INTENSIVE CARE IN THE BELFAST CITY HOSPITAL

The First Two Years — an Audit

by

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The Intensive Care Unit, Belfast City Hospital

THE Intensive Care Unit (ICU) in the Belfast City Hospital was opened on 1st September, 1978. The object of this paper is to present an audit of the first two years work. The ICU is a four-bedded unit which was intended to provide support for the needs of the acute services of the South Belfast Group. The main hospitals are the Belfast City Hospital (1116 beds) and the Musgrave Park Hospital (700 beds). A breakdown of the bed complements is shown in Table 1. It can be seen that there are a total of 600 beds providing acute medical, surgical and gynaecological care. Patients requiring specialised investigations or surgical intervention for cardio-thoracic or neurosurgical problems are referred directly or indirectly to the Respiratory Intensive Care Unit at the Royal Victoria Hospital.

**Table 1**

| Belfast City Hospital | Musgrave Park Hospital |
|-----------------------|------------------------|
| Total Beds            | 1116                   |
| General Medicine      | 180                    |
| Surgery               | 142                    |
| Acute Orthopaedics    | 48                     |
| Gynaecology           | 34                     |
| Obstetrics            | 79                     |
| Other                 | 633                    |
| Total Beds            | 700                    |
| General Medicine      | 82                     |
| Surgery               | 80                     |
| Gynaecology           | 32                     |
| Orthopaedic           | 300                    |
| Other                 | 206                    |

THE UNIT

The building is a converted staff canteen adjacent to the main operating theatres. It had previously been used as a postoperative recovery room. Two beds are in separate cubicles, while two more beds are situated in the large open area. The lay-out of the building does not lend itself to easy expansion beyond four beds.

The function of an ICU will not be defined. The unit was set up because anaesthetists and surgeons were dissatisfied with the quality of care that patients were received after major surgical interventions. In addition, the new Central
Hospital is designed to include an eight-bedded ICU, and it was considered essential that experience in this type of work be gained before the new hospital opens. The unit opened with sufficient nursing staff to care for two critically ill patients. This was patently inadequate to serve the needs of 600 acute beds, and led to immediate problems when excessive demands were made on the unit. At the end of the first year staff shortages due to resignations and sickness were so acute that for a time only one patient could be cared for. The second year has been fraught with fewer difficulties of this kind with the recognition of the demands made on the unit, and the need to maintain a high nurse to patient ratio.

Medical cover has been shared by four consultant anaesthetists, with one junior anaesthetist assigned on a monthly rotation, and additional night cover using a three or four tier on-call rota.

**ADMISSIONS**

The admission policy has been unrestricted. Providing there is a reasonable prospect of restoring the patient to an acceptable level of health all who require facilities for mechanical support of breathing, close monitoring, or intensive therapy are accepted. The number of patients admitted in the first year was 227, giving a bed occupancy of 2.1 (53 per cent of maximum). In the second year there were 162 admissions, and the bed occupancy averaged 2.6 (65 per cent) and ranged from 35 to 95 per cent on a monthly average. Admission categories are shown in Table 2, and it is clear that the majority were postoperative; these patients required either respiratory support, controlled oxygen therapy, electro-cardiographic monitoring, or close observation of vital functions.

| Reason for Admission                      | Number of Patients | Per cent of Admissions |
|------------------------------------------|--------------------|------------------------|
| Postoperative                            | 269                | 69.2                   |
| Respiratory failure                      | 47                 | 12.1                   |
| Neurological (head injury, epilepsy)     | 37                 | 9.5                    |
| Overdose                                 | 24                 | 6.2                    |
| Abdominal (pancreatitis, etc)            | 8                  | 2.1                    |
| Cardiac                                  | 2                  | 0.5                    |
| Renal failure                            | 2                  | 0.5                    |
| **Total**                                | **389**            |                        |

The average age of the patients was 54 years (range 10-90), and 50 per cent were aged 60 or more. Sixty per cent were male. The length of stay in the ICU varied from a few hours to 104 days, the average being 4.1 days. Twenty-one per
cent of patients were ventilated with a mechanical respirator (average time of ventilation was six days), while a further 5 per cent were intubated and received controlled oxygen therapy via a 'T-piece' without artificial ventilation.

