Discharge considerations for adult asthmatic patients treated in emergency departments

ANTON F GRUNFELD MD FRCPC, J MARK FITZGERALD MB FRCPC
Department of Emergency Medicine and University of British Columbia Respiratory Clinic, Vancouver Hospital and Health Sciences Centre, Vancouver, British Columbia

OBJECTIVE: To review the medical literature on outcome of treatment of acute asthma in the emergency department and issue recommendations regarding patient admission or discharge.

DATA SOURCES: A MEDLINE search was done for articles in the English language on acute asthma and treatment in the emergency department for the years 1975 to 1993. In addition, references in pertinent review articles were reviewed.

STUDY SELECTION: Studies addressing treatment of acute asthma in emergency departments were selected by consensus.

DATA SYNTHESIS: Three major areas have been shown to affect outcome and the decision to admit or discharge a patient following treatment in the emergency department: first, the severity of the attack and the response to therapy; second, historical risk factors; and third, care following discharge from the emergency department. This paper reviews the literature on outcome of acute asthma attacks and issues recommendations regarding objective airflow measurements and co-existing risk factors to be assessed before discharging patients. The role of anti-inflammatory therapy in emergency department treatment and in postdischarge treatment of these patients is also reviewed.

CONCLUSION: Evaluation for discharge following treatment of acute asthma should integrate objective measures of airflow obstruction with historical high risk factors. The use of systemic corticosteroids in the emergency department and following discharge, with careful follow-up, may help control the attack and reduce relapse of asthma.

Key Words: Acute asthma, Discharge criteria, Outcome, Therapy

Correspondence: Dr Anton Grunfeld, Department of Emergency Medicine, Vancouver Hospital and Health Sciences Centre, 855 West 12th Avenue, Vancouver, British Columbia V5Z 1M9. Telephone 604-875-4995, fax 604-875-4872, e-mail grunfeld@unixg.ubc.ca

voir page suivante
Although the great majority of patients treated in emergency departments (ED) with acute asthma recover and are safely discharged home, significant morbidity and mortality are well-recognized (1-3). The important outcomes to be prevented are death or a near fatal event, and relapse with a further episode of acute asthma. Because most asthma deaths occur in the community and those deaths that occur in the ED are usually in patients who arrive moribund (2), this article focuses on the ED evaluation of patients in whom a decision regarding admission or discharge needs to be made. In addition, it will review the important role of anti-inflammatory therapy in the follow-up care of these patients.

DISCHARGE CONSIDERATIONS

Because of the complexity of medical and nonmedical factors associated with the outcome of an asthmatic attack (4), our ability to predict and alter it is imperfect. The three major areas that have been shown to affect outcome and thus require evaluation before discharging the patient are as follows:

- the severity of the attack and response to therapy;
- historical high risk factors;
- care following discharge.

SEVERITY OF THE ATTACK AND RESPONSE TO THERAPY

The assessment of the severity of an acute asthma attack is based both on clinical examination and on the objective evaluation of airflow obstruction. Several physical signs have been recognized as being associated with life-threatening asthma, such as tachycardia, tachypnea, use of accessory muscles, pulsum paradoxus, diaphoresis and an inability to complete sentences in one breath. More ominous signs include a silent chest, cyanosis, bradycardia and decreased levels of consciousness. It must be noted that the absence of these signs cannot be interpreted as signifying that the attack is not life-threatening. In addition, studies in both adults and children failed to show a good correlation between the physical findings and physiological measurements in the assessment of acute airway obstruction (5-7), underlining the need for using objective airflow measurements in addition to the clinical examination.

Attempts have been made to construct and validate severity scores for acute asthma to predict the need for hospitalization and safety in discharging patients. Fischl et al (8) developed an index score based on heart rate over 120 beats/min, respiratory rate more than 30 breaths/min, pulsum paradoxus 18 mmHg or greater, peak expiratory flow rate (PEFR) 120 L/min, moderate to severe dyspnea, the use of accessory muscles and wheezing. Each of the signs was scored with one point. The authors found that a score of 4 or more was 96% accurate in predicting the need for hospitalization and 95% accurate in predicting relapse. However, when this scale was tested prospectively in two other locations, it failed to show any useful predictive value (4,9).

