Annals of the Royal College of Surgeons of England (1989) *vol.* 71

Outcome of mechanical ventilation in Sri Lanka

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Key words: INTENSIVE CARE; MECHANICAL VENTILATION; SRI LANKA

Summary

The outcome of mechanical ventilation is reported in a series of 43 patients managed in an intensive care unit in Sri Lanka. Eighteen patients (42%) survived. Of these, all except one were discharged from hospital. Patients with organophosphate poisoning and Guillain–Barré polyneuritis had a mortality of 47% and 50% respectively. Patients who were ventilated postoperatively as a result of anaesthetic complications during surgery had a mortality rate of 20%. Patients with tetanus and myasthenia gravis had 100% recovery. The following categories of patients had a poor prognosis with 100% mortality: patients with severe head injuries, subarachnoid haemorrhage, non-traumatic coma, severe chest injuries and porphyria. The series is compared to similar series from other countries.

Introduction

Well-equipped intensive care units with facilities for long-term artificial ventilation are present in most hospitals in the developed countries. Such units comprise 1% of acute hospital beds in the UK and 15% in the USA *(1)*. In Sri Lanka, due to economic constraints, only five large hospitals are equipped with intensive care units where long-term artificial ventilation can be undertaken. Even in these hospitals only about 0.25% of hospital beds are devoted to intensive care. The aim of this study is to evaluate the effectiveness of mechanical ventilation at the Genral Hospital Kandy (Teaching), Sri Lanka.

Methods

THE INTENSIVE CARE UNIT

The General Hospital, Kandy, is the second largest teaching hospital in Sri Lanka with 1395 beds overall and a surgical intensive care unit (SICU) of four beds. The hospital serves a population of 2.5 million.

STAFFING

The unit is staffed by one sister and eight nurses. There are no resident medical officers in the unit. The doctors attached to the units under which the respective patients were originally admitted and the three consultant anaesthetists attached to the hospital are on call for the unit. The consultant anaesthetists take turns to perform an administrative role in the unit, as well as to supervise the patients while at the same time covering regular operating lists and being on call for emergencies.

EQUIPMENT

The patients are ventilated using one of three electric powered ventilators available in the unit: one East Radcliffe ventilator and two Bromptom Blease ventilators. Electric powered hot water humidifiers are used to humidify the inspired gases.

Although the unit has a sophisticated AVL 945 blood gas analyser it is very often out of order due to lack of trained personnel and equipment needed to maintain and repair it. Blood gas and pH measurements are therefore generally not available. Two Wright respirometers are available.

Suction is provided by two or three electric powered suckers. Standard haematological, biochemical and microbiological investigations and portable X-ray facilities are available as well as an ECG monitor.

Nurses are trained to ventilate the patients manually using an Ambu bag in case of power failures. A standby power generator provides electricity in case of main electricity failures.

Patient management

Patients are admitted to the unit on referral from the consultants at the General Hospital, Kandy. Since the hospital has a separate coronary care unit, cardiac patients are not admitted to the unit. Although preference is given to surgical problems, patients with non-surgical conditions needing intensive care are also admitted, space permitting. All patients in the hospital who need long-term artificial ventilation are treated in the unit, space permitting, except very small children as there is no paediatric ventilator.

The summary of each patient's notes is entered in a file assigned to each patient by one of the consultant anaesthetists before discharge.

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Results

SURVIVAL

During the period of study, from 1 January 1987 to 31 December 1987, 113 patients were treated in the unit. Of these, 43 (38% of admissions) needed mechanical ventilation and, of these, 18 patients (42%) were returned to the general ward but one died later in the ward. The other 17 patients recovered completely and were discharged from hospital. The quality of life of those who survived ventilation was good. There were no residual disabilities attributable to ventilation.

AGE DISTRIBUTION

Table I shows the age distribution of the patients. Thirty-two (75%) of the patients ventilated belong to the age group 15–59 years, ie the most productive age group. The mortality was lowest in the age group 15–29 years.

