AN INTENSIVE CARE UNIT IN A PROVINCIAL GENERAL HOSPITAL*

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Russell *et al.*[1] have recently pointed out that an intensive care unit should form an integral part of all modern hospitals offering specialist services. By the beginning of 1967 it was apparent that the need for such a unit at Grey's Hospital was indeed urgent.

It had become a common occurrence to have several critically ill patients scattered throughout the various wards of the hospital, all of whom would benefit from the amenities which an ICU could offer.

By day these cases were being cared for by trained sisters and staff-nurses who had simultaneously to contend with the day-to-day running of a busy ward, while at night they were in the care of untrained staff under the supervision of a trained night-sister who, having other duties to perform, was able only to act as a supervisor from a distance. When absolutely necessary and when staff availability allowed, 'specials' were provided, but this made heavy demands upon the nursing establishment.

A further factor in the care of the critically ill is the expensive and often delicate apparatus. Before the establishment of the ICU an Electrodyne Monitor Alarm Defibrillator and a Bennett IPPR ventilator were in use. These had to be transported from ward to ward and it was not a rare occurrence to find that an essential part of the apparatus was missing, quite apart from the obvious disadvantages of being trundled about the hospital and handling by an ever-changing staff.

At the beginning of 1967 a committee was established under the chairmanship of the Medical Superintendent, consisting of the Principal Matron and heads of the departments of medicine, surgery and anaesthetics. It was unanimously agreed that the establishment of an ICU in which highly trained staff and specialized equipment could be located together was an urgent priority. Funds were short because of a national economy drive, and it was realized that some improvization would be necessary.

METHODS

A pilot study was conducted for 6 weeks to establish the bed requirements. During this time patients who were felt to be in need of intensive care were noted daily. Fifteen categories of cases were thus noted (Table I) and during the 42 days under study there were 76 patient-days of bed occupancy, giving a bed occupancy of 1·8 patients per day. It was felt that, to begin with, a 4-bedded ward would therefore be adequate.

TABLE I. PILOT SURVEY OF TYPE OF CASES REQUIRING INTENSIVE CARE

To be filled in with bed state by Night Matron

Date: .....

	Number of cases
1. Severe head injury	
2. Severe multiple injuries	
3. Early tracheostomy	
4. An early postoperative case causing concern	
5. Small bowel fistula	
6. Renal shut-down	
7. Bacteraemic shock	
8. Severe coronary occlusions causing concern	
9. Acute respiratory failure	
10. Severe life-threatening pneumonia	
11. Unresponsive status asthmaticus	
12. Resuscitation after near-drowning	
13. Resuscitation after cardiac arrest	
14. Drug overdosage with threatened respiratory depression	
15. Severe burns	

Locality

After much thought it was decided that the ICU should be located as near as possible to the main operating theatre suite.

Firstly, many of the patients would be those returning to the unit following major surgery and it was desirable that the journey should be as short as possible. Secondly, throughout the day there is invariably medical staff in the theatre. Staff members are therefore often available to deal with sudden emergencies that may arise. A suitable area which had previously been used as a nurses' lecture room and was adjacent to the theatre was appropriated (Fig. 1). A sluice room and a small kitchen were situated immediately across the corridor, and along the same corridor was another small room which was converted into a sitting room for the relatives of patients in the unit. The nursing staff rightly stressed that this facility was of paramount importance.

Equipment and Installations

Cupboards and shelves were installed in the service section (Fig. 1, area A). Runners and curtains were erected in area B to screen individual beds. Each bed was provided with water vacuum suction and an oxygen point to which oxygen was piped from the theatre bank.

The oxygen meter bottles were detachable to allow the line from a respirator to be plugged in should it be desired to run the machine off pure oxygen.

Fig. 2 shows the wall fittings described. Four beds from the surgical store were adapted to give access to the patient for emergency intubation, etc., by sawing off the bed heads. Pegs were fitted so that the head rails could be replaced or removed rapidly at will. These beds were already fitted with an independent crank to raise the upper or lower half, and the foot of each bed could be raised by lever action. Short metal tubes with side screws were welded vertically to the top of each bedpost to take the uprights of an orthopaedic frame.

