

Acute asthma: emergency department management and prospective evaluation of outcome

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To determine the current management of acute asthma in the emergency department and to evaluate outcome we reviewed the charts of 99 patients aged 15 to 55 years who presented to the emergency department of a tertiary referral, university-affiliated hospital and were subsequently discharged with a diagnosis of acute asthma. Outcome was evaluated prospectively, with a structured questionnaire, by telephone. During the visit pulsus paradoxus was documented in four patients. Spirometry was done in 63 patients; postbronchodilator values ranged from 0.9 to 4.1 L. A total of 92 patients received inhaled bronchodilator therapy, most by wet nebulization. Sixteen patients received anticholinergic agents and three received theophylline. Ingested corticosteroids were given to 27 patients. Of the 71 patients contacted, a mean of 12 days after the visit, 26 (37%) had sought further medical attention, 19 at the emergency department; 9 had required admission. Forty-six patients reported that their condition had improved, but over 60% continued to have cough, sputum production, nocturnal waking and early-morning chest tightness. The results indicate that asthma continues to be undertreated in the emergency department and highlight the importance of routine spirometry in all patients and the need for systemic corticosteroid therapy.

Comment traite-t-on actuellement l'asthme aigu en salle d'urgences, et avec quels résultats? Pour le savoir nous analysons les dossiers de 99 sujets âgés de 15 à 55 ans s'étant présentés à la salle d'urgences d'un hôpital universitaire dit de troisième ligne, chez qui on a posé au congé un diagnostic d'asthme aigu. L'issue est jugée de façon prospective au moyen d'un questionnaire téléphonique. Lors de la visite on a observé un pouls paradoxal chez quatre malades. On a pratiqué la spirométrie chez 63 malades: le volume expiratoire maximum seconde après administration d'un bronchodilatateur varie de 0,9 à 4,1 L. On traite 92 malades par inhalation d'un bronchodilatateur, le plus souvent en nébulisation. On donne des anticholinergiques à 16 sujets, de la théophylline à 3, des glucocorticoïdes per os à 27. Parmi les 71 qu'on a pu rejoindre, au bout de 12 jours en moyenne, 26 (37%) ont encore vu un médecin, dont 19 à la salle d'urgences; 9 d'entre eux ont été hospitalisés. Si 46 malades se disent mieux, plus de 60% de tous les sujets ont continué de tousser, d'expectorer, de s'éveiller en pleine nuit et d'éprouver de la dyspnée au petit matin. Le tout fait croire que l'asthme est encore insuffisamment traité en salle d'urgences. Il fait ressortir l'intérêt de la spirométrie systématique et de la glucocorticothérapie par voie générale.

Recent data indicate increased mortality from asthma, particularly among younger patients.¹ The reason for this is not clear, but reviews of asthma mortality have shown that underestimation of the severity of a particular episode by both physician and patient as well as failure to use corticosteroids appropriately are contributing factors.^{1,2}

The emergency department is an important point of contact between patients with asthma and their health care providers. Previous evaluations of the management of patients with asthma in the emergency department³⁻⁵ failed to provide prospective data on outcome, with the exception of one study published in 1979,⁵ when the importance of airway inflammation and its treatment with cortico-

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steroids was not well appreciated.⁶ We therefore conducted a study to retrospectively evaluate the current management of patients with asthma in our emergency department and to prospectively evaluate their outcome. We were particularly interested in assessing how well patients were evaluated through history taking, what investigations were done, what treatment was given and, most important, how well patients' asthma was controlled once they were discharged from the emergency department.

Methods

The study was approved by the Research Committee of St. Joseph's Hospital, Hamilton, Ont., and was carried out between September 1987 and May 1988, excluding the month of December. Permission to conduct the study was obtained from the head of the Department of Emergency Medicine 6 months before the study began, but otherwise emergency department staff were not informed of the study. St. Joseph's Hospital is a tertiary referral, university-affiliated hospital. The emergency department is staffed by staff emergency department physicians and junior residents rotating through various training programs.

