory care, it is natural to make use of the experience of personnel in this field, in the recovery room as well as in the intensive care unit. Therefore it is desirable to have a combined staff for recovery room and the intensive care unit, for the sections to be in proximity but separated from one another. Intensive care is, from the psychological point of view, an arduous duty for the staff, attending only to the most seriously ill patients; thus it is of benefit to the staff in an intensive care unit to alternate in the care of postoperative patients, from time to time.

General Design. It is an advantage to have an open style recovery room; however, in the intensive care unit, to which patients come from all parts of the hospital, there is a need for isolation areas. The danger of nosocomial infection cannot be overemphasized and makes isolation a necessity. In addition, the patient in the intensive care unit is not necessarily unconscious and there are psychological implications in his knowing that he is so seriously ill as to be in an intensive treatment area. Better care can be given such a patient in an isolated room.

The more intensive and specialized the treatment, the larger the area required per bed. Plenty of working space is required about the patient who is on respirator care or requires artificial dialysis for treatment of renal insufficiency.

Table I lists the variety of diseases which may be complicated by respiratory insufficiency.

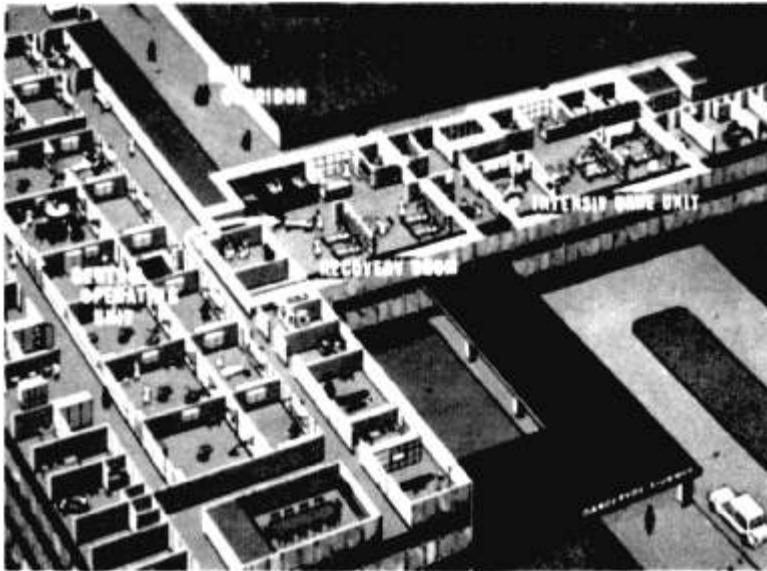


FIG. 1. Cutaway view of operating rooms, recovery room and intensive care unit for adults at Danderyds Sjukhus.

Because of the specialized care and attention required by patients on respirators this treatment should be concentrated in an intensive care unit. Thus every bed in an intensive care unit should have facilities for respirator treatment. However, as respirator treatment is extended to conscious patients and since tracheostomized patients are particularly

liable to infection, we thought it wise to have a number of larger areas for prolonged respirator treatment. Twenty to 25 square meters is the recommended size.

The New Treatment Area

The newly built hospital will have a total capacity of 1,400 beds, with 800 beds for

TABLE 1. 100 Patients Treated by IPPB in the Intensive Care Unit at Danderyds Sjukhus, Sweden

Indication	Number of Patients	Average Duration of IPPB (hours)	Results	
			Survivors	Deaths
Inadequate postanesthetic ventilation	16	11 $\frac{1}{2}$	16	0
Neurologic disorder and operation	2	52	2	0
Chronic respiratory insufficiency and operation	4	28	4	0
Postoperative complications	17	68	3	14
Chest injury	10	167	9	1
Neurological problems				
Head injury	5	101	2	3
Cerebrovascular accident	7	106	0	7
Encephalitis, myelitis, meningitis	3	114	1	2
Drug intoxication	32	22	31	1
Resuscitation				
Drowning	1	45	1	0
Asphyxia neonatorum	1	3	1	0
Miscellaneous				
Tracheobronchitis	1	100	1	0
Fat embolism	1	192	1	0
Totals	100	77	72	28