It was considered necessary at this stage to obtain a further respirator since many of the patients in an ICU, both medical and surgical, are likely to require IPPR.

*Date received: 6 November 1968.

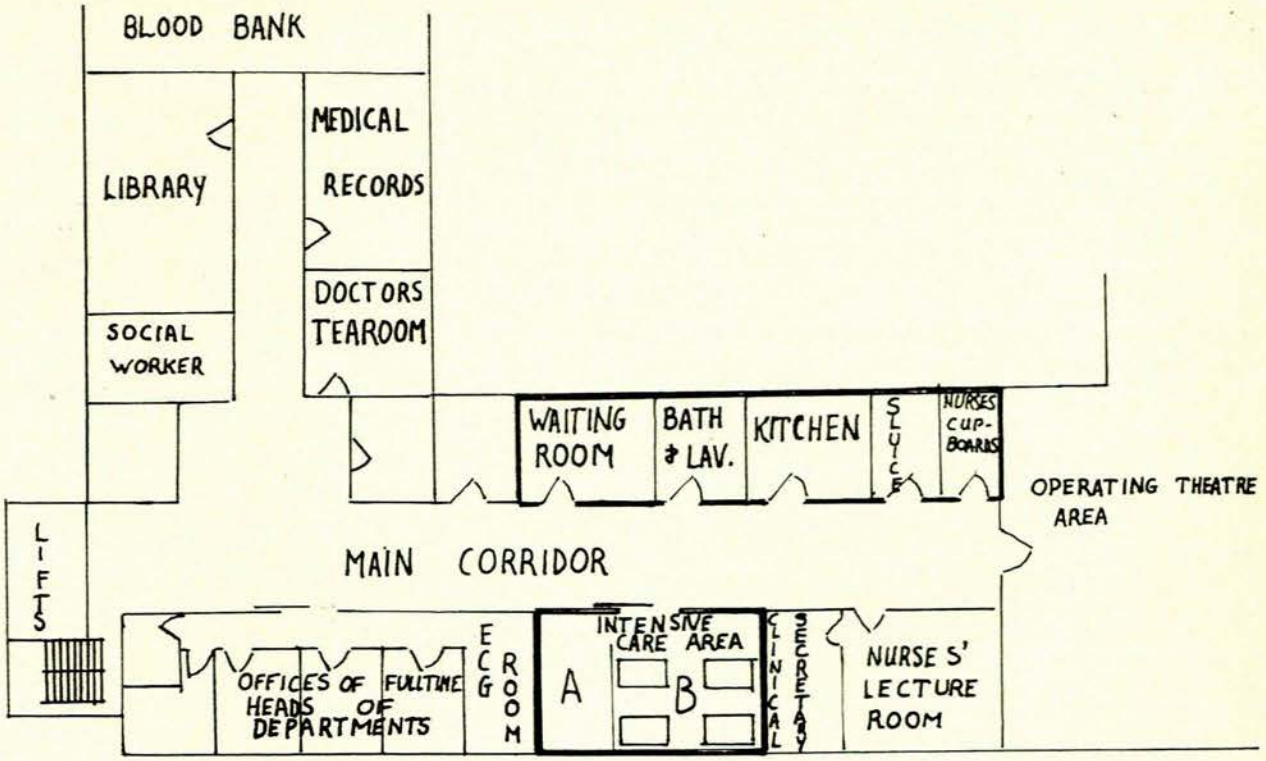

Fig. 1. Intensive care area and supporting facilities (heavily outlined) and environs.

A number of opinions were sought, regarding both the clinical management of the problems envisaged[2,3] and the selection of a second respirator,[4,5] and it was decided to purchase a Bird Mark VIII, which can be worked directly from an oxygen line at suitable pressure, or an air compressor.

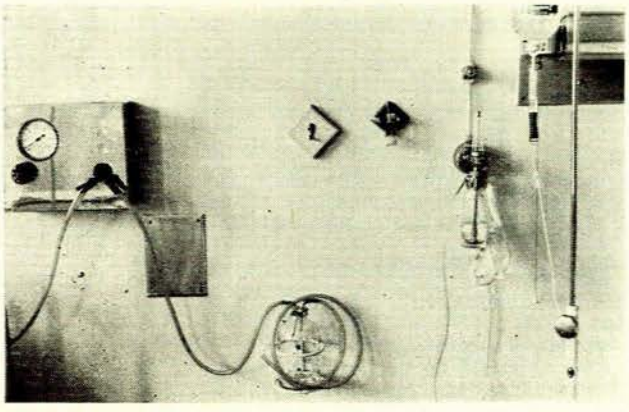

Fig. 2. Wall fittings in ICU. On the left is a water vacuum suction apparatus with 2 taps; on the right is a Drager oxygen meter.