All patients aged 15 to 55 years presenting to the emergency department and subsequently discharged with a diagnosis of acute asthma were included in the study. Data for patients who were admitted were not evaluated. The emergency department records of the patients were reviewed the day after the visit and the following information recorded: patient's name, address, age, times of arrival and departure, history of symptoms, therapy before arrival, physical examination findings, investigations, drug therapy given in the emergency department and discharge medications. The outcome was evaluated prospectively. The family doctor of each patient was contacted and permission sought to talk to the patient. The diagnosis of asthma was confirmed at this time. A letter was then mailed to patients to outline the purpose of the study and to inform them that they would be contacted by telephone. Patients were telephoned 1 to 2 weeks after the emergency department visit and were asked about subsequent need for medical attention, current symptoms and medications and whether the emergency department physician had advised them to be followed up by their family doctor.

Results

A total of 99 patients (53 females with a mean age of 25 [extremes 15 and 42] years and 46 males with a mean age of 29 [extremes 15 and 52] years) fulfilled the inclusion criteria. Patients spent a mean of 149 (extremes 20 and 500) minutes in the emer-

gency department. Of the 58 patients for whom the duration of increased symptoms was documented, 25 (43%) had them for less than 1 day, 26 (45%) for 1 to 7 days and 7 (12%) for more than 7 days. The complaints documented were dyspnea (in 39 of the 99 cases), wheeze (in 15), cough (in 12) and upper respiratory tract infection (in 10); in 23 cases there was no specific complaint apart from asthma.

The pulse rate was measured in 98 of the patients (mean 95 [extremes 64 and 134] beats/min) and blood pressure in 93 (mean diastolic pressure 80.5 [extremes 60 and 105] mm Hg and mean systolic pressure 131 [extremes 100 and 175] mm Hg). Pulsus paradoxus was documented in only four patients. The respiratory rate was measured in 93 patients (mean 25/min [extremes 16/min and 44/min]) and temperature in 90 (mean 37.4°C [extremes 36°C and 38°C]).

Spirometry was done in 63 patients; of the 36 remaining patients 1 refused spirometry. The baseline prebronchodilator forced expiratory volume in 1 second (FEV₁) in the 50 patients in whom it was recorded ranged from 0.7 to 3.1 L (17% to 109% of predicted) (mean 1.6 L [40% of predicted]). The postbronchodilator FEV₁ values in the 62 patients in whom it was recorded ranged from 0.9 to 4.1 L (25% to 110% of predicted) (mean 2.0 L [52% of predicted]).

Arterial blood gases in room air were measured in 10 patients. The arterial carbon dioxide pressure (PaCO₂) ranged from 22 to 47 (mean 33) mm Hg. The arterial oxygen pressure ranged from 62 to 86 (mean 72) mm Hg.

Chest roentgenography was done in 28 patients. One patient had right middle-lobe pneumonia, but a diagnosis of acute bronchitis was made and the patient treated with erythromycin.

The patients' therapy before presentation is shown in Table 1. Therapy given in the emergency department is shown in Table 2. For only 5% of the patients was oxygen therapy documented. Therapy on discharge is shown in Table 3.

Follow-up evaluation

A total of 71 patients were contacted by telephone, a mean of 12 (extremes 7 and 28) days after their visit; only 7 patients were contacted more than 2 weeks after their visit. Of the 28 patients not contacted 16 had no telephone, 8 did not answer on repeated calls, 3 were not listed in the directory, and 1 spoke no English. Of the 71 patients contacted 26 (37%) had sought further medical attention, either at the emergency department (19 patients) or from their family doctor (7 patients).

Of the 71 patients 9 (13%) had required hospital admission 1 to 11 (mean 4) days after the emergency

department visit. Only two of the nine had received corticosteroids in the emergency department.

Of the 71 patients 46 reported that their overall condition was improved; the other 25 noted no improvement. However, 44 patients (62%) were still waking at night, 55 (77%) had cough, 48 (68%) had early-morning chest tightness and 45 (63%) had sputum production.

Most of the patients (87%) were taking β_2 -agonists, 38 (54%) were taking inhaled or oral corticosteroids and 16 (22%) were taking both inhaled and oral corticosteroids.

