Acute severe asthma: oxygen and high dose β agonist during transfer for all?

Despite the increased understanding of the pathogenesis of asthma, improved prophylactic treatments, and increased patient knowledge and awareness of asthma, acute severe attacks of asthma are common and deaths from asthma are not declining. The causes of deaths from asthma have been studied for 20 years and several contributing factors have been suggested. Asthmatic deaths could be reduced if avoidable factors had been identified in the events that led to about 80% of deaths. The severity of the attack is often inadequately assessed by patients, relatives, and medical practitioners, but the very rapid progress of some severe attacks makes such sudden deaths difficult to prevent. The introduction of national and international guidelines, such as those from the British Thoracic Society, are designed to limit and reduce asthma mortality and morbidity associated with these factors. However, two factors that contribute to asthma mortality have tended to receive less attention - namely, asthma deaths occurring at home or during transportation to hospital, and delays in receiving medical care before arriving at hospital.

Crompton et al developed an emergency asthma service using self-referral to hospital; asthmatic patients with access to this service were shown to have a lower mortality rate than patients without direct hospital access. The effectiveness of such self-admission was considered to be the result of the shorter time interval from the onset of the attack to the institution of appropriate treatment. Such a service is, however, likely to be most useful with educated cooperative patients.

The role of the emergency services in preventing fatal asthma was studied by Barriot and Rion in a combined retrospective and prospective study of acute asthma attacks requiring hospital transfer in Paris during the 1980s. Prehospital emergency care was organised via the fire brigade where emergency calls received at the switchboard were dealt with by a chief physician who gave advice to the patient and relatives, and organised a fireman and paramedic trained in simple cardiopulmonary resuscitation to attend the patient, or an emergency care ambulance with a physician was sent. Retrospective analysis over a two year period to August 1985 showed that there were 480 acute asthma emergencies of which 216 were treated by emergency ambulance and no deaths occurred. In the non-ambulance groups there were 90 deaths from asthma; 21 of whom were already dead on arrival of the fireman/paramedic, and 69 of whom died during transfer. The death rate from asthma was 34 per annum or approximately 1·05 per 100 000 Parisian population. From September 1985 to March 1986 both the fire team and an emergency ambulance with a physician attended whenever an asthmatic patient called the emergency service. In the prospective study there were 259 emergency calls of which 243 were transferred by ambulance to hospital (16 refused) with only four deaths, one of these being a patient who refused to go to hospital. This represented a sixfold reduction in the anticipated asthma mortality, despite there being a similar proportion of near fatal asthma attacks. The reduction in the number of deaths from asthma was considered to be due to a combination of rapid cardiopulmonary resuscitation with early intervention by the physicians of appropriate anti-asthma treatment including β agonists, oxygen, and corticosteroids. This conclusion is supported by Malfino et al who studied near fatal attacks of asthma and considered that their near fatal nature was due to severe asphyxia rather than cardiac arrhythmias - that is, undertreatment rather than overtreatment could contribute to mortality from asthma.

The initial management of an acute severe attack of asthma has been clearly stated in the guidelines but, at its most basic, is the administration of selective β agonists with increased inspired oxygen concentration to prevent hypoxia and cardiorespiratory arrests. A meta analysis of metered dose inhalers and nebulisers in the acute setting (emergency room) concluded that there was no significant difference between nebulisers and metered dose inhalers with spacer in the treatment of acute asthma attacks. However, higher doses of β agonists have usually been recommended and should be delivered by oxygen-driven wet nebulisation. Ambulance personnel with basic and extended training (paramedics) are highly competent in cardiopulmonary resuscitation, and in many authorities are trained to treat patients during transfer including intubation.

Since 1986 the Lothian ambulance service has been equipped with nebulisers, and crews have administered salbutamol with increased inspired oxygen concentration to patients with acute asthma on the way to hospital. An early report suggested that this treatment was safe, with an improvement reported in 80% of patients subjectively assessed by the ambulance personnel. These subjective observations were supported by studies by Hill and Murphy. No comparison of different modes of delivery or doses of β agonist given during transfer to hospital were available until the report by Campbell et al in this issue of Thorax (pages 79–80).