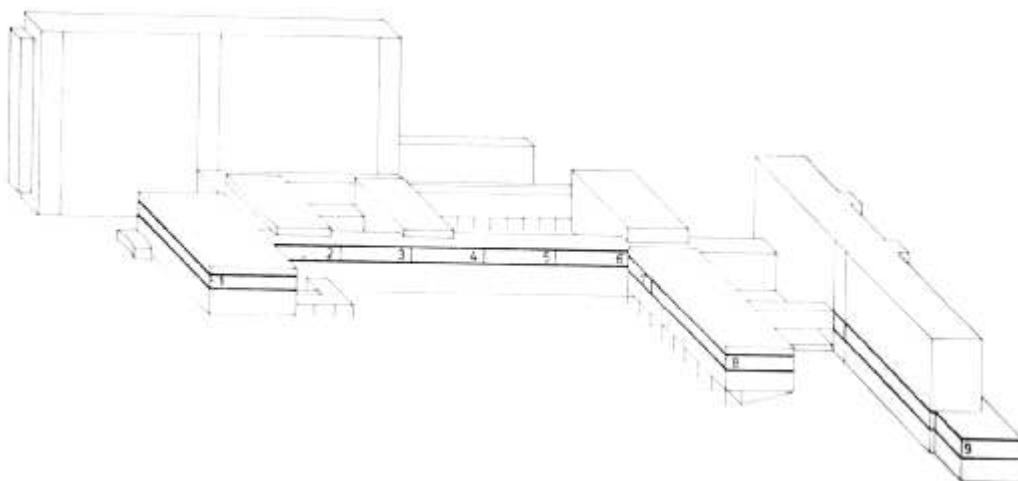


FIG. 2. The relation of different sections of the working area. On the left, central operating unit. To the right, gynecological and obstetrical department. In the center, intensive care unit with facilities for prolonged IPPB, and treatment area for artificial renal dialysis. 1. Central operating unit. 2. Recovery room. 3. Intensive care unit for adults. 4. Anesthesia offices. 5. Intensive care unit for neonates. 6. Treatment area for artificial renal dialysis. 7. Postoperative unit. 8. Operating unit of the gynecological department. 9. Obstetrical department.

treatment of somatic disease. In the general planning it has been possible to concentrate the special working area for the anesthesia department on one floor.

The recovery room and intensive care with their special working areas are planned as one unit, in relation to function, administration and personnel; but for reasons of asepsis and special working conditions, there is separation into sections: (1) recovery room with a 12- to 15-bed capacity in close proximity to the central operating unit, (2) postoperative unit with 8-bed capacity in the gynecological-obstetrical department, (3) main intensive care unit with 8- to 12-bed capacity for adults, (4) treatment area for renal dialysis; and (5) intensive care unit for children and neonates.

Recovery Room and Intensive Care Unit

The following paragraphs will be limited to a description of the recovery room in the central operating unit and to the intensive care unit for adults, both of which have been in use since May 1964.

Recovery Room. This part of the treatment area is a postanesthesia unit wherein the patient is closely observed until the possibility of development of asphyxia, shock or other complications requiring ventilatory or circulatory resuscitation is no longer a threat.

The central operating unit has 10 operating theaters. Directly connected to it, and from the bacteriological point of view, in the same area, is the recovery room, the dimensions of

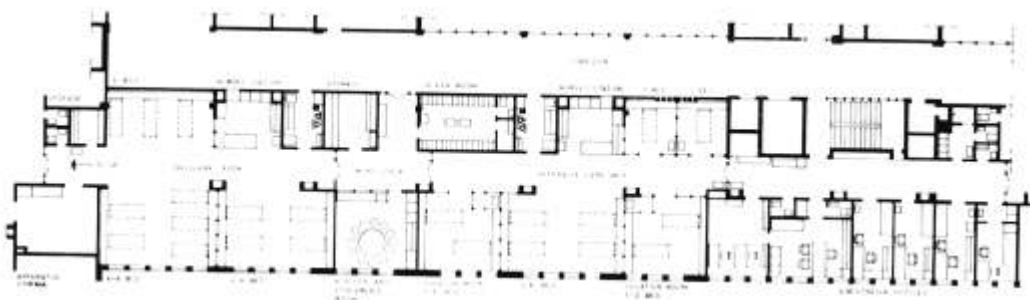


FIG. 3. Plan of recovery room, intensive care unit and anesthesia offices.



