

## RECOVERY ROOM: LIFE SAVING AND ECONOMICAL •

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UNTIL recently little has been said on the importance of a recovery room in preventing morbidity and death during the postanesthesia period.

The need for postanesthesia rooms becomes strongly apparent to those who have made a study of the causes of death related to anesthesia.

Ruth, Haugen and Grove, in describing the findings of the Philadelphia Anesthesia Study Commission for eleven years, reported 307 deaths related to anesthesia (1). Nearly half of these were classified as preventable. Ninety-five of the preventable deaths, or 63 per cent, occurred as a result of inadequate nursing care, coupled with respiratory obstruction. All occurred in the immediate postanesthesia period.

These figures show that asphyxial death happens as a postanesthetic complication too frequently. Such negligence in after-care reveals a glaring defect in what might otherwise be considered good anesthetic management.

This report deals mainly with observations on 35,000 recovery room cases handled during the past seven and a half years in two hospitals in the District of Columbia by a single group of anesthetists. Some of the observations will be described to show that a recovery unit not only will provide immeasurable benefits for the patient and the physician but may be operated by the hospital on an economically feasible basis.

Before the establishment of the recovery room at Emergency Hospital in 1942 and at Doctor's Hospital in 1947, the commonest preventable sequela to anesthesia was respiratory obstruction with associated hypoxia or anoxia.

Outstanding as examples of preventable accidents which occurred at one of these hospitals before the advent of the recovery room were 2 cases of acute respiratory obstruction following thyroidectomy. In each case the obstruction was caused by tracheal compression from hemorrhage. One patient died an asphyxial death because the situation was not detected in time. The other patient lived because an alert intern happened by at the critical moment and immediately opened the wound. Had a recovery room been in existence, both patients would undoubtedly have been saved.

Since the advent of the recovery room in these hospitals such serious

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complications have been prevented in all cases in which the recovery room was utilized. Unavoidable sequelae to anesthesia, such as respiratory depression or circulatory depression, when they have occurred, have been detected sooner and more properly managed.

In order to present a picture of the organization and functions of a recovery room, the actual practice afforded by the large number of cases mentioned should be described with regard to: (1) the requisites for a successful recovery unit, (2) the advantages of a recovery room, with particular reference to the problem of economic feasibility, (3) the more common recovery room complications with reference to prevention, incidence and treatment, and (4) the fatalities and the near-fatalities in the recovery room during its existence.

#### REQUISITES FOR A SUCCESSFUL RECOVERY UNIT

The requisites for a successful recovery unit are as follows.

*Supervision.*—The recovery room should be under the direct supervision of the anesthesiology department. It should be the special province of the anesthesiologist, since it affords him a means of guaranteeing a safe recovery to the patient.

*Personnel.*—Probably the most important key to a successful unit is a capable graduate nurse who has been carefully instructed by the anesthesiology staff to recognize and care for the emergencies which are peculiar to the postanesthesia state. Student nurses and aides may be utilized as assistants when needed. The resident surgical staff as well as the anesthetic staff are on call at all times.

*Equipment.*—In order of importance, the necessary equipment consists of a resuscitator for delivering oxygen under measured pressure, an electric aspirator, oral and nasopharyngeal airways, equipment for oxygen therapy including nasal and mask apparatus, equipment for parenteral therapy for giving fluids or blood, and a supply of the most commonly used drugs and medication.

*Space.*—The space allotted to the recovery ward should be sufficient to accommodate two litters per active operating room at any one time. This space is about one-fourth that required for the usual ward patient. The recovery room at Emergency Hospital is approximately 30 by 20 feet, and will accommodate up to 12 patients simultaneously.

*Location.*—If possible, the recovery unit should be situated on the same floor as the major operating rooms, so as to be more accessible to the anesthesia staff.

*Availability.*—Ideally, the recovery room should be open for use twenty-four hours a day.

