Education and a standardized management protocol improve the assessment and management of asthma in the emergency department

Claudia Steurer-Stey[a], Ursula Grob[a], Sabine Jung[a], Wilhelm Vetter[a], Johann Steurer[b]

[a] Department of Internal Medicine, Medical Policlinic, University Hospital of Zurich, Zurich, Switzerland
[b] Horten Centre for patient oriented research, University of Zurich, Zurich, Switzerland

Summary

Study objective: To evaluate the effect of a standardized management protocol on acute asthma care in the emergency department (ED).

Method: We conducted a before-after study regarding acute asthma management. Deficiencies in acute asthma care over a time period of 19 month (January 1997– October 1998) were identified. Subsequently a management protocol consisting of an assessment sheet and written guidelines for the initial management of acute asthma in the emergency department, was developed. In addition, physicians and nurses of the emergency department were informed about the recommendations given in the guidelines, and instructed in peak-flow meter use. The assessment sheet was introduced in January 2002 and posted at several locations in the emergency department.

Between February 2002 and August 2003 the acute asthma consultations in the emergency department were consecutively registered. Data on medical history, physical examination and objective measurements of airflow obstruction, as well as data on treatment and assessment of the response to therapy were collected. In addition, medication and instructions at discharge were reviewed and compared with the results before the introduction of the assessment sheet.

Results: The first group consisted of patients seen between January 1997 and October 1998; the second group consisted of all patients seen between February 2002 and August 2003 (104 *vs* 273 patients respectively). Both groups had a similar gender distribution (56% females in the first group *vs* 53% females in the second group) and the mean age of both groups was also alike (median 33 *vs* 36 years). Most patients had a known history of asthma (76% in the first group *vs* 70% in the second group). The self-referral rate was high in both groups (86% *vs* 96% respectively). Blood pressure and pulse rate were reported in the majority of patients (95% *vs* 98% respectively), whereas the respiratory rates were reported in 14% of patients in the first group *vs* 65% of patients in the second group. The introduction of the assessment sheet led to an increased measurement of initial airflow obstruction (53% of patients in the first group *vs* 96% of patients in the second group) as well as repeated measures under treatment (36% of patients in the first group *vs* 85% of patients in the second group). Repeated inhalations with short-acting inhaled beta-agonists, and use of systemic corticosteroid therapy at admission and at discharge increased significantly (from 31% to 84%, 43% to 68% and 37% to 70% respectively).

Conclusion: The assessment and management of patients presenting to the emergency department with acute asthma can be improved with a guideline based management protocol, and by educating physicians and nurses in the management of acute asthma.

Key words: asthma; management protocol; education; emergency department

Introduction

Asthma is a common disorder with major medical and economic impact [1–3]. In Switzerland the prevalence of asthma is seven percent, affecting approximately 500.000 people [4, 5]. Most of the morbidity and mortality associated with asthma result from acute exacerbations. Therefore prevention and adequate treatment of exacerbations according to guidelines is essential to improve outcome and to save costs [6].

Guidelines for optimal treatment of acute asthma are available [7–9]. However, studies evaluating the management of patients admitted to an

emergency department (ED) identified major deficiencies in the assessment and management [10–12].

At the ED of the University Hospital Zurich we evaluated the management of acute asthma between 1997 and 1998. We identified major deficiencies, including inadequate drug therapy and failure to guide therapy by objective measurement of the illness severity [13]. In response to these problems we developed and introduced an assessment sheet and a management protocol to improve acute asthma care in our ED. In this paper we report the effects of the management protocol 18 months after its introduction.

Methods

The study was performed in an urban teaching hospital with 12000 annual internal medicine ED visits. After analysing data from the first observation period (1997–1998) an assessment and management protocol was developed for the management of patients with acute asthma. The protocol consisted of an assessment sheet (appendix) and guideline recommendations according to the National Asthma Education and Prevention Programmes of the National Institute of Health and the British Thoracic Society [8, 9]. The guidelines were presented in a series of educational forums for the staff, including physicians and nurses. The project focused on the objective measurement of the illness' severity and its response to therapy. Therefore, in addition to the educational forums, a training session on Peak Expiratory Flow (PEF) meter use for nurses was included, and a PEF nomogram was copied on the back of the assessment sheet. The assessment sheet with the key points of the guideline was posted throughout the ED and a copy was added to the patient's record. To limit potential observer effects, we didn't tell the caregivers that the impact of the sheet on patient management was evaluated.