FIG. 4. Close view of the bed-stand.

which are determined by the fact that approximately one and a half beds are required per operating theater. It is an open unit with the nurses desk in the center and three sections of 3 to 6 beds each.

Fittings and Fixtures. All beds are supplied with ordinary recovery room equipment: oxygen outlets for oxygen therapy and for inhalation therapy with aerosols; double outlets with compressed air for suctioning, with a special bacterial lock on the suction bottle; sphygmomanometer; four electrical outlets; a place for records; and, wall shelves with a rail upon which equipment and instruments can be mounted.

For each 3-6 beds there is a "resuscitation panel" with bag and mask for ventilation, a

"panic button," when cardiac arrest occurs, to alert the whole unit and operating room, and outlets for portable roentgen-ray apparatus.

Intensive Care Unit. The intensive care unit is separate but close to the recovery room. By intensive care is meant the treatment of patients with failure of vital functions: unconsciousness, established or anticipated ventilatory deficiency, circulatory insufficiency, fluid balance disturbance or renal failure. Our experience over a five-year period suggested the number of beds required in the intensive care area as shown in table 2.

Based on these figures the intensive care unit for adults has an 8- to 12-bed capacity. It has an open section with 4 to 6 beds, two

large isolation cubicles for 1 or 2 patients, and two single-bed rooms.

Technology. When nurses work at their desks, they must be able to supervise the entire unit, including the isolation rooms. It is easy for the nurse to see the area just in front of her. With the aid of cameras in the isolation rooms she can also follow on a television screen what is going on within these rooms. The screens have been built into a special panel in a central location.

From the desk the nurse can direct a camera to survey a patient at all times, or with the assistance of a zooming lens pay close attention to a monitoring instrument, for example, the pressure guage on a respirator.

Television cameras are of real value and diminish the need to visit the isolation rooms. If a patient is on respirator care there is always someone beside the patient, but this person may be a less qualified member of the team. The trained nurse and a physician though not within the isolation room can keep in touch with what is happening there.

All beds in the intensive care unit are supplied with the same equipment as in the recovery room; in addition, all beds have facilities for continuous monitoring and recording of EEG, ECG, body temperature and arterial pressure. The signals from the patient pass to the central nursing station where they can be recorded on a four-channel recorder and be visualized on an oscilloscope. Measurements such as temperature can be recorded simultaneously for 6 patients or observed on a centrally placed electrical thermometer. On the electrical panel there is an automatic timer which, for example, enables ECG records to be taken for 20 seconds each half an hour, in a critically ill patient.

It is important that the signal observed at the central nursing station also be seen beside the patient. Therefore, all beds have outlets for oscilloscopes and each group of three beds has an optical thermometer.

Ventilation of the Area. The unit has effective air-conditioning but because of the demand for total isolation of infected patients or those particularly liable to infection, isolation cubicles are provided with their own ventilation. They provide filtered air, a high humid-