The compressor was located in the service area so as to cause minimal disturbance to the patients in the ward and a hole was drilled in the wall through which the pipeline to the machine was passed.

A complete set of intubation equipment was assembled together with a Wright's respirometer for monitoring purposes.

The Electrodyne monitor alarm was transferred to the ICU, and a USCI bipolar pacemaker electrode catheter and a small portable external transistor pacemaker of the Wentworth Hospital pattern were obtained.

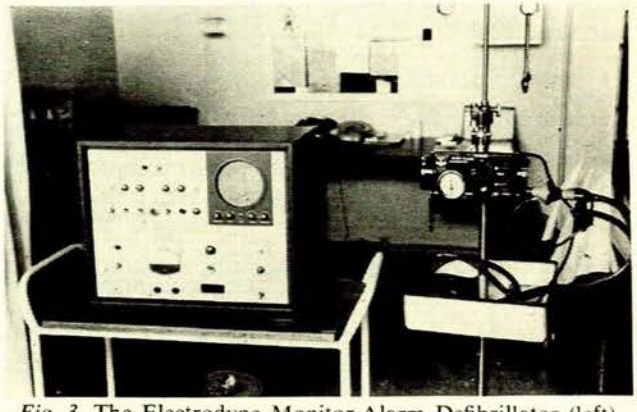

Fig. 3. The Electrodyne Monitor-Alarm Defibrillator (left) and the Bird Mk. VIII Respirator (right).

Subsequently an Electrodyne Oscilloscope Monitor-Alarm system (Model M.S. 25) has been purchased which allows 2 patients to be monitored simultaneously. Lastly, the cupboards were stocked with intravenous fluids and drugs, and simple furniture for the nursing station was provided, and at the beginning of September 1967 the ICU was ready to receive patients.

Staffing and Control

Medical staff. The over-all control of the unit rests with the Medical Superintendent. It is essential to have a single authority who decides which patients will or will not be admitted, particularly when the demand exceeds the number of beds—although this has seldom arisen.

There is no single expert in clinical charge of all cases, and patients remain under the care of the physician or surgeon under whom they were admitted. The head of the department of medicine has supervised the good order and maintenance of the biometric and electronic equipment, while the department of anaesthetics cares for the respirators and other respiratory equipment.

Regrettably, owing to shortage of resident staff, it has not been possible to provide continuous medical care at the registrar level in the unit itself, although after normal working hours an intern and registrar from each of the departments of medicine and surgery are on call at all times.

Nursing staff. The constant supervision and close observation of the patients have been delegated to the nursing staff of the unit, which comprises: 1 sister in charge; 3 or 4 staff-nurses; 4 student nurses; and 1 ward cleaning maid. This provides cover for night duty and allows for time off. Table II shows a typical duty roster for 1 week. During quiet periods the sister in charge instructs the student nurses in the care and use of the equipment and the keeping of ½-hourly observations. If necessary, some of the staff return to general duties in the hospital, but they retain their ICU status on and off duties and can be returned to the unit within minutes. All student nurses spend one month in the unit during their training.

TABLE II. A TYPICAL NURSING OFF-DUTY ROSTER

Staff member	*Day of week*						
	Sun.	*Mon.*	*Tues.*	*Wed.*	*Thur.*	*Fri.*	*Sat.*
Sister	1–7	1–4	4–7	7–1	4–7	4–7	DO
Staff-nurse	DO	4–7	1–4	1–7	1–4	1–4	1–7
Staff-nurse	7–1	ND	ND	ND	SD	DO	7–1
Staff-nurse	ND	NO	NO	NO	ND	ND	ND
Students:							
Student nurse 1	10–3	5–8	4–8	DO	5–8	2–5	2–5
Student nurse 2	DO	7–12	2–5	5–8	5–8	5–8	5–8
Student nurse 3	3–8	2–5	5–8	2–5	2–5	4–8	DO
Student nurse on night duty	ND	ND	ND	ND	ND	NO	NO
(Relief nurse)						ND	ND

ND = night duty; NO = night off; DO = day off; SD = sleeping day.
Time periods refer to times when off-duty.