A before-after design was used with retrospective data collection for the first period and prospective data collection for the second period. The "before" group included patients admitted to the ER between January 1997 until October 1998 whose diagnosis of acute asthma was confirmed or considered most likely at discharge (104 patients). The "after" group included all registered asthma patients that visited the ER after introduction of the assessment sheet in January 2002, from February 2002 until August 2003 (273 patients).

Demographic details, medical history, physical examination results with particular attention to signs of severe asthma and high-risk symptoms were noted. In addition, measurements of respiratory function and details on treatment were extracted from the patient records. Data on objective measures of the response to therapy before discharge, as well as discharge therapy and patient instruction were collected.

Diagnosis of asthma was established by medical history, a reduced PEF or FEV_1, and an increase of PEF of >60 L/min or of FEV_1 >12% after therapy. The severity of asthma was classified according to PEF values; mild asthma (PEF >70% predicted), moderate asthma (PEF 50–70% predicted) and severe asthma (PEF <50% predicted).

Data were analysed with SPSS 12.0.1. for Windows, Apache Software Foundation, and Graph Pad Prism 4 (Graph Pad Software Inc, San Diego, CA). We assessed the associations between use of the management protocol (cohort 2002–2003) and adherence to guidelines using logistic regressions models. The dependent variable was adherence to the recommendation ("use of systemic corticosteroids") and the independent variable "use of the management protocol" (cohort 1997–98 versus cohort 2002–2003) while adjusting for potential confounding variables such as patient age (years), gender, immigration status (yes/no), self-referral (yes/no), history of prior ED visits (yes/no), symptoms >24 hours (yes/no), severity of asthma (severe/not severe) and treatment of asthma before ED visit (yes/no). We considered an interaction to be present if the P value associated with an interaction term was <0.05.

Results

In the first group (1997–1998) 11 (9.6%) of 115 patients with the primary diagnosis of asthma were excluded, nine for incorrect diagnosis and non-available data for two patients. From February 2002 until August 2003, the second phase of the study, 339 consultations with the diagnosis of acute asthma were registered. 66 patients (19.5%) had to be excluded from analysis; in 56 patients diagnosis was incorrect (COPD, heart failure) and for ten patients no data were available.

Demographic data, disease characteristics and treatment before attending the emergency department (table 1)

Most patients were self referred and showed progressive worsening of their symptoms over several days. There were no major differences in the demographic characteristics between the two groups. However, former asthma related ED visits were less frequent in the first observation period compared to the second observation period (27% *vs* 59% respectively). Considering therapy before attending the ED, 53% of the patients in the first group had no regular asthma treatment, compared to 27% in the second group (table 1).

Clinical examination, x-ray and objective measurement of airway obstruction (figure 1)

The assessment sheet provided columns for blood pressure, pulse rate, respiratory rate, oxygen saturation and PEF or FEV_1. Blood pressure and pulse rate were listed in almost all patients in both groups. Respiratory rate was documented in 14% of the patients before and in 65% of the patients

after introduction of the assessment sheet. Registration of ausculation, mentioning of wheezing, and chest x-rays showed no significant differences between the two groups. In the first period initial measurement of airway obstruction was done in 53% of patients compared to 96% in the "after" group.

Asthma was assessed as mild, moderate and severe in 39%, 41% and 20% of patients in the first group and 19%, 42% and 39% in the second group. The mean PEF averaged 63% (SD 15%) in the first observation group versus 56% (SD 19%) in the second group. Data on pulse oxymetry were available in 24% of patients in the first group *vs* 84% of patients in the second group. Arterial blood gases were obtained in 6% *vs* 16% of patients in the first and second group respectively.

