THE PROFILE OF ICU ADMISSIONS FOR ACUTE SEVERE ASTHMA IN A GENERAL HOSPITAL

K N Sin Fai Lam, B M F Mow, L S Chew

ABSTRACT

The clinical profile of 22 patients admitted to the Intensive Care Unit of Alexandra Hospital over a 2-year period was studied. The mean age was 48.8 years with a majority in the older age group. The attacks leading to admission were generally rapid in evolution with 59% having symptoms for less than 12 hours and 84% for less than 24 hours. Most had a history of sèvere asthma, and of long duration. The pre-admission therapy had been suboptimal in the majority. Severe respiratory acidosis was a predominant feature. 68% were transferred to the ICU within one hour of arrival at hospital. Mechanical ventilation was required in 86.4% of cases, but the duration of ventilation was usually short. There was no serious complication due to barotrauma. Overall mortality was 23%(5/22). Problems in patient education remain a major hurdle in our attempt to reduce asthma mortality.

Keywords: acute severe asthma, ICU

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INTRODUCTION

Mortality from asthma has been rising in many countries especially New Zealand where it has reached epidemic proportions. This has occurred in spite of significant improvement in drug therapy and management strategies.

We reviewed the profile of patients treated for acute severe asthma in the ICU, as they were a group which were at particularly high risk of mortality in order to determine if the data could throw any light on the possible circumstances of asthma death.

METHODS

The study was a retrospective one and data was collected from hospital case records of all patients admitted to the Intensive Care Unit of Alexandra Hospital with acute severe asthma over a period of 2 years from January 1989 to December 1990.

Alexandra Hospital is a small general hospital of about 450 beds, with a 5 bedded ICU which include beds used for coronary care and post operative surgical patients.

Paediatric patients below 12 years old were not included in the study as they were looked after in a separate paediatric ICU.

Patients with cardiac disease, heart failure and chronic obstructive pulmonary disease were excluded.

The patients were studied with respect to their previous history of asthma and therapy, the circumstances of admission, their modes of management, complications and outcome.

RESULTS

The characteristics of the patients included in the study are shown in Table I. There were 22 patients altogether. Ten were male and twelve female.

Department of Medicine
Alexandra Hospital
Alexandra Road
Singapore 0314

Dr K N Sin Fai Lam, MBBCh, FRCPI
Consultant

Dr B M F Mow, MBBS
Medical Officer

Dr L S Chew, MBBS, FRACP
Head

Correspondence: Dr K N S F Lam

The mean age was 48.8 years. A large proportion was in the older age group.

Table I - Demographic data

Age Group (years)	No. of cases	Percentage
26-35	2	9.1
36-45	6	27.3
46-55	7	31.8
56-65	6	27.3
66-75	1	4.5

Male : 10 Female : 12
Racial distribution : Chinese 11, Indian 5, Malay 6
Mean Age: 48.8 years (S.D. 11.09)

Background history of asthma

We were careful to ensure that patients with chronic obstructive airways disease were not included in the study. All the 12 female subjects were non-smokers. Four of the male subjects gave a present or past history of smoking. Two of them were below the age of 40. All 4 gave a history of asthma since young. Twelve patients had records of serial peak expiratory flow rates (PEFR), and the mean maximum variability of the PEFR was 34%.

Seventeen patients (77.3%) had a fairly long history of asthma (over 5 years). Four had a history of between 2-5 years and one had a history of less than 2 years. Fifteen of them (68%) had previously been admitted indicating that they were prone to severe attacks.

Fourteen of the patients were looked after by primary care doctors, and six were being treated by a hospital specialist clinic. One of the patients did not have any regular medical attention. There was no information about the previous care of the remaining one patient.

Only 15% of the patients were on inhaled steroids. Of those who were on follow up at a hospital specialist clinic, 60% were on inhaled steroids.

Duration of symptoms

The duration of exacerbation of asthma prior to admission was short. 59% had symptoms of less than half a day in duration and altogether 86% had symptoms of less than one day in duration.

Most of the patients had symptoms of short duration and had not consulted a primary health care doctor prior to coming to hospital.

Potassium level

Only four of the patients had hypokalaemia (serum potassium of less than 3.6 mEq/L) on admission.