Clinical Experience

The first patient was admitted to the ICU on 6 September 1967, and by 5 September 1968 145 patients had been treated, of whom 25 died, giving an over-all mortality of 17·2%.

Of these, 88 patients were surgical (Table III), of whom 14 died, giving a mortality of 16% (Table IV) and there were 57 medical cases (Table V) with 11 deaths—a mortality of 19·3%.

The average duration of stay was 4 days, being 4·3 days in the case of the surgical patients and 3·2 days for the medical cases.

TABLE III. SURGICAL CASES TREATED IN THE UNIT (TOTAL 88)

	No. of cases
I. *Major trauma including multiple injuries from traffic accidents*	
(*a*) Predominantly head injuries	14
(*b*) Multiple injuries including head, abdomen and fractures	11
(*c*) Fractures of extremities only	3
(*d*) Trauma due to causes other than traffic accidents	2
Total	30
II. *Postoperative care of major abdominal surgery* including gastrectomies, cholecystectomies in bad risk cases, abdominoperineal resections, colectomies, etc.	28
III. *Vascular surgery* including endarterectomies, bypass procedures and aneurysm repairs	7
IV. *Other conditions*	
Tracheostomies for conditions other than head injuries	3
Monitoring after cardiac arrest at surgery	3
Evacuation of subdural haematoma	1
Repair of oesophageal atresia	1
Resection of carcinoma of mandible	1
Thyroidectomy	1
Cervical fusion in severe rheumatoid arthritis with early cord compression	1
Repair of large incisional hernia	1
Repair of wound dehiscence	2
Major urological procedures	3
Repair of hiatus hernia	3
Thoracotomy	2
Obstructive jaundice for investigation (critically ill, died pre-op.)	1
Total (II, III and IV)	58
Grand Total	88

TABLE IV. SURGICAL MORTALITY

Diagnosis	*No. of cases*
Multiple injuries including motor accidents	6
Resuture of wound dehiscence	2
Ruptured aortic aneurysm	1
Resection of abdominal aneurysm	1
Obstructive jaundice for investigation (elderly, frail, critically ill, died pre-op.)	1
Evacuation of subdural haematoma	1
Laparotomy in patient with severe emphysema	1
Repair of hiatus hernia and oesophageal structure	1
Total	14

TABLE V. MEDICAL CASES TREATED IN THE UNIT

Condition	*No. of cases*	*No. of deaths*	*Average stay (days)*
Coronary occlusion	22	5	3
Status asthmaticus	6	3	1
Drug overdose	5		1·2
Complete heart block (with or without CT)	5		7
Arrhythmia, monitored or converted	5		1·6
Acute respiratory failure added to chronic obstructive airways disease	3	1	3
Malignant hypertension	2		5
Acute respiratory infection in children	2		5·5
Peritoneal dialysis	1	1	1
Coma, undiagnosed	1		7
Hepatic failure	1		1
Meningococcal meningitis with respiratory failure	1	1	9
Severe pneumonia	1		2
Penicillin anaphylaxis	1		1
Status epilepticus	1		5
Total	57	11	3·2

DISCUSSION

Gotsman and Schrire[6] have pointed out that coronary care units have reduced the mortality of coronary occlusion from 30% to 15%.

The mortality at Groote Schuur Hospital, using standard methods, was 27% before the introduction of intensive care.

The mortality of our coronaries admitted to the ICU over the 12-month period has been 22%. This does not comprise all coronaries admitted to Grey's Hospital during the period under consideration, as a number were not monitored at all and were not admitted to the ICU.

Moreover, a number of desperately ill patients admitted to the ICU may have died, no matter how treated, so that the group treated in our ICU is somewhat loaded yet still shows a slightly lower mortality than figures given where intensive care was not applied. All coronary occlusions dying in the ICU have done so within the first 24 hours.