Several authors have correlated the severity of airway obstruction on presentation and at discharge from the ED with the probability that the patient would suffer a relapse. In a prospective study, Kelsen et al (7) found no significant difference in the initial level of airflow obstruction between patients who did and those who did not experience relapse within the next 10 days (mean forced expiratory volume in 1 s [FEV1] was 1.15 L for the group as a whole, P>0.05). However, patients with significantly lower levels of lung function and a smaller degree of improvement in lung function at the time of discharge were shown to be more likely to suffer a subsequent relapse (Table 1). Patients who showed an FEV1 increase after treatment of 400 mL had a 67% relapse rate, while those with an improvement of more than 400 mL had a relapse rate of only 29%.

Banner and co-workers (10), in a prospective evaluation of
of 67 episodes of acute asthma, found that patients who were successfully discharged had a median peak flow of 70% predicted. In the seven episodes where the treatment failed, no patients had peak flow greater than 42% predicted. In addition, patients with initial peak flows of less than 16% predicted and less than 16% improvement after an initial injection of adrenaline were admitted or had a relapse (Table 2).

Fischl et al (8), in a prospective evaluation of 205 patients with acute asthma, found that PEFR at presentation was significantly better than those in patients who experienced a relapse, which were better than those in admitted patients (299 L/min, versus 191 L/min, versus 118 L/min, respectively) (Table 3).

Nowak et al (11), in a prospective evaluation of 85 episodes of acute asthma, also found significant differences in FEV₁ among the three groups of patients, both at the time of presentation and following treatment (Table 1). Thirty-five per cent of the patients studied had an initial FEV₁ of 0.6 L or less and a post-treatment FEV₁ of 1.6 L or less. Ninety per cent of patients either were admitted or had a subsequent relapse.

In two further studies, Nowak et al (12,13) also found significant differences among values of air flow in admitted patients, patients who developed problems following discharge and patients who were discharged without relapse (Tables 1-3). In one of these studies (12), 92% of patients with a pretreatment PEFR of less than 100 L/min and a post-treatment value of less than 300 L/min required admission or had an unsuccessful outpatient course. Of patients with a pretreatment PEFR of less than 100 L/min and an improvement of less than 60 L/min after initial terbutaline, 85% were admitted or had problems after discharge.

Fanta et al (14), in a prospective evaluation of different therapeutic combinations, found that the rate and magnitude of response in the first hour depended on the severity of airway obstruction at presentation. In this study it was found that patients with an initial FEV₁ of less than 30% predicted and who did not improve to an FEV₁ of at least 40% predicted at the end of 60 mins of intense bronchodilator therapy required prolonged ED treatment and/or hospital admission.

The data in these studies show consistency in correlating spirometric measurements and outcome. This allows for recommendations regarding discharge of asthmatic patients from the ED, as summarized in Table 4.
given are approximations for the ‘average adult’. Percentage predicted or previous best are more helpful when available. The pre- and post-treatment FEV1 or PEFR are probably the best guides to therapy.

However, there are two points worth noting: first, corticosteroids were not routinely used as part of the protocol in these studies; and second, the discharge criteria suggested in these studies, based on airflow obstruction, have not been prospectively validated.

Several authors have showed that reliance on FEV1 or PEFR as the only criterion to predict the need for hospitalization or relapse has limitations. Verbeek and Chapman (15) examined Nowak’s data and showed that using a proposed PEFR above 300 L/min or an FEV1 greater than 2.1 L would lead to one-third of all recommended admissions being unnecessary. Worthington and Ahuja (16) found that using the combination of FEV1 of at least 0.7 L at presentation and FEV1 of at least 2.1 L before discharge had a low positive predictive value (47%) for admission or relapse. However, a final FEV1 of greater than 2.4 L had a high sensitivity (90%) and negative predictive value (94%) when used as a criteria for discharge. Patients who attained this value could be discharged with a high degree of confidence. While indicating a safe discharge, this cut-off value was not useful for deciding admission because of the low specificity of only 41%. In this study, knowledge of the FEV1 did not alter the decision to admit or discharge a patient in 97% of cases.