DEATHS

Eleven per cent of the patients admitted during the first year died in the unit. The mortality during the second year was 14.8 per cent, giving an overall mortality for the two year period of 12.6 per cent. The average age of the patients who died was 62 years. There was a "late" mortality (after discharge from the unit but before discharge from hospital) of 3.6 per cent and the average age of these patients was 56 years.

It is not always possible to give a precise cause for death. Of the 49 deaths which occurred in the unit, 75 per cent were considered to be due to a combination of respiratory failure combined with a surgical complication (sepsis, renal failure or shock). Some patients who survived for several days in the unit developed "multi-organ" or multiple systems failure with almost simultaneous failure of a number of major organs including the heart, liver, kidneys and brain. The remaining deaths were nearly equally divided between primary cardiac or neurological causes, with only two deaths being due to overdose and one to primary renal failure.

PSYCHOLOGICAL PROBLEMS

Intensive care units are a potent source of psychological problems. Anxiety, exhaustion and communication difficulties have been identified as particular problems. Tomlin described reactive apathetic depression occurring when the patient had got over the worst of his illness and was apparently getting better. Marked intolerance to physical disturbance by nurses and physiotherapists was a feature and these patients may inflict physical harm on their attendants. Some patients are most reluctant to allow the ventilator to be removed from the bedside when weaning after respiratory failure has been prolonged or difficult. About one quarter of all patients had no memory of their stay in the ICU, although, unlike patients in coronary care units, most were pleased to return to their own ward since this was a land-mark in their recovery.

Psychological pressures are just as severe for the nursing staff. The close contact with death, the inability to relax, the technical equipment which has to be mastered and the general air of anxiety is too much for some to cope with. The attitudes of medical staff and senior nursing administrators can make or break the morale of a unit. A degree of over-staffing may be necessary to cope with unexpected absences and illness. Background music is helpful to both staff and patients. Short periods of relative inactivity should be welcomed as an opportunity for teaching and to allow the staff to recharge mental batteries.
CONTROL OF INFECTION

Intensive care units present an obvious hazard to the patients being treated in them. The accumulation of a number of compromised hosts in a small area provides a fertile medium for the development and spread of infection. On two occasions Pseudomonas aeruginosa has colonised all the patients in the unit. These episodes presumably reflect transfer of organisms from patient to patient by the staff. Such problems have largely been eliminated by common-sense restriction of equipment to one patient only and allocation of one nurse to look after one patient during her tour of duty. On one occasion, Klebsiella aerogenes was probably passed from one patient to another by a breakdown in ventilator sterilization procedures. Patients with potentially infective lesions or those who have an increased susceptibility to infection are, whenever possible, nursed in a cubicle.

COST

The exact cost of patient care under the National Health Service is remarkably difficult to determine. We have attempted to calculate the annual cost of running the unit and the cost of care per patient/day. The basic salaries of the nursing staff and auxiliaries are known. Medical staff salaries are assumed to be the equivalent of a full-time consultant and two senior house officers. Overtime payments are not included. Central sterile and pharmaceutical supplies were costed over three months and averaged over a year with allowance for bed occupancy. These may well be underestimated since both these departments are reassessing their methods of estimating costs. Bills for routine and emergency servicing of equipment are included. However, costs of heating, light, power, X-rays, laboratory and other special investigations are not included. All prices are as of January, 1980 (Table 3). The average daily cost per patient was £148 and the true cost probably nearer £170. This was approximately 3.5 times the average per patient/day for the hospital as a whole.7

Table 3

Estimated annual costs of running the ICU for the two years September, 1978 to August, 1980. Prices as of January, 1980. Capital equipment totalled approximately £60,000.

