THE IMMEDIATE OUTCOME OF VENTILATION FOR PULMONARY DISEASES

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ABSTRACT

Fifty-eight patients were ventilated for acute respiratory failure complicating respiratory diseases between 1985 to 1990. There were 19 cases of chronic obstructive airway disease (COAD), 17 cases of asthma, 16 cases of pneumonia and 6 cases with other diagnoses. Overall, 40% of patients survived and were discharged from the ward. Patients with pneumonia had the lowest survival rate (25%) whilst the survival rates for asthma and COAD were 47% and 42% respectively. Increasing age had an inverse relationship to survival rate ($r=-0.96$, $p<0.05$) but the duration of ventilation did not correlate with survival. Patients who were electively ventilated before respiratory arrest had a better chance of survival (57%) compared with only 18% survival rate in patients who were ventilated as an emergency ($x^2 = 4.47$, $p<0.05$). Patients who developed other organ failure had higher mortality (71%) than those who did not (22%; $x^2 = 2.14$, $p<0.05$). We conclude that patients younger than 50 years of age, who were electively ventilated and without other organ failure had a better immediate survival after assisted ventilation.

Keywords: assisted ventilation, respiratory failure, asthma, chronic obstructive pulmonary disease, pneumonia.

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INTRODUCTION

The majority of patients who present with acute respiratory failure can be managed successfully without mechanical ventilation[1-3]. In one prospective study, Martin et al found that 94% of such patients survived hospital admission without the need for assisted ventilation[3]. The decision to ventilate these patients requires good clinical judgement and must take into account the pre-morbid respiratory function and disability of each individual patient. Knowledge of the previous forced expiratory volume in one second (FEV_1), arterial blood gases, exercise capacity, and quality of life may be helpful, but this is not always the case[4] and such data are often unavailable at the time hard decisions have to be made.

Various pulmonary diseases may lead to acute respiratory failure requiring mechanical ventilation. The prognosis of these patients has improved since the advent of respiratory intensive care unit[5]. During the period from January 1985 to December 1990, 1,830 patients were admitted to Hospital University Sains, Malaysia with respiratory diseases (631 asthma, 321 chronic obstructive airway disease, 205 pneumonia, 99 bronchiectasis and 576 others). Fifty-eight of these patients (3.2%) were ventilated in the intensive care unit. The aim of this study was to evaluate the clinical outcome and prognostic factors for these patients who were ventilated due to respiratory diseases.

PATIENTS AND METHOD

The case records of 58 patients (23 males, 35 females) who were ventilated for pulmonary diseases between January 1985 and December 1990 at the Hospital Universiti Sains Malaysia, Kelantan were reviewed. There were 19 patients with chronic obstructive airway disease (COAD), 17 patients with acute exacerbations of bronchial asthma, 16 patients with pneumonia and 6 patients with other diagnoses [bronchiectasis (3); pulmonary haemorrhage (1); massive aspiration of blood after a motor vehicle accident (1) and adult respiratory distress syndrome (1)].

The patients were classified into those who were ventilated electively (as a result of deterioration of arterial blood gases, respiratory muscle fatigue and/or worsening level of consciousness) and those who were ventilated as an emergency procedure after the patients developed respiratory arrest.

Patients were considered to have survived if they could be taken off the ventilator and discharged either to home or to the general ward. Death was recorded if the patient died while he/she was on mechanical ventilation. The medical complications which occurred during assisted ventilation were also recorded.

Chi-square test of significance with Fisher's correction was used for all statistical analysis.

RESULTS

The diagnostic classification, sex distribution, the mean age and the overall survival of the patients are listed in Table I. There were almost an equal number of patients with COAD, asthma and pneumonia who were ventilated. The male to female ratio was 1.5:1 and male predominance was seen in all diagnostic groups except for asthma which had an equal sex ratio. The oldest patient was a 90-year-old man with

Table I - Comparative features of 58 patients who were ventilated for respiratory diseases.