Arterial blood gases

Figs 1(a) and 1(b) plot the values of pH and pCO_2 in the respective patients. All of the blood gas samples were taken on admission to the ICU when the patients were breathing oxygen enriched air. The Mean pH was 7.124 (SD 0.192) with a range of 6.801-7.421. The Mean pCO_2 was 60.8 mmHg (SD 32.65) with a range of 27-154. The predominant picture was that of an acute respiratory acidosis.

Fig 1(a) - Plot of pH value on admission

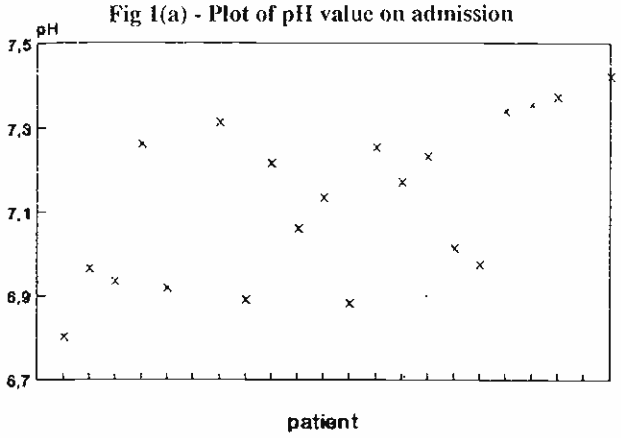
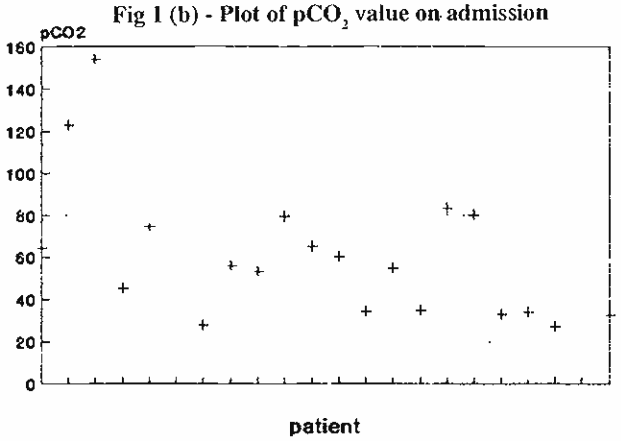


Fig 1 (b) - Plot of pCO_2 value on admission



Initial treatment of attack in hospital

All the patients were treated with high concentration oxygen, hydrocortisone usually at a dose of 200 mg 8-hourly, followed by prednisolone 30 mg daily, nebulised salbutamol 10 mg initially and as necessary subsequently, intravenous aminophylline infusion at a dose of 0.5-0.6 mg/kg/hr. Occasionally a bolus dose of aminophylline 250 mg was administered, and nebulised ipratropium bromide was added to the treatment.

Admission to ICU

Direct admission from the A&E Department was the case in 5 (22%) of the patients. Altogether 15 (68%) of the patients were admitted to the ICU within one hour.

Ventilation

Mechanical ventilation was required in 19 patients (86.4%) and was mostly done as an emergency measure, either because the patient was moribund on arrival to the A&E Department (26%), or the patient had a respiratory arrest in hospital (36.8%). However, 7 (36.8%) were intubated because of clinical deterioration, eg increasing drowsiness, confusion or exhaustion. In none of the cases was ventilation carried out solely because of deterioriating blood gas values.