DURATION OF VENTILATION

Tables II and III show the distribution of duration of ventilation. Intermittent Positive Pressure Ventilation (IPPV) lasted from a minimum of 4 h to a maximum of 20 days, with an average duration of ventilation of 5.3 days. Table II shows that on average patients who survived needed ventilation for twice as long as those who died. Of the 25 patients who died in our series, nine (36%) died within the first 24 h. On the other hand, only two of the survivors needed ventilation for less than 24 h.

TABLE I *Relationship between age distribution and mortality*

Age group	*No. of patients (n=43)*	*Deaths (n=25)*	*Mortality rate (%)*	*Survivors (n=18)*	*Survival rate (%)*
0–15 years	5	4	80	1	20
15–29 years	20	9	45	11	55
30–44 years	8	5	62.5	3	37.5
45–59 years	4	4	100	0	—
60–65 years	4	2	50	2	50
65+	2	1	50	1	50

TABLE II *Distribution of duration of ventilation*

	Survivors (n=18)	*Deaths (n=25)*
Shortest	6 h	4 h
Longest	18 days	20 days
Average	7.9 days	3.8 days
Range	17 days 18 h	19 days 20 h

TABLE III *Relationship between the duration of ventilation and outcome*

No. of days on ventilator	*No. of patients (n=43)*	*Survivors (n=18)*	*Survival rate (%)*	*Deaths (n=25)*	*Mortality rate (%)*
0–24 h	11	2	18	9	82
1–2 days	5	0	—	5	100
3–4 days	7	3	43	4	57
5–8 days	9	4	44	5	56
9–16 days	8	7	87.5	1	12.5
16 days+	3	2	67	1	33

Of the seven patients who needed ventilation for more than 10 days, six recovered. This suggests that the deaths of the ventilated patients were due to the severity of the original pathology rather than to the complications of ventilation. Table III shows that the survival rate improved with increase in the duration of ventilation.

DIAGNOSTIC GROUPS

Table IV shows the distribution of the different diagnostic groups ventilated with their mortalities. Patients with organophosphate poisoning constitute the largest single diagnostic group, making up 40% of those ventilated, with a mortality rate of 47%. Some of these patients were deeply unconscious and had vomited and aspirated prior to admission.

Six patients with Guillaine-Barré polyneuritis were ventilated, three of whom recovered.

The postoperative group consisted of three patients with Mendelsohn's syndrome (one of whom died) one patient with bronchiectasis who needed IPPV for 4 h following a laparotomy, and one patient who had a cardiac arrest during recovery from general anaesthetic. This last patient was successfully resuscitated and required IPPV for 6 h.

Medical causes of coma included encephalitis (2 patients) and one case of uncertain aetiology, probably typhoid.

The patients with head injuries and subarachnoid haemorrhage had severe brain damage before admission to the unit. Two of them had fixed dilated pupils at the time of starting ventilation, both having been transferred from other hospitals. We had no means of monitoring intracranial pressure.

Three patients with severe chest trauma had multiple rib fractures, flail segments and contused lungs. In the absence of blood gas and pH estimations we were unable to adjust their respiratory and biochemical parameters adequately. Presumably they died of Adult Respiratory Distress Syndrome.

Ventilatory accidents were the cause of death in two patients. One patient recovered partially, became restless and pulled out the endotracheal tube. By the time an anaesthetist was summoned the patient had suffered

TABLE IV *Relationship between the different diagnostic groups and mortality*

	No.	*% of Admissions*	*Death (n=25)*	*Survivors (n=18)*	*Mortality rate (%)*
Organophosphate poisoning	17	40	8	9	47
Guillain-Barré syndrome	6	14	3	3	50
Postoperative	5	11.6	1	4	20
Chest trauma	3	7	3	0	100
Coma (medical)	3	7	3	0	100
Head injuries	3	7	3	0	100
Subarachnoid haemorrhage	2	4.6	2	0	100
Tetanus	1	2.3	0	1	—
Myasthenia gravis	1	2.3	0	1	—
DIC	1	2.3	1	0	100
Porphyria	1	2.3	1	0	100