Diagnosis	No. of patients		Age (Yrs) ventilation	Duration of of	Number of
	Female	Male	Mean+SD	Mean (days)	survivors
COAD	7	12	62.7+12.8	10.6	8
Asthma	8	9	42.4+16.2	7.6	8
Pneumonia	6	10	41.1+16.8	5.4	4
Others	2	4	35.1+8.8	17.0	3
Total	23	35	47.9+18.1	8.9	23 (40%)

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emphysema. The mean age of the patients was 47.9 ± 18 years (range 18 to 90 years). Patients with COAD were older than the others.

Overall, 40% of our patients survived ventilation. Patients who were ventilated as a result of respiratory failure complicating pneumonia carried the worst prognosis with only 25% of them surviving. Survival from the COAD and asthmatic groups was 42% and 47% respectively.

The age of the patient was inversely related to survival ($r=-0.96$, $p<0.05$) as shown in Fig 1. Less than 27% of those older than 50 years of age survived ventilation compared to 55% survival in the younger age group ($x^2 = 9.56$, $p<0.05$).

The duration of ventilation ranged from 0.5 to 54 days (mean 8.9 days). There was no correlation between the duration of ventilation and survival (Table II). Patients who were ventilated because of pneumonia had a shorter duration of ventilation with a mean of 5.4 days; many pneumonia patients died within 2 days of ventilation.

Forty-one patients (71%) were ventilated electively whilst 17 others were ventilated after they developed respiratory arrest (Table III). All patients who had respiratory arrest developed the arrest suddenly without any indication of worsening of respiratory function (symptomatically, serial peak flow or arterial blood gases). Patients who were ventilated electively had a significantly better survival (57%) compared to those who were ventilated as an emergency procedure (18%) ($x^2 = 44.67$, $p<0.05$). None of the patients with COAD survived after emergency ventilation while only 25% and 20% of asthmatic and pneumonia patients respectively survived emergency ventilation.

The development of complications during ventilation significantly affects survival. The medical complications that occurred during assisted ventilation are shown in Table IV. The two most frequent complications were septicaemia (14 patients) and cardiovascular problems; myocardial infarction and cardiac ventricular arrhythmias (11 patients). The mortality was higher in patients who developed one or more complications (71%) compared to only 22% mortality in those who did not develop any complication ($x^2 = 21.4$, $p<0.05$). Mortality was highest in those patients who developed cardiovascular complications and septicaemia. All patients who developed myocardial infarction died during mechanical ventilation and in all these cases death was attributed to the infarction. Five of the 14 patients (36%) who developed septicaemia died. The majority of them had associated disseminated intravascular coagulation.

Fig 1 – Percentage of survivors in relation to age

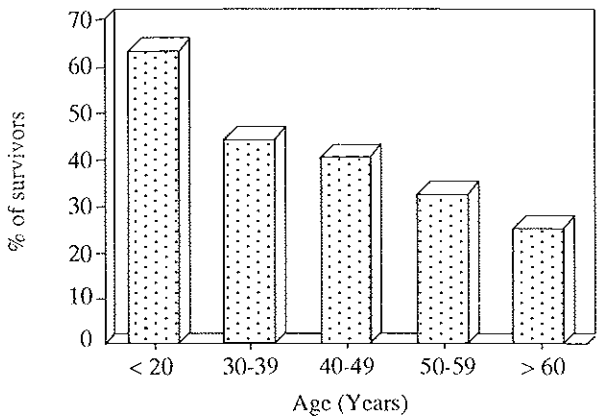

Table II - Relationship between the duration of ventilation to the survival rate in 58 patients who were ventilated for respiratory diseases.

Duration of ventilation (Days)	Number of patients	Number of survivors
Less than 2	15	6
3 – 7	21	5
8 – 14	12	5
15 – 21	4	2
More than 21	6	5

Table III - Survivors in relation to elective or emergency ventilation.

Diagnostic Groups	Elective ventilation		Emergency ventilation	
	Total	Survivors (%)	Total	Survivors (%)
COAD	13	8	6	0
Asthma	13	7	4	1
Pneumonia	11	4	5	1
Others	4	2	2	1
Total	41	21 (57%)	17	3 (18%)

$x^2 = 44.67$,
$p < 0.05$ significance.