| Item                              | Cost (£) |
|-----------------------------------|----------|
| Nursing and auxillary             | 55,000   |
| Medical                           | 27,000   |
| Central Sterile Supplies          | 23,000   |
| Pharmaceutical Supplies           | 21,000   |
| Routine maintenance of equipment and emergency repair | 2,500   |
| Total                             | 128,500  |
Comparing costs of different units is probably irrelevant since the work undertaken can be so varied. However, some observations on our figures may be of interest. Salaries and wages are a major item of expenditure and since these units are so demanding of manpower, economics cannot be made here. Suction catheters made up from one third to one half of the cost of sterile supplies in any month. We have tried re-sterilising these, but the results were highly unsatisfactory. Of the pharmaceutical items, antibiotics made up 24 per cent, intravenous and parenteral feeding solutions 18 per cent, and muscle relaxants (for patients being artificially ventilated) 12 per cent, the annual cost of the latter item being nearly £3000.

An alternative method of costing patient care was suggested by Cullen. He used the Therapeutic Intervention Scoring System which attempts to classify the severity of illness by quantitating the therapeutic interventions, these being scored on a 1 to 4 basis, according to the time and effort required for nursing care. For example, routine ECG monitoring would score 1 point, a central venous pressure (CV1) line 2 points, an arterial line 3 points and a pulmonary artery catheter 4 points. This approach overlooks the prophylactic value of intensive care, where a simple manoeuvre such as chest physiotherapy or ECG monitoring and arrhythmia detection (which score one point each) may prevent a major crisis requiring bronchoscopy or cardio-pulmonary resuscitation which score 4 points.

DISCUSSION

Three hundred and eighty-nine patients were admitted to the unit in the period under review. One hundred and forty-one were critically ill, 49 died in the unit and a further 12 died later, so that perhaps 80 patients (21 per cent of admissions) might have died without intensive care. If the unit existed purely to save life, then each life “saved” cost an average of £3200. Tomlin considered that 80 per cent of the patients admitted to his ICU would not have survived without intensive care facilities, but this figure seems unduly optimistic.

Our experience in the treatment of septic shock confirmed the value of aggressive therapy and early institution of intermittent positive-pressure ventilation. An aggressive approach to postoperative surgical problems was also found to be beneficial in terms of patient survival. On the other hand, severely ill elderly patients who continue to require a high level of therapeutic intervention after days of intensive care were unlikely to survive, and put a considerable strain on manpower and resources. A reliable means of predicting an unsatisfactory outcome would be of great value.

Is intensive care justified? Some would argue that intensive care units remove the most skilled nurses from the wards, others that the ability of ward personnel to deal with sick patients lessens as difficult cases become sequestered in the ICU. On the other hand, no one will deny the value of close observation of ill patients. During periods when the ICU was full, several postoperative deaths occurred in the wards. These deaths were probable preventable. Tarhan et al showed that
patients who had suffered a myocardial infarction 6 months or more before surgery had a 5 per cent incidence of re-infarction postoperatively, that half the infarcts were fatal, and that a significantly higher number of infarctions occurred on the third day after surgery.

Apart from considerations of mortality, there are obvious advantages in concentrating highly skilled nurses and sophisticated, expensive equipment in one area. An unknown number of patients may have benefited from careful monitoring and supervision in the early postoperative period. Pain relief with local anaesthetics or small doses of morphine injected through an epidural catheter has virtually abolished postoperative distress in selected patients. The experience gained in the unit can be applied to less ill patients in both the operating theatres and in the wards. Procedures which are now standard in the ICU are being used with increasing frequency in other areas of the hospital, hopefully leading to a corresponding reduction in morbidity and hospital stay.

SUMMARY

The Intensive Care Unit in the Belfast City Hospital opened on 1st September, 1978. In the first two years, 389 patients were admitted. Of 141 patients considered to be critically ill on admission, 80 survived who would probably have died without intensive care. This form of care is expensive, the daily cost being about three and a half times the average for a hospitalised patient.

We are indebted to all the nursing, medical and ancillary staff who have worked in the unit, without whose enthusiasm and devotion this paper could not have been written.

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