DIC, Disseminated Intravascular Coagulation

brain damage. The second patient had recovered sufficiently to be able to breathe spontaneously; the endotracheal tube was retained in place, however, since it was felt that this would facilitate ventilation if the respiration became depressed again. The tube became blocked and the absence of a resident anaesthetist in the unit proved fatal. These two accidents were particularly unfortunate since they were avoidable and directly attributable to ventilation. Early tracheostomies are now performed in patients who need ventilation. These are easier for the nursing staff to manage in the absence of a resident anaesthetist.

Although there was a high incidence of respiratory infections, none proved resistant to antibiotics.

There was one death from renal failure.

Uncontrollable tachycardias and cardiac arrhythmias occurred in patients with Guillain-Barré polyneuritis, in spite of prophylactic treatment with β-blockers.

Discussion

Management of patients in intensive care units is expensive. In Britain the cost of a bed in an ICU is about four times that of one in a general ward *(2)*. Because of economic constraints we are unable to have a resident medical officer in our surgical intensive care unit. Furthermore, in our hospital only 0.28% of the total bed strength is allotted to intensive care, while in Britain such units comprise 1% of acute hospital beds and in the USA, 15% of acute hospital beds.

The selection of patients for intensive care therefore has necessarily to be more stringent and the care even more meticulous in Sri Lanka than in the developed countries. We admit patients to our unit only on referral from other consultants in the hospital. Every attempt is made to confine admissions to those with recoverable diseases.

The overall mortality rate of 58% in our series is less than that reported from other developing countries. Sinclair *et al. (3)* reported a mortality of 74% from Zambia. From Nigeria, Oji *(4)* reported a mortality rate of 83.3%.

Similar series in the developed countries of Europe and USA reported mortalities between 30% and 57%; in 1979, Nunn *(2)* reported an ICU mortality rate of 33%, and 20% mortality in the ward. In 1984, Cullen *(5)* reported a mortality rate of 57% after one month, while in 1974 Bell *(6)* reported a mortality rate of 30.4%.

However, the mortality in any ICU depends upon the condition of the patients admitted to the unit, the spectrum of diseases treated and the facilities available.

In our series the mortality rate was greatest within the first 24 h and the mortality rate decreased as the duration of ventilation increased. If the mortality during the first 24 h is excluded from this study the mortality in the series decreased to 44%. Nunn *(2)* excluded all patients ventilated for less than 4 h from his series which had a mortality rate of only 30%. Patients ventilated for less than 24 h also did well in his series with an ICU mortality rate of 7%. This may be due to the high proportion of postoperative patients he electively ventilated. No postoperative patients were electively ventilated in our study.

In our experience, patients who were ventilated postoperatively because of anaesthetic complications during surgery had a good prognosis, with a mortality rate of 20%.

Patients with tetanus and myasthenia gravis (one patient each) had 100% recovery. Those with organophosphate poisoning and Guillain-Barré polyneuritis had mortality rates of 47% and 50% respectively.

The patients who needed ventilation following bad head injuries had a poor prognosis with 100% mortality in our series. This finding is supported by others. Searle *(7)* reported 23 deaths out of 36 patients ventilated for head injuries, Jennet *(1)* reported that mechanical ventilation was associated with a greater than expected head injury mortality and Sinclair *et al.* reported a mortality rate of 85.1% *(3)* in similar patients.

Patients with subarachnoid haemorrhage, non-traumatic coma, severe chest injuries, or porphyria had a poor prognosis with 100% mortality.

We wish to thank all the other consultants at the General Hospital Kandy (Teaching), the house officers in the respective units and the house officers in anaesthesia who helped to look after the patients. We also wish to thank the sister and nursing staff of the Surgical Intensive Care Unit for looking after the patients.

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Received 28 February 1989