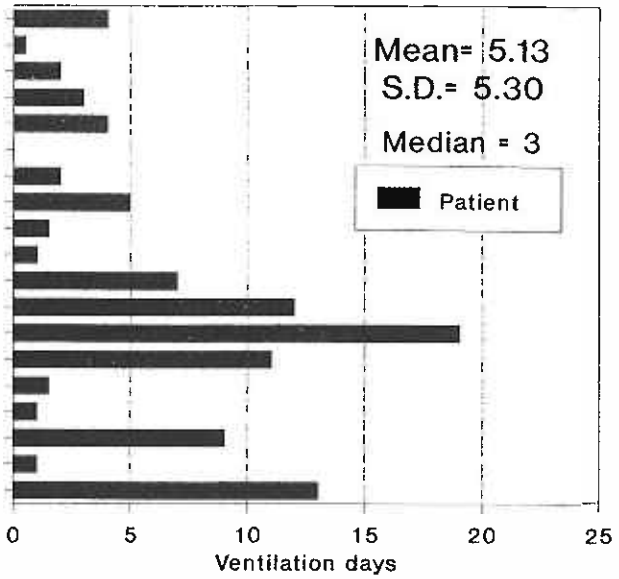
All the patients were ventilated with a volume cycled ventilator (Bennett MA2). Although sedation was often required, the use of neuromuscular paralysing drugs (pancuronium) was usually limited to the initial stages after endotracheal intubation.

Complications of ventilation included self-limited hypotension in 5 patients (26.3%), cardiac arrhythmia in 4 (21%)– atrial fibrillation and atrial tachycardia responding to treatment with either verapamil or digoxin, pneumonia in 6 (31.6%), and mediastinal emphysema in a single patient.

The duration of ventilation

The duration of ventilation was short in most patients (Fig 2). Mean = 5.133 days (SD 5.30) Median = 3 days. The patients who needed longer periods of ventilation were those in whom complications had developed.

Fig 2 - Duration of ventilation



Deaths

There were 5 deaths. Three of them were moribund on arrival and had anoxic brain damage before admission to the ICU. The other two had a respiratory arrest in the hospital.

Follow-up

Fourteen out of the seventeen survivors were given a follow-up appointment at the hospital specialist clinic. Of these, 50% subsequently defaulted attendance.

DISCUSSION

Until this century, asthma was thought of as a relatively mild illness with a normal or even long life-expectancy ("le brevet de longue vie"). However, we now know very well that this is not always the case and the events of the last two to three decades have brought home the message that asthma can be fatal [1-4] and the mortality has been rising in several surveys[5,6] done in different countries.

The identification of patients at high risk[7] for a fatal attack of asthma is a difficult problem, and a number of risk factors have been postulated. We have tried in our study to identify any such risks in our patients who had to be managed in the ICU.

Previous studies had documented that death often occur in young people. In our context a large number of the cases requiring ICU care were in the older age group. The mean age was 48.8 years and more than 60% were over the age of 46. This raises the question of whether these older patients may have been incorrectly diagnosed as suffering from chronic obstructive pulmonary disease and therefore been deprived of more aggressive treatment of their asthma. The pre-admission therapy of our patients would seem to support this hypothesis.

The history of our patients confirmed the findings in previous studies[1,2,6] in that most (77.3%) had a fairly long background history of asthma and that they had been known to have previous severe attacks (68% were previously admitted to hospital). Two of them had been admitted over the last 2 months and one has had more than five attacks over the past year.

Asthma is well known to be a disease of inflammation of the airways. Many experts believe that asthma of more than mild severity should be treated with a prophylactic drug. Yet, we find that in our group of asthmatic patients who had been known to have severe attacks, only 15% were on prophylactic inhaled steroids. Cromoglycate was not used in any of our patients. The reason for the failure to utilise a prophylactic drug may be manifold. It may be reluctance on the part of the doctor, perhaps related to a tendency to incorrectly label the older asthmatic patient who happens to be a smoker as having chronic obstructive pulmonary disease, or on the part of the patient because he does not obtain immediate symptomatic relief from the inhaled steroids. There is a need for more effective patient education.

The speed of onset of asthma in our group of patients was rapid. 59% had symptoms of less than half a day, and altogether 86% had symptoms of less than one day. This may indicate one of two possibilities. The first is that indeed the patients deteriorated very rapidly and may be said to have "catastrophic" asthma. On the other hand, there may have been gradual deterioration of the airway function over several days or weeks which the patient had ignored or had been unable to perceive. Which one of these possibilities is the correct one makes a lot of difference as to what measures will be helpful to reduce the mortality from asthma[8]. In the case of "catastrophic" asthma, perhaps faster access to hospital and to an intensive care unit (self-admission services)[9] may be the answer. The use of a nebuliser at home or in the ambulance while awaiting transfer to hospital, is also another consideration. In case of worsening asthma of several days, attention to monitoring objectively the peak flow rate with an appropriate action plan for every individual patient would be appropriate. Better education of the patient to take control of his own disease, and access to reserve supplies of prednisolone during crises is necessary.