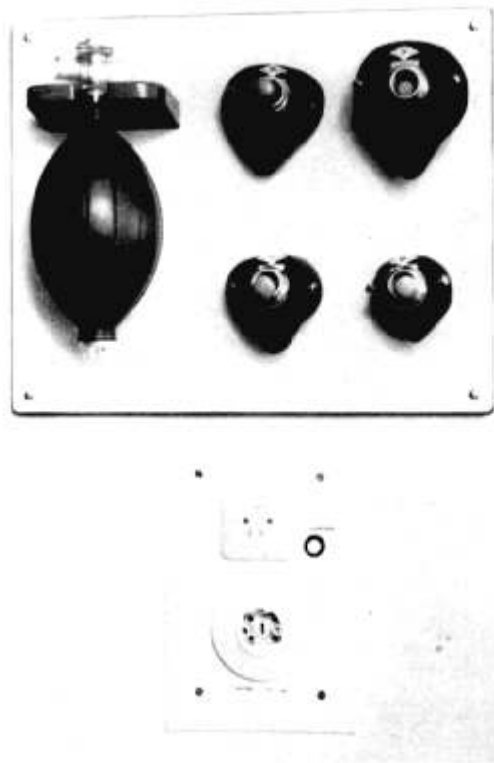


FIG. 5. Resuscitation panel.

ity, as well as heating or cooling by means of the ceilings.

Further detailed description of the equipment and special areas for this combined recovery room and intensive care unit is unnecessary, but it is worth mentioning that the unit has an intercommunication system between rooms, a storeroom for portable equipment, utility rooms for each section and a small kitchen. The overnight room for relatives and offices for the staff are separated from the patient unit.

TABLE 2. Number of Beds Required in Intensive Care Area

Clinic	Percentage of Total Hospital Beds
General Surgery	3.5
Gynecology	1
Orthopedics	1
Ear, Nose and Throat	1/2
Medicine	3



FIG. 6. Nurses desk in the intensive care unit.

Close connection is maintained with the central laboratory which provides round-the-clock service for the immediate measurement of standard bicarbonate, base excess, carbon dioxide tension, oxygen saturation, blood volume and fluid-balance determination.

Staff. An attending anesthesiologist is available to the unit at all times. The combined unit is staffed by 14 registered nurses, 10 undergraduate nurses, 8 orderlies and 2 male attendants. Physiotherapists are available to administer breathing exercises.