Table IV - Medical complications during assisted ventilation and the rate of survival.

Complications	No. of patients	Survivors
Septicaemia	14	4
Cardiovascular		
- myocardial infarct	6	0
- ventricular arrhythmias	5	0
Acute renal failure	9	3
Pneumothorax	7	3
Gastrointestinal haemorrhage	4	1
Pneumonia	4	3
Pulmonary embolus	2	1

DISCUSSION

The 40% overall survival rate of patients who were ventilated for respiratory conditions in our series is comparable to that reported in other studies[6-8]. The survival amongst the various diagnostic groups did not differ significantly except for those patients who were ventilated for pneumonia, in whom the survival rate was only 25%. In the study done by Petheram and Branthwaite[8], 33% of patients who were ventilated for pneumonia survived.

The death rate in our asthmatic patients was very high (53%) compared to that found in other series, which reported

death rates of between 10% and 18%[8,9]. One possible explanation could be the delay in seeking medical attention by our patients when their acute attacks were not relieved by symptomatic therapy. Sixty-two percent of these patients had severe episodes of wheezing and breathlessness lasting longer than 24 hours before they were admitted to the hospital. The underestimation of the severity of airway obstruction by patients and the attending doctor, and the delay in instituting elective artificial ventilation as a supportive measure is commonly stated as the cause of mortality in asthma[10,11]. This factor may also have contributed to the low survival rate in our patients.

The inverse relationship between increasing age and survival was also noted by others[12,13]. Witek et al[13] found that successful extubation in elderly patients was not necessarily indicative of a good prognosis. They found a high mortality in this age group which occurred in the period between successful extubation and hospital discharge. In our series, all patients who were successfully taken off the ventilator survived. Consistent with other studies[12,13] we found that the duration of ventilation did not correlate with survival.

Temporary use of artificial ventilation as a supportive measure should be considered in all patients with acute respiratory failure who fail to respond to maximum medical therapy. We found that survival following assisted ventilation was better if the patients were ventilated electively. The survival rate in patients who were ventilated after the development of respiratory arrest was very poor. None of the COAD patients survived following respiratory arrest as compared to a survival rate of 61% if they were electively ventilated. In asthma and pneumonia patients, emergency ventilation reduced the survival rate to approximately half that of those who were ventilated electively. However, the decision to restrict assisted ventilation to patients who are expected to have a better prognosis raises serious ethical issues which would not easily be resolved.

Problems such as septicaemia, cardiovascular failure and renal failure were frequently found in association with respiratory failure in our patients. Mortality for those who developed multisystem failure was higher than in uncomplicated patients. Gillespie et al[6] have also shown an increase of mortality from 40% in uncomplicated cases to 81% in patients with multisystem failure. Kraman et al[14] emphasised the importance of sepsis as a complication associated with increased mortality in patients with acute respiratory failure. In addition to contributing to mortality, they showed that infection was also associated with renal failure, hepatic failure, coagulopathy and other problems. Twenty-four percent of our patients developed septicaemia and five of them (36%) died because of this complication. Cardiovascular complications are also grave prognostic signs. None of our patients who developed myocardial infarction or ventricular arrhythmias during ventilation survived. Myocardial infarction and arrhythmias were more common in those who were more than 50 years of age and known to have ischaemic heart disease. Burk and George[7] noted that cardiac arrhythmias occurred in 30% of their patients overall, but in 73% of those with evidence of coronary artery disease.

Other complications such as acute renal failure, upper gastrointestinal bleeding, pneumonia and pulmonary embolus also contributed to mortality in our patients. The recognition, prevention and appropriate therapy of these complications are critical to optimising the outcome of ventilated patients. In conclusion, about 40% of patients ventilated for pulmonary disease survived. Patients with pneumonia had the worst prognosis. The immediate survival is better if patients are ventilated electively before respiratory arrest, are less than 50 years of age and they do not develop other organ failure. The duration of ventilation does not affect the chance of survival.

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