These workers had the opportunity to compare prospectively three different treatment regimens given by emergency ambulance personnel to acutely wheezy patients on the way to hospital in three adjoining health districts in South Wales. Patients aged over 14 and thought by their general practitioners or ambulance crew to have acute asthma, and who could record a peak expiratory flow rate
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(PEFR), were entered into the study. Pulse rate, respiratory rate, PEFR, and subjective assessment of breathlessness were recorded before and 30 minutes after treatment (or on arrival at hospital). Treatment varied between districts, with district A giving 20 metered doses of terbutaline (0.25 mg dose) over three minutes via a 750 ml large volume spacer (Nebuhaler), district B giving 5 mg salbutamol over 3–5 minutes via a non specified nebuliser driven by oxygen at 6 l/min, and district C giving two metered doses (100 μg/dose) of salbutamol from a standard pressurised aerosol. Increased concentration of inspired oxygen was administered after treatment by all three ambulance services until arrival at hospital. One hundred and thirty patients entered, with no significant differences in demographic data, “on scene time”, subjective and objective assessment except in PEFR where patients in districts B and C (130 l/min and 143 l/min, respectively) were significantly lower than those in district A (184 l/min). Analysis of covariance showed a greater reduction in respiratory rate and breathlessness score with a greater mean improvement in PEFR in patients in district B (62 l/min) than in districts A and C (25 l/min and 19 l/min, respectively). Subdividing diagnostically between asthma and bronchitis demonstrated similar trends. Five patients died in hospital but the deaths were not considered to be associated with acute asthma or the treatment regimens during transfer.

The comparative failure of multiple inhalation from a metered dose inhaler via a Nebuhaler is surprising but was not due to greater journey time with a longer time for bronchodilatation for patients in group B. Low dose inhaled salbutamol (group C) was clearly inferior and potentially more dangerous and this health district now uses nebulised salbutamol with oxygen (Campbell, personal communication).

Objective confirmation of the efficacy and safety of nebulised β agonists en route to hospital is given by Ferguson et al also in this issue of Thorax (pages 81–2).17 All emergency ambulance crew in Lothian were given a four hour tutorial on recognition and management of severe asthma. All patients diagnosed as asthmatic below the age of 40 years, those prescribed emergency treatment by their referring general practitioner, or self-admission referrals were given 5 mg salbutamol via a Unicorn nebuliser (system 22) driven by oxygen at 6 l/min and this higher inspired oxygen concentration was maintained following nebulisation. PEFR was reassessed before and after treatment. One hundred and thirty one treatments, 50 initiated by the ambulance crew, were given. PEFR data before and after treatment were only available in 86 and a further 17 patients were unable to register a PEFR value before treatment but were after treatment, suggesting improvement. Seven patients did not complete nebulisation before their arrival at hospital. Significant improvement was recorded in the peak flows after nebulisation, the mean pretreatment PEFR of 139 l/min rising to 202 l/min after treatment. No improvement was seen in 16%, and only in 5% was there a fall in PEFR, but this was not associated with any additional morbidity. There were no deaths.

The data presented suggest that salbutamol nebulised with high flow oxygen (6–8 l/min) is an effective and safe treatment for acute severe asthma. The time taken between the onset of an acute severe attack of asthma and receiving treatment is critical, so deaths during transfer could be reduced with ambulance crews initiating this treatment. Most ambulance crews are trained in cardiopulmonary resuscitation and paramedics are also trained in intubation. It appears irrational that there is not a uniform approach among all ambulance services to allow ambulance crews to administer nebulised β agonists such as 5 mg salbutamol driven by oxygen at 6–8 l/min. The London Ambulance Service instituted a policy of nebulisation in 1991 and in 1993 over 5000 such treatments were given. Fears of carbon dioxide retention in patients with chronic obstructive bronchitis are justified but Crompton’s group (personal communication), which originally used a cut off of 40 years, have now shown that a cut off of 50 years is safe, and this appears to be the experience of the London Ambulance Service (personal communication). A simple protocol recommending the initiation of such treatment by ambulance crews to asthmatic patients under the age of 50, or at the request of the referring general practitioner or self-referral, appears to be safe and both subjectively and objectively effective. In addition, oral corticosteroids could be given during transfer by all crews as only a few asthmatic patients require intravenous steroids.

A reduction in asthma mortality will be difficult to prove, but morbidity and safety have now been shown for early treatment of severe asthma during ambulance transfer and should be encouraged nationally.

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1 Report on trends in asthma. Lung and Asthma Information Agency, St George’s Hospital Medical School, London, 1994.