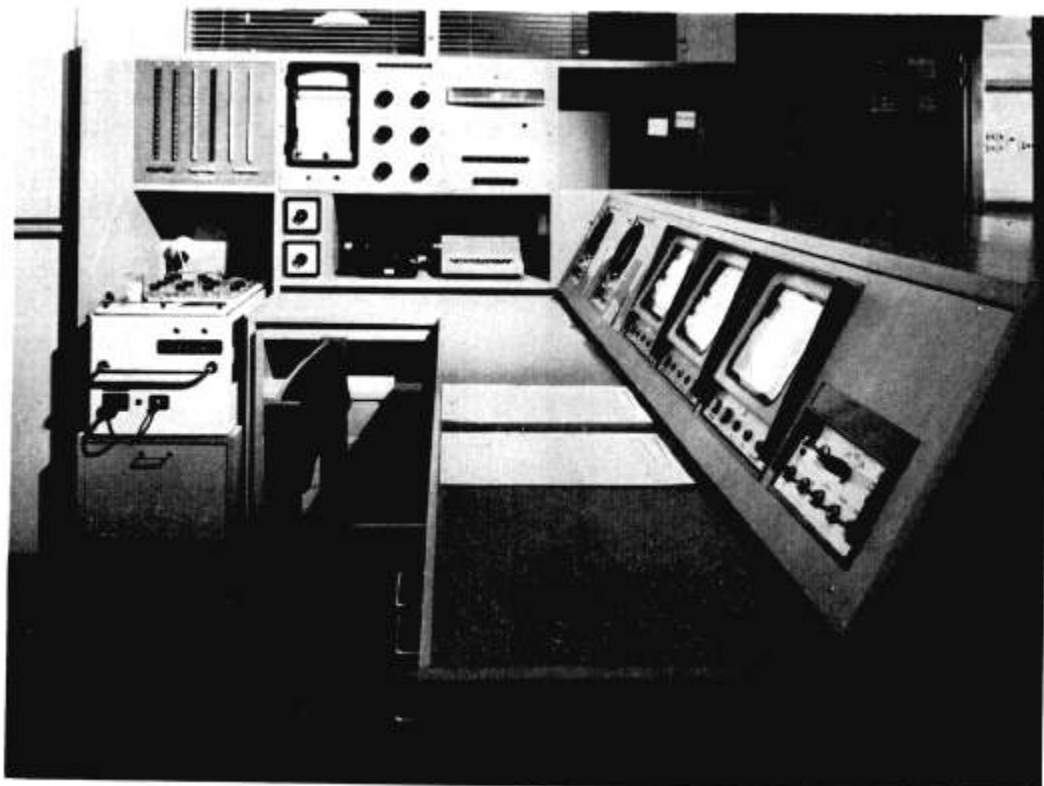
Summary

In new construction or the remodeling of hospitals anesthesiologists should take active part in planning better facilities for today's activities in anesthesia. These include optimal care for patients in the immediate postoperative period and the intensive treatment of patients with failure of vital functions.

FIG. 8. The electronic panel.



FIG. 7. From the desk the nurse can direct the television cameras to view the interior of the isolation rooms. The patient or the instruments can also be seen on monitors in the anesthesia office, in the "on call" room for anesthesiologist and in the kitchen of the unit.



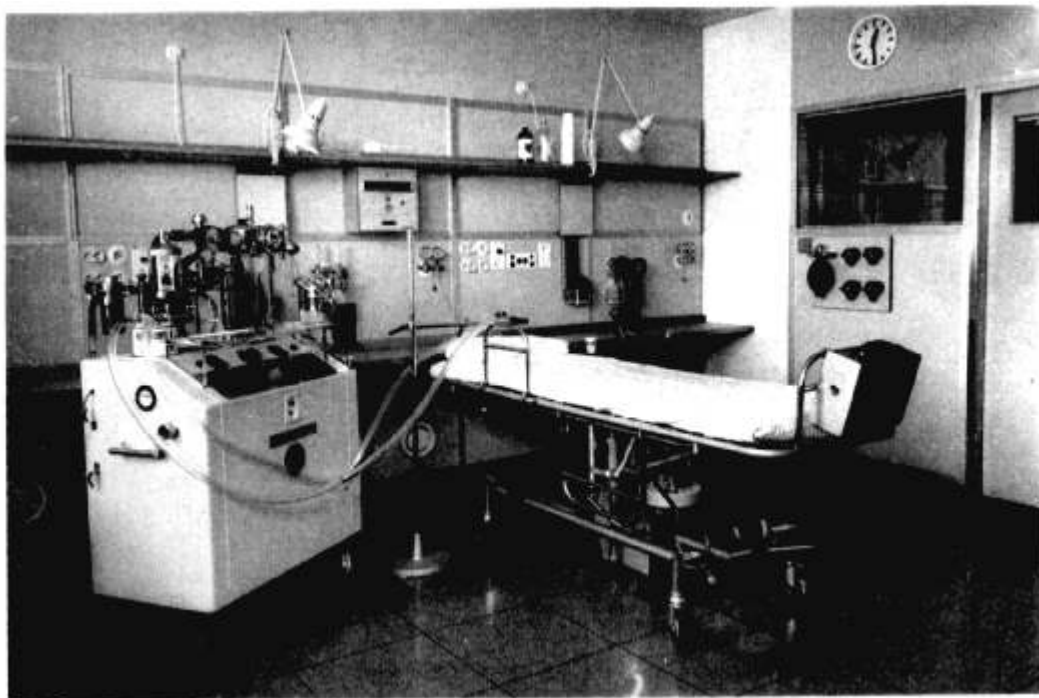


FIG. 9. The isolation room.

A plan of the treatment area in Danderyds Sjukhus, Sweden, has been described. It is based upon the experience in a small combined postanesthetic and intensive therapy unit where a thorough evaluation took place over a five-year period.

The new working area has been built on one floor, with the intensive care unit and the anesthesia offices in the center, surrounded by recovery rooms for short-term postoperative treatment, operating theaters and labor rooms.

The recovery rooms and the intensive care unit with their special working areas are planned as one unit with regard to function, administration and personnel, but for reasons of asepsis and special working conditions they are separate.

A detailed description of the recovery room and the intensive care unit for adults has been presented, wherein the benefits of modern technology have been given particular attention.