The first four requirements are essential for success. The last two, although desirable, often are not feasible. Satisfactory compromise, however, may be made.

The recovery unit at Emergency Hospital could not be located on the same floor as the main surgical suite but is available and staffed from 8 a.m. until 11 p.m., and although the unit at Doctor's Hospital is open

only eight hours a day, the recovery room is located on the main operating room floor. In both hospitals the other requisites have been fulfilled, and a close liaison is maintained among the recovery, anesthesia and resident staff.

#### ADVANTAGES OF A RECOVERY WARD

The advantages of a recovery ward are as follows.

*Centralization.*—All patients who have undergone anesthesia, together with the special equipment and personnel which may be necessary for a safe recovery, are centralized. The anesthesiologist is thereby assured a great measure of control over that period following anesthesia which probably offers more dangers to the patient than does the induction of anesthesia.

*Increased Safety.*—Increased safety to the patient is guaranteed by expert after-care. As stated previously, statistics have shown that more than 60 per cent of preventable deaths occur during the immediate postanesthesia period. Our experience has proved that none have occurred since the recovery room has been used in these two mentioned hospitals.

*Economy.*—The use of a recovery room effects an economy of material by preventing reduplication. For instance, one resuscitator serves the recovery room adequately, in spite of the fact that as many as 12 patients may be cared for at the same time.

There is a great saving in nursing care, an important factor because of the existing shortage of nurses. A few trained personnel can care for many patients. It is unnecessary to arrange for a nurse for each patient.

The cost to the patient is small, averaging slightly over two dollars, whereas if he were to bear the cost of a special nurse, it would be five times this amount.

The cost to the hospital may be exemplified by a survey of the year 1949. One hospital showed a gross income from the recovery room of \$8,000.00, a net income after deducting salaries, of \$5,000.00. The space for the recovery room was available in this hospital so that the establishment of the recovery room did not affect the total number of beds.

At the second hospital where space is at a premium, a system of cost-accounting applied to the recovery unit showed very slight difference between revenue from the recovery room and revenue from the same space when it was used for bed patients on the basis of 100 per cent occupancy (2).

*Protection.*—One other advantage is the protection afforded the physician and the hospital. Whether justified or not, legal action against physicians and hospitals seems to become ever more common. This is important to us since the trend is for the anesthetist to assume, more and more, the responsibility for immediate postoperative care. No better way of assuring uneventful recovery from anesthesia can be accomplished than through the recovery room system.

## COMPLICATIONS: PREVENTION, INCIDENCE AND TREATMENT

Prevention begins at the termination of anesthesia and is considered a part of care in the recovery room. In order to minimize circulatory and respiratory depression and to reduce the incidence of laryngospasm and pentothal "shiver," it is necessary to stress the importance of great gentleness in moving anesthetized patients from operating room table to stretcher. By keeping patients on their litters during the recovery period, only one transfer is necessary while the patient is in a state susceptible to slight trauma. This move occurs in the operating room where proper help is plentiful. The importance of maintaining a free airway during transport to the recovery room must also be emphasized. Placing the patient in proper position will prevent a number of accidents. The arms and legs should be placed so that they do not extend over the edge of the stretcher and become subject to injury. The patient's head should be in extension with constant support of the chin.

When there is a possibility of vomiting and when surgical procedures have been done on the nose and throat, patients should be placed in the lateral position to help maintain a free airway and prevent aspiration.

When a new patient is admitted to the recovery unit, the nurse in charge immediately checks the airway, notes the color, respiration, capillary refill, pulse, blood pressure, condition of the skin and state of reactivity, in that order. These observations are routinely repeated in each case, and a permanent record kept. The anesthetic record is noted with particular reference to the anesthesiologist's instructions for after-care. By early recognition of deviations from normal, complications are prevented.

The criteria for discharge from the recovery room are: full orientation, normal respirations and a stable circulation as evidenced by a warm, pink, dry skin and a blood pressure reading which is near normal for the individual patient.