In spite of the above limitations, because of the known variations in the ability of patients to estimate the severity of airflow obstruction (17-20) the measurements are important, not only in gauging objectively the response to therapy, but also in integrating these levels into decisions regarding disposition, as outlined above.

HISTORICAL HIGH RISK FACTORS

Studies of asthma deaths have identified historical factors that increase the risk of patients dying of their disease. These include a recent hospital admission, a recent visit to the ED, poor medical management and poor compliance (21-28).

In a retrospective case control study of death from asthma, Rea et al (29) confirmed the significance of these risk factors. In addition, they showed that psychological problems were more common in cases than in controls. These included recent unemployment, recent bereavement, depression, personality disorders and alcohol abuse. They concluded that the best way to identify asthma patients at risk of death is to identify those who have had a recent hospital admission and, in particular, those who have ever had a life-threatening attack requiring mechanical ventilation.

The existence of two groups of patients who are considered at risk of dying from asthma was noted at a recent consensus meeting on asthma mortality (30). The groups are:

- **patients with a history of near fatal episodes**, requiring resuscitation, regardless of the underlying severity of disease or presence of any other risk factors

| TABLE 5 |
|-----------------|-----------------|
| **Historical high risk factors associated with asthma relapse** |
| Previous near fatal episode |
| Sudden precipitous attacks |
| Allergic or anaphylactic triggers |
| Recent emergency department visit |
| Frequent hospitalizations |
| Dependence on systemic steroids or recent use |
| Recent attack of prolonged duration |
| Poor compliance or knowledge of asthma |
| Returning to the same environmental triggers |

- **patients with underlying severe disease**, judged by chronic severe symptoms, systemic steroid requirement, frequent regular use of bronchodilators, frequent ED visits or hospitalizations. Patients in this group may also have one or more of the following problems: recent discharge from the hospital for severe asthma, poor self-care or non-compliance with medications, depression or severe emotional disturbance, significant other psychological factors, or shortcomings in education and supervision.

The potential role of indiscriminate use of beta-agonists as a risk factor for fatal asthma has received attention recently. A number of case control studies from New Zealand have suggested that the use of fenoterol may be associated with an increased risk of death from asthma (31,32). More recently, Spitzer et al (33) matched 129 cases who had fatal or near fatal asthma and compared them with 655 controls from the Saskatchewan Health Insurance database. The use of both fenoterol and albuterol was associated with increased risk of death (OR 2.6 per canister per month, CI 1.7 to 3.9) and of death or near death from asthma considered together (OR 1.9 per canister per month). The adverse effect of regular use of beta-agonist was also shown by Sears et al (34) in a crossover study that compared on-demand versus regular use of fenoterol. The regular use of fenoterol was associated with less optimal asthma control than its use on demand.

Molfino et al (35) examined the characteristics of 10 patients who arrived at hospital in respiratory arrest or in whom it developed within 20 mins of arrival at the ED. These patients were similar to those described in the literature with a high risk of death from asthma, including a long history of asthma in young- to middle-aged patients, previous life-threatening attacks or hospitalization, delay in medical aid and sudden onset of a rapidly progressive attack. Extreme hypercapnia and acidosis were found before mechanical ventilation was begun, but no patient developed serious cardiac arrhythmias during resuscitation. They suggest that undertreatment, as shown by severe asphyxia, rather than overtreatment with potential cardiotoxicity, may be a major factor in the increased number of deaths from asthma.