Gotsman and Schrire have further rightly pointed out that a trained physician should be within the ward precinct throughout the 24 hours. This has not been possible for us and we have had to depend upon early warnings such as extrasystoles seen on the oscilloscope screen, when, for example, a standard lignocaine infusion can be instituted. The nursing staff have been trained to recognize and report immediately any deviations from the normal wave pattern on the oscilloscope, and interns and registrars are trained in the use of the defibrillator and antiarrhythmic drugs since they are often the first doctors on the scene. Without doubt our mortality has been reduced, but ideally we feel that coronaries should be treated in an isolated part of an ICU, as the disturbance caused by other patients in the unit frequently prevents them from having the peace and quiet they so urgently require. We feel, moreover, that all cases of myocardial infarction should have the benefit of 48 hours of intensive care as it is well known that patients who can be classified as 'good risk' cases initially may rapidly assume a very different outlook. These are the patients who may die of a sudden arrhythmia rather than from what Gotsman and Schrire refer to as pump failure. This would contribute to an increase in the number of beds approaching the ideal of 1 - 2% in the district hospital given by Sherwood Jones.[7]

Acute respiratory problems, both medical and surgical, place a big demand upon an ICU. Campbell *et al.*[8] have pointed out the desirability of separate facilities for intensive respiratory care. Before the establishment of our ICU, patients at Grey's Hospital needing respirator care were looked after in a suite of single and double wards which had originally been used as a respiratory unit during a previous poliomyelitis epidemic. The Bennett respirator has remained in the old unit and the Bird Mk. VIII has been used for the ICU, so that we now have facilities for the separate care of acute and chronic respiratory problems. We have neither the staff nor the facilities to separate all respiratory problems of a medical nature from the ICU.

Of the 3 cases of acute respiratory infection following chronic obstructive airway disease, one died. In one of the two survivors a tracheostomy and intermittent positive-pressure ventilation with the Bird apparatus were livesaving. Proper attention to physiotherapy, antibiotics and aerosols, and, above all, careful oxygen administration have kept many potential patients out of the ICU. A report of the findings of Sund Kristensen *et al.*[9] has been most useful in the proper selection of cases.

The high mortality (50%) in patients with status asthmaticus is noteworthy, and a possible lesson to be learnt is the earlier transfer of such cases to the unit before the situation becomes desperate. It has usually been found more convenient to perform peritoneal dialyses in the general wards. Thus, only one was performed in the ICU during the year.

Surgical cases which have been treated in the ICU have comprised mainly accident cases with multiple and extensive injuries and patients who have been to theatre for extensive and major surgery. They have been admitted because they needed the constant care and observation that the skilled and experienced nursing staff in the ICU could give them. Previously, the return of such patients to a general ward interfered greatly with the routine care of other patients.

The average length of time for which surgical cases have been kept in the ward has been 4·3 days. These patients tended to require close attention to fluid balance, while tracheostomies and various drainage tubes were common. In exceptionally ill patients the time has been extended up to 19 days, whereas many are fit for transfer to a general ward within 48 hours. In view of the critical condition of many of these patients the figures for mortality and length of stay are not unduly high.

CONCLUSION

Our experiences over the year have left us in no doubt regarding the improvement of standards despite the absence of a sophisticated layout and unlimited equipment.

Intensive supportive treatment by selected trained nursing staff, including the intelligent use of complicated equipment, has given many patients the optimum chance of survival.

SUMMARY

The establishment of an intensive care unit at a 500-bedded hospital is described.

The method of planning, equipping and staffing is described, together with the experiences of the first 12 months of operation. During this time 145 patients were treated, of whom 88 were surgical and 57 were medical. There were 25 deaths, giving a mortality of 17·2%. The mortality for surgical cases was 16% and for medical cases 19·3%. The average duration of stay in the unit was 4 days, being 4·3 days for surgical cases and 3·2 days for medical cases.

We wish to thank Dr L. Fernley, Medical Superintendent, for permission to publish this report. It was due to his untiring efforts and ingenious improvization that formidable difficulties were overcome.

We should also like to thank the Principal Matron, Mrs G. K. Gray, for her co-operation in planning and making available the nursing staff so necessary to maintain the unit, and Sister A. J. Schlebusch and her staff for their hard work during the year.

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