The incidence of the more commonly seen complications is given in table 1. These figures were obtained from an analysis of 800 cases. The percentage figures given overlap because more than one complication occurred in many cases. The commonest circulatory symptom was simple depression in 11 per cent. This may be caused by operation, spinal anesthesia or prolonged general anesthesia, or the reception of painful stimuli by any reacting patient. Simple treatment consisting of Trendelenburg position, oxygen inhalations, intravenous administration of fluids, or ephedrine, as indicated, usually suffices.

Severe depression or true shock, occurring in about 1.5 per cent, necessitates adequate transfusion of blood and the use of oxygen therapy.

Respiratory depression of varying degrees occurred in a small percentage. Oxygen inhalations by mask were given in mild cases, assistance with positive pressure oxygen was used in more severe cases. Partial respiratory obstruction was seen in a few patients when they were able to react partially. Such a patient is easily roused, but the

jaw may be too relaxed otherwise to allow free breathing and an airway is not tolerated. Mild manual stimulation or conversation will maintain muscle tone and a free airway.

Pain and restlessness in 14 per cent of cases were the most frequent symptoms, and were usually associated with one of the other complications mentioned. Restlessness is usually caused by pain in a reacting patient and easily controlled by the use of morphine. It must be cautioned, however, that restlessness may also be an early symptom of suboxygenation and therefore requires investigation.

Muscle spasm as represented by the so-called pentothal "shiver" and avertin "chill" occurred during emergence in 2 per cent. This is manifested by mild to severe muscle spasm and rigidity, the precursor of which is seen in the fine fibrillary twitchings of the masseter muscles. The treatment is to prevent all external stimuli and to administer oxygen, if necessary, under positive pressure. Morphine, given intravenously, may be helpful in relieving persistent symptoms.

TABLE I  
RECOVERY ROOM INCIDENCE OF COMPLICATIONS

Circulatory		Neuromuscular	
	Per cent		Per cent
Hypertension . . . . .	0.2	Pain, restlessness . . . . .	13.7
Simple depression . . . . .	11.0	Muscle spasm . . . . .	2.0
Shock . . . . .	1.4	Laryngospasm . . . . .	0.0
Cardiac failure . . . . .	0.0	Excitement . . . . .	0.6
		Slow reaction . . . . .	1.4
Respiratory		Gastrointestinal	
Depression . . . . .	0.6	Nausea . . . . .	2.8
Partial obstruction . . . . .	1.7	Vomiting . . . . .	1.7

Laryngospasm was seldom seen in the recovery room. Oxygen under slight positive pressure should be given. More radical measures are undertaken only by the anesthesiologist.

Sedation and restraint may be required for the rare case of emergence excitement.

#### FATALITIES AND NEAR-FATALITIES ENCOUNTERED IN THE RECOVERY ROOM

The fatalities in the recovery room, from 1942 to 1950, are shown in table 2. From 1942 until the present there have been 4 deaths in the recovery room. Although none of these can be considered due to errors in post-anesthetic management, they warrant a brief comment. One patient was moribund upon admission and died five hours after operation. A second patient who had had a craniotomy, received adequate resuscitative efforts in the recovery room to no avail. A third patient had a coronary occlusion at the termination of a prostatic resection, as shown later at autopsy. The fourth patient suffered a cerebral hemorrhage while awaiting operation. Fortunately, no anesthetic had been

TABLE 2

## DEATHS IN THE RECOVERY ROOM, 1942-1950

Operation	Cause of Death	Time in Recovery Room hours
Resection, gangrenous bowel	Irreversible shock	5
Craniotomy for tumor	Cerebral edema and shock	3
Prostatic resection	Coronary occlusion on table	1
None, no anesthetic	Cerebral accident	18

given. Respiratory failure was treated for eighteen hours with artificial respiration by means of the Kreiselman resuscitator.