One of the postulates put forward to explain some of the asthma deaths is that they are consequent to cardiac arrhythmia secondary to hypokalaemia. We found no evidence of this. Only 4 of our patients had hypokalaemia on admission. None of these 4 were moribund or had a cardiorespiratory arrest on admission. Although two of them subsequently required ventilation, by then the potassium level was adequately corrected. We therefore feel that asphyxia rather than cardiac arrhythmia is the more likely cause of death in severe asthma.

Many of our patients had marked hypercapnia, with some values as high as 120-160 mmHg. Frank respiratory failure with retention of carbon dioxide occurs only in 10% of patients presenting with asthma to the emergency room[6]. Even then, the level of hypercapnia was slight, averaging 50 to 55 mmHg. Marked hypoxemia is even more uncommon[6]. Obviously our patients are in a special group of very severe asthma who required ICU admission. However, Molfino et al[10] have suggested that the very high carbon dioxide tensions and the associated respiratory acidosis seen may have resulted at least in part from the administration of hyperoxic gas mixtures rather than overwhelming airway obstruction. This is usually a phenomenon which we try to avoid when administering oxygen to a patient with chronic hypercapnia. Mc Fadden[6] suggested that until the prevalence and circumstances of this phenomenon in acute severe asthma are determined, prudence would dictate that oxygen therapy for acute asthma also should be initiated in a controlled fashion in severe obstruction and then be adjusted as appropriate according to the arterial blood gas values.

Some of our patients were admitted directly from the A&E Department to the ICU, and up to 68% were admitted to the ICU within one hour of arrival to hospital. However, the remainder (32%) were initially managed in the general wards but required transfer to the ICU and mechanical ventilation. This suggests that there is a place for more liberal use of ICU beds for managing and monitoring patients with acute severe asthma who do not yet require ventilatory support. A more liberal use of ICU beds was suggested as far back as 1971 by Sherwood Jones [11], whose criteria was that all patients with Grade III and IV, and patients with Grade II of more than 8 hours in duration (Sherwood Jones Grading) should be treated in an intensive therapy unit rather than in an intermediate stay ward. (Grade II severity indicates that the patient is confined to a chair or bed but able to get up with moderate (IIA) or great (IIB) difficulty. With increasing severity when the patient is not able to get up any more, he is classified as Grade III. Grade IV refers to a moribund patient). If these criteria are applied strictly, perhaps more than 20% of patients admitted with asthma would be treated in the ICU [12].

Two techniques of ventilation have been used[13]: (1) Normalising the pO_2 by avoiding high inflation pressure and in so doing accepting an elevated pCO_2 and respiratory acidosis (hyperoxic hypoventilation); (2) Ignoring high inflation pressure and restoring arterial blood gases to normal as quickly as possible. We tend to use the second strategy. The high inflation pressures usually do not persist very long and fall gradually as bronchospasm is relieved. We have not had any serious complication resulting from barotrauma.

The number of deaths was relatively high. Could they have been avoided? Certainly the number of patients who are admitted moribund or who die before arrival to hospital can be reduced by better education of the patients, a more intelligent and efficient use of the drugs already in existence, a faster access to hospital, and a more thought-out action plan for each individual patient in times of crisis. The numbers who die in hospital can be reduced by a more positive identification of those at particular risk, a more careful monitoring system, and a more liberal use of ICU beds.

The best way to reduce asthma mortality is prevention, and all acute attacks should be considered as preventable. One main approach is the intelligent use of regular prophylactic treatment. The other main approach to reduce current mortality is patient education. The failure in patient education is perhaps reflected in the fact that 50% of our patients who survived a near fatal attack of asthma and who were given a specialist clinic appointment subsequently defaulted attendance. Patients should know about the disease, about what may bring about worsening of their symptoms, the purposes of the different types of medications, how to gauge the severity of their symptoms, and how to objectively measure their peak flow. They must know how to use their inhalers and delivery systems properly, and how to respond when things go wrong. Above all, they should be involved in the management of their own illness.

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