Treatment (table 2)

Short-acting inhaled beta-agonists were given upon arrival in the ER to 88% of patients in the first group versus 96% in the second group using salbutamol by a wet nebulizer. Parenteral use was not reported. With the introduction of the assessment sheet more patients received repeated inhalations with short-acting inhaled beta-agonists, 31% of patients in the first group compared to 84%

Table 1

Demographic data and illness characteristics of adults with acute asthma.

Demographic factors	1997–1998 % (n = 104)	2002–2003 % (n = 273)
Female	52.9	56.4
Age (median)	33	36
Self-referral	85.6	96.0
Immigrants	40.4	37.0
Near east	14.4	4.0
India/Sri Lanka	12.5	8.1
Balkan	10.6	8.1
Others	2.9	16.8
Disease characteristics		
Known history of asthma	76.0	70.3
History of former emergency visits	26.9	58.6
History of former hospitalisation	3.9	7.3
History of former intubations	0	1.5
Symptoms >24 h	71.0	76.9
Severe asthma (PEF <50%)	20	39
Duration of illness in years (median)	n. a.	8.2
Treatment before the emergency visitx	n. a.	8.2
Any treatment	46.8	73.4
Beta-agonists only	21.5	27.1
Beta-agonists plus inhaled corticosteroids	13.9	30.2
Systemic steroids	8.9	4.2

Figure 1

Clinical assessment, chest x-ray and objective measurements of asthma severity before and after the introduction of the management protocol.
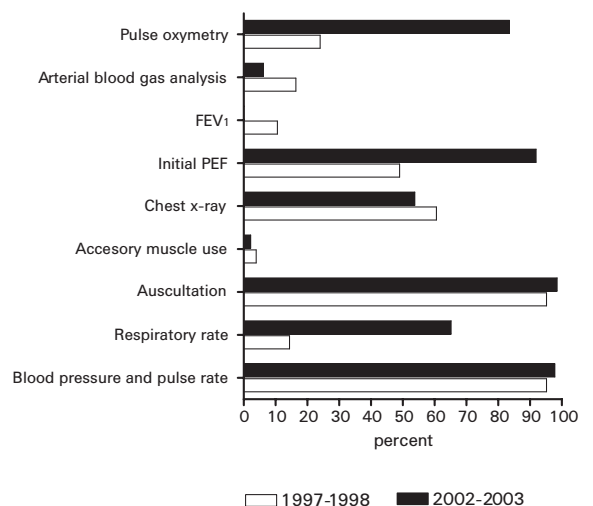

Table 2

Comparison with adherence to guideline recommendations before and after using a management protocol.

Recommendation	recommendation followed between 1997–1998 in % N = 104	recommendation followed between 2002–2003 in % N = 274	Odds of following recommendation in 2002–2003 compared to 1997–1998	
			unadjusted (95% CI)	adjusted* (95% CI)
Objective measure of obstruction at admission	53	96 (n = 266)	20.6 (10.1–42.3)	13.4 (4.2–42.8)
Short acting beta-agonist as first line therapy	88	96 (n = 264)	3.2 (1.1–9.2)	3.2 (1.4–9.2)
Titrated use of bronchodilators (repeated	31	84 (n = 266)	12.0 (7.1–20.4)	16.5 (7.7–35.6)
Systemic corticosteroids	43	68 (n = 270)	2.8 (1.8–4.5)	2.1 (1.1–3.8)
Objective Control of therapy	36	85 (n = 273)	10.0 (5.9–16.7)	13.2 (6.2–27.8)
Discharge based on PEF/FEV$_1$	6	90 (n = 264)	149.5 (59.7–374.5)	260.3 (71.0–953.9)
Systemic corticosteroids at discharge	37	70 (n = 272)	4.0 (2.5–6.5)	2.4 (1.3–4.4)
Inhaled steroids at discharge	74	92 (n = 273)	3.8 (2.1–7.0)	1.7 (0.7–4.0)
Instruction	5	14 (n = 273)	3.3 (1.3–8.6)	2.8 (0.9–9.0)

* Adjusted for age, gender, self-referral, history of prior ED visits, severity of asthma, symptoms >24 hours and treatment of asthma before ED visit.

of patients in the second group. In both groups almost all patients received a combination therapy of salbutamol and ipratropium bromide (91% *vs* 95%).