The 6 cases representing near-fatalities are more interesting in that some of them must be classified as preventable (table 3).

The first 2 were cases of anoxic reaction resulting from cardiac arrest during operation. Both of these patients were resuscitated in the operating room and treated during the ensuing critical period in the recovering room. Complete mental recovery occurred in twenty-four hours in one case and within thirty-six hours in the other.

The third patient suffered a mild but definite anoxic reaction caused by respiratory obstruction during anesthesia. This was a preventable accident. Full recovery took place within fourteen hours.

The fourth patient suffered a prolonged period of hypoxia during the postanesthesia period, owing to partial respiratory obstruction. This complication occurred as a result of inadequate nursing care because the recovery room was not available. When the condition of the patient was discovered the following morning, he was moved to the recovery room. After twelve hours with slight improvement one unit of albumin was given; this was followed by a dramatic return to a semiconscious state. Recovery was complete in thirty-six hours.

In the fifth case, a child, massive atelectasis occurred following an eye operation and after extubation. The treatment consisted of prompt aspiration of the tracheobronchial tree and oxygen inhalations. Some laryngeal edema resulted from manipulation, but the patient recovered without further incident.

TABLE 3

## NEAR-FATALITIES IN THE RECOVERY ROOM

Cases	Diagnosis	Cause	Preventable	Outcome
1	Anoxic Reaction	Cardiac arrest	No	Recovery; 24 hours
2	Anoxic Reaction	Cardiac arrest	No	Recovery; 36 hours
3	Anoxic Reaction	Respiratory obstruction	Yes	Recovery; 14 hours
4	Anoxic Reaction	Respiratory obstruction	Yes	Recovery; 36 hours (albumin intravenously)
5	Massive Atelectasis	Mucus (?)	No	Recovery; slight laryngeal edema
6	Pulmonary Embolism	Thrombosis	No	Fatal recurrence (10th day)

In the last case pulmonary embolism occurred probably while the patient was in transit to the recovery room. Recovery from this particular episode was prompt. The diagnosis was proved when a second embolism proved fatal on the tenth postoperative day.

The cases in which there was a question of survival because of errors in management illustrate again the importance of the recovery room in after-care. These patients could not have been given as skilled supervision and treatment elsewhere.

The fact that none of the deaths in the immediate postanesthesia period could be attributed to faulty postanesthesia care is evidence of the function of the recovery unit.

### SUMMARY

We believe very strongly that the use of the recovery room has without question saved lives and probably reduced the over-all morbidity from anesthesia and surgery. In addition, actual practice over a seven and a half year period has proved that a recovery ward can be made economically feasible. The establishment of such units as an integral part of good anesthetic management is recommended.

### REFERENCES

1. Ruth, H. S.; Haugen, F. P., and Grove, D. D.: Anesthesia Study Commission; Findings of Eleven Years' Activity, *J. A. M. A.* **35**: 881-994 (Dec. 6) 1947.
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### FIFTH NEW YORK POSTGRADUATE ASSEMBLY

The New York State Society of Anesthesiologists announces the preliminary program for its Fifth Postgraduate Assembly to be held at the Hotel New Yorker, New York City, December 5-8, 1951. The panel subjects and chairmen are as follows:

Autonomic Mechanisms .....	James C. White, M. D.
Nitrous Oxide .....	Kenneth C. McCarthy, M.D.
The Aging Patient .....	Edward J. Stieglitz, M.D.
Theories of Anesthesia .....	Thomas C. Butler, M.D.
Controversial Aspects of Spinal Anesthesia .....	Ralph M. Tovell, M.D.
Cardiac Resuscitation .....	Julian Johnson, M.D.
Chloroform .....	Ralph M. Waters, M.D.
Kidney Function and Anesthesia ..	Homer W. Smith, M.D.

There will also be an "Information Please" session and a program of papers presented by residents in anesthesiology. All anesthesiologists are cordially invited to attend the meetings.