Discussion

Our results provide important information on the current management of asthma in the emergency department. As in previous studies^{3,4} there was a significant lack of documentation of features suggesting a need for increased caution, such as a history of hospitalization and, in particular, mechanical ventilation, previous or current need for corticosteroid therapy and past history of rapid worsening of asthma. This may be partly due to the difficulty of obtaining a full history during an acute episode, but we suspect that most patients could have supplied this important information.

Table 1: Therapy received before presentation by 99 patients seen at the emergency department for acute asthma

Therapy	No. of patients
β_2 -agonist	70
Corticosteroid	
Inhaled	33
Oral	10
Theophylline preparation	13
Anticholinergic	6
Not stated	20

Table 2: Therapy given at the emergency department

Therapy	No. of patients
β_2 -agonist	91
Via nebulizer	46
Via metered-dose inhaler	36
Combination	9
Anticholinergic	16
With β_2 -agonist	15
Alone	1
Theophylline	3
Intravenous	2
Oral	1
Corticosteroid	30
Parenteral	21
Oral	5
Inhaled	3
Parenteral and inhaled	1
Refused therapy	2

Physical signs associated with acute episodes of asthma (e.g., tachycardia, accessory muscle use, pulsus paradoxus and monosyllabic speech) are poor predictors of outcome when applied to a group of patients,⁷ but we feel an attempt should be made to document them, because in individual patients their reversal may be associated with objective evidence of improvement. Airflow was objectively evaluated in a much higher proportion of patients in our study (63%) than in previous studies;^{3,4} however, this figure still falls short of the optimum. It has been well documented that patients with asthma may have a poor perception of their symptoms,^{8,9} and there may still be significant airflow obstruction even in the presence of substantial resolution of symptoms.¹⁰ We therefore recommend that all patients presenting with acute life-threatening asthma have objective evaluation of airflow limitation and assessment of the short-term response to therapy. The measurements should be used to guide treatment and the decision to admit or discharge. Despite a recent suggestion that objective evaluation does not contribute to the decision to admit or discharge,¹¹ we continue to recommend it.¹² Current evidence suggests that an FEV₁ greater than 60% of predicted is adequate to allow discharge.^{13,14} Because of limitations on bed space we have on occasion discharged patients with a lower FEV₁ than this.

The indications for arterial blood gas measurement¹⁵⁻¹⁸ and chest roentgenography¹⁹⁻²¹ in acute life-threatening asthma have previously been outlined. It is suggested that chest roentgenography is not needed unless the patient is not responding appropriately to bronchodilator therapy or is to be admitted.²¹ In our series chest roentgenography was not helpful. Measurement of arterial blood gases is unlikely to reveal hypercapnia or significant hypoxemia when the FEV₁ is less than 1 L.¹⁶ It has therefore been suggested that if the patient is responding appropriately to therapy, arterial blood gas measurement is not routinely indicated, particularly if the FEV₁ is greater than 1 L.¹⁶ Obviously if the patient is drowsy or if there is any concern about gas exchange such measurement is indicated. A normal

Table 3: Therapy on discharge

Therapy	No. of patients
Bronchodilator	
β_2 -agonist	60
Theophylline	17
Anticholinergic + β_2 -agonist	11
Corticosteroid	
Oral	26
Inhaled	11
Antibiotic	20
Not stated	22

PaCO₂ and, in particular, hypercapnia are markers of a severe attack and indicate the need for close, ongoing monitoring. When therapy is appropriate, the PaCO₂ rapidly returns to normal, even in the presence of significant hypercapnia.²²

Despite objective evaluation of airflow in most of our patients and despite values indicating significant airflow limitation even after bronchodilator therapy, in general there was a failure to appreciate the importance of aggressive therapy in these patients.

Most of our patients received β_2 -agonists in the emergency department. Despite evidence of the efficacy of therapy with metered-dose inhalers (with a spacer device)²³⁻²⁷ most patients received the drug by wet nebulization. In addition, most patients received only one treatment with a β_2 -agonist despite significant ongoing airflow limitation, which often responds to repeated therapy.^{28,29}

The infrequent use of anticholinergic therapy (e.g., ipratropium bromide) is disappointing. Recent evidence suggests that treatment with this agent is a useful adjunct to β_2 -agonist therapy in acute asthma.³⁰⁻³² Higgins, Stradling and Lane³² reported that the addition of ipratropium bromide resulted in an improvement of 12.5% in the FEV₁, a result that was both clinically and statistically significant.

The infrequent use of aminophylline therapy is gratifying. Studies have shown that the agent contributes little to bronchodilatation when adequate β_2 -agonist therapy has been given and has considerable toxicity.^{33,34} Littenberg³⁵ recently reviewed 13 adequately controlled randomized trials and concluded that there was no convincing evidence supporting the routine use of aminophylline in acute life-threatening asthma.

The infrequent use of corticosteroids before, during and after the visit is particularly disappointing. Previous studies have cited failure to use these agents or failure to use adequate doses as a significant factor contributing to death from asthma.³⁶

The fact that a substantial proportion of our patients continued to complain of cough, sputum production, nocturnal waking and chest tightness, all indicative of poor control, suggests that control of the asthma after the emergency department visit was suboptimal. Our relapse rate (37%) and the proportion of patients needing hospitalization after relapse (13%) are comparable to those reported in a series in which corticosteroids were not used routinely in all patients presenting with acute life-threatening asthma.⁵ The routine use of corticosteroids in patients with acute asthma presenting to the emergency department has been shown to significantly reduce the relapse rate and the immediate need for hospitalization.^{37,38} The appropriate dosage in the emergency department has not been established. Littenberg and

Gluck³⁸ suggested that all patients should receive 125 mg of methylprednisolone sodium succinate intravenously. A previous report³⁹ and more recent evidence^{40,41} suggest that oral therapy is adequate, even in patients needing hospitalization. Harrison and colleagues³⁹ used 45 mg/d of prednisone given in divided doses, whereas Ratto and associates⁴⁰ used considerably higher dosages of methylprednisolone, at least 80 mg given twice daily. Jónsson and coworkers⁴¹ reported that 80 mg/d of prednisone is adequate during the acute phase, even in patients needing hospitalization. Further prospective studies are needed to establish the appropriate dosage.

The retrospective portion of our study could be criticized. However, a prospective design might have changed the management of patients, and our results would therefore not have accurately reflected current practice. The more important follow-up was done prospectively. Our failure to contact all the patients could mean that we were unaware of patient deaths, but we feel that we eliminated this possibility by talking to the family physicians of all the patients. In addition, there was no difference in the severity of asthma between the patients we contacted and those not contacted.

We conclude that management of patients with acute asthma in the emergency department is suboptimal. We recently reviewed in detail the appropriate management of patients with acute asthma in the emergency department.⁴² All patients should have objective evaluation of airflow with a spirometer or peak flow meter. In more severe episodes chest roentgenography and measurement of arterial blood gases may be indicated. In all patients with acute asthma of such severity as to require assessment in the emergency department the use of corticosteroids is routinely indicated. If the patient is discharged, therapy with prednisone, 40 mg/d given orally for at least 1 week, is needed to ensure optimum resolution of airway inflammation, which is considered a key pathophysiologic element of the acute asthma episode.⁶ In addition, appropriate arrangements should be made for follow-up evaluation by the patient's physician. These patients should also be assessed in a respiratory clinic so that the severity of their disease can be documented and an appropriate strategy devised to prevent future severe episodes.

There is evidence that patients with acute asthma who have direct access to medical care have lower rates of illness and death than patients who must go through their family physician to receive urgent medical care.⁴³⁻⁴⁵ It is important that all patients with asthma have an appropriate plan of action to deal with an acute worsening of their symptoms. This should include an appropriate increase in or introduction of anti-inflammatory medication (i.e., corticosteroids) and antibiotic therapy

when indicated. Patients noted to have poor perception of their symptoms or a history of rapid worsening of symptoms should be provided with a peak flow meter so as to monitor their asthma control.

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