Significantly more patients received systemic corticosteroids in the second period compared to the first period (68% versus 43% of patients). Corticosteroids were given intravenously to 22% in the first group and to 29% in the second group, and orally to 19% in the first group and to 49% in the second group. The mean dosage of intravenously administered methylprednisolone was 98 mg (SD 19 mg) in the first and 94 mg (SD 12 mg) in the second group. The mean dosage of orally administered prednisone was 51 mg (SD 30 mg) and 48 mg (SD 31 mg) in the first and second group respectively.

Response to therapy (table 2)

After the introduction of the assessment sheet, repeated measurement of the response to therapy increased significantly (from 36% in the first to 85% in the second group). The PEF showed a mean increase at discharge from 56% (SD 19%) to 79% (SD 13%) in the first group and from 63% (SD 15%) to 76% (SD 21%) in the second group. Instruction in proper drug-delivery technique and providing a brief written treatment and action plan was mentioned in 5% and 14% of patients in the first and second group respectively. No significant differences were found between the two groups regarding the prescription of inhaled corticosteroids at discharge. Significantly more patients in the second group than in the first group were discharged with systemic corticosteroids (70% versus 37% respectively).

Discussion

The results of this study show that using a standardized protocol for the assessment and management of patients with acute asthma presenting to the emergency department, and instruction of physicians and nurses increase the adherence to guidelines. In the first observation period we collected information that showed the apparent deficiencies, i.e. the omission to perform objective measures of the severity of asthma, the inadequate application frequency of short-acting beta-agonists and the under-use of systemic corticosteroids. After introduction of the assessment sheet the PEF values before starting therapy were measured and documented twice as often as before. Peak-flow values to assess response to therapy objectively were measured about two times more often than before the introduction of the assessment sheet. The proportion of patients receiving repetitive beta agonist treatment within shorter time periods and the application of systemic steroid use at admission and at discharge increased significantly.

Further improvements include an increase in the documentation of respiratory rate and oxygen saturation at admission, and a fifteen time increase in using objective parameters (PEF) for deciding about discharge of the patients.

Despite an improvement in some areas, other issues like instruction and education of patients before discharge are still below optimal care. One could argue whether the ED is the adequate place for patient education. However, patients should at least be instructed at discharge by the physician or the nurse in inhalation techniques and they should receive an action plan regarding future complications [8, 9].

The hospital admission rate was eight percent higher in the second time period compared to the first time period. Possible explanations are that in the second period more patients showed signs of more severe asthma, and that due to the better objective assessment less patients with insufficient response to therapy were discharged.

In the two time periods the demographic characteristics of the sample populations were similar. However there was a noticeable increase in the ED visits for acute asthma. Possible reasons could be a higher prevalence of asthma associated with increasing air pollution [14], but also a lower barrier to visit an ED and more self-referrals, a trend also noticed in other countries [15].

Since the publication of the first NAEEP guidelines [7] several studies have demonstrated that care for asthma patients in the ED fails to meet recommendations. Deficiencies included failure to define the severity of the asthma episode and the response to therapy objectively, inappropriate bronchodilator and systemic corticosteroid use. Further, inappropriate monitoring of oxygen delivery and failure to discharge patients without clear instructions for follow up care and a review of drug delivery technique [10–12, 15].

Physician's and patient's estimates are often inaccurate and correlate poorly with lung function. It has been shown that the assessment of asthma severity and the response to therapy cannot be based on symptoms and clinical signs alone, but should include an objective measure of airway obstruction such as PEF or FEV_1 [16, 17].

One of our programme's central components was therefore to encourage the medical staff to measure PEF as an acceptable alternative to FEV_1 in all patients presenting at the ED, and to make further recordings after initial bronchodilator treatment. Based on those results subsequent decisions regarding further treatment and need for hospital admission could be made.

Our study demonstrates improvements in the assessment and care of asthma patients but was not

designed to show the reasons for the changes. We assume that the better management is the result of a combined strategy, namely dissemination of guideline recommendations through educational forums for physicians and nurses and the use of a management protocol