Kallenbach et al (36) studied 81 patients with acute severe asthma in whom mechanical ventilation was required. In this group of patients they found no evidence to support the con-
TABLE 6: Recommendations for follow-up care

<table>
<thead>
<tr>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Majority of patients require systemic corticosteroids in the emergency department and following discharge</td>
</tr>
<tr>
<td>Patients need to be educated in the use of their medication and recognition and treatment of relapse</td>
</tr>
<tr>
<td>Follow-up by the family doctor or a specialist, especially in high risk cases, is required</td>
</tr>
</tbody>
</table>

FOLLOW-UP CARE

In recent years the pivotal role that airway inflammation plays in the pathogenesis of asthma has been recognized (37). Jeffrey et al (37), in an ultrastructural study of biopsies taken from the airways of patients with asthma and compared with control subjects, showed the presence of inflammatory changes in the patients with asthma that were not found in the controls. They in particular found an increase in lymphocytes in the airway and postulated that these cells play a prominent role in the inflammatory process. It follows that patients presenting to the ED have a significant amount of airway mucosal inflammation and edema. These airway changes have been the basis for the many recommendations to use anti-inflammatory therapy, usually in the form of systemic corticosteroids (38). Despite this rationale patients continue to be discharged from the ED without such therapy (39), leading to unacceptably high rates of relapse as well as ongoing poor symptom control.

A recent meta-analysis (40), as well as a preliminary report of our own (41), critically reviewed the current literature and made specific recommendations as to dosage and route of administration of corticosteroids in acute asthma. Rowe and Oxman (40) reviewed over 700 articles and found 30 relevant randomized controlled trials. They found that early use of corticosteroids for exacerbations reduced hospital admissions for adults (OR 0.47, 95% CI 0.27 to 0.79) and children (OR 0.06 to 0.42). In the outpatient setting they also found that corticosteroids prevented relapses in patients with acute exacerbations (OR 0.15, 95% CI 0.05 to 0.44). The majority of patients who come to the ED with acute asthma have disease of such severity that systemic corticosteroids are required. Largely based on one study the dose of corticosteroids given has usually been 125 mg of methylprednisolone intravenously (42). However, a number of studies have shown that oral prednisone will suffice, even in subjects requiring hospital admission (43,44). Rowe also looked at the effect size of oral versus intravenous corticosteroids and found no difference in the groups treated with either route.

Traditionally a dose of prednisone 40 mg has been recommended for subjects discharged from the ED (45). Where this dose is used, and in the presence of the ongoing use of inhaled anti-inflammatory steroids, routine tapering of corticosteroids at the end of a 10-day course of systemic medication is not required (46). O’Driscoll et al (46) evaluated 35 patients admitted to hospital with an acute exacerbation of asthma, randomized them to a 10-day course of prednisolone 40 mg daily and then randomized them to placebo or a traditional tapering dose and found no difference between the two groups. The importance of maintenance anti-inflammatory inhaled corticosteroids can be gauged from the fact that, although there was a treatment effect at the end of 10 days in the study of Chapman et al (45), there was no such difference at 21 days, showing that short term benefit of systemic corticosteroids is rapidly lost in the absence of appropriate ongoing care.

Although the use of a doubling dose of inhaled corticosteroids has been recommended in a number of asthma guidelines (47), there are no published data supporting this recommendation in preventing the evolution of deteriorating asthma into a full-blown acute attack. Although intuitively it makes sense, the dosing and duration of such therapy needs to be validated in a prospective study.

Patients are usually referred to family physicians for follow-up within the following week to monitor response to therapy. There is evidence, however, that facilitated referral to a specialist leads to improvement in ongoing asthma care (48) and likely leads to a better transition from acute care to appropriate ongoing control of the underlying asthma. The integration of a program of asthma education and these therapeutic interventions will likely lead to better results (49,50). These studies support the recommendations listed in Table 6.

CONCLUSIONS

Patients presenting to the ED should have airflow obstruction evaluated objectively. These measurements should be integrated with historical features outlined above in coming to a decision on admission or discharge. The use of systemic corticosteroids and follow-up with topical inhaled corticosteroids will ensure good initial and ongoing control of asthma and prevent many admissions to hospital, reduce relapse rate and, over time, lead to lower asthma morbidity and likely mortality.

ACKNOWLEDGEMENTS: This paper was prepared in conjunction with the development of Guidelines for Emergency Management of Adult Asthma by the Asthma Work Group of the Canadian Association of Emergency Physicians. The authors also thank Drs Naser Awadh and Kendall Ho for their review of the manuscript.
REFERENCES
18. Burdon JG, Juniper EF, Killian KJ. The perception of breathlessness in asthma. Am Rev Respir Dis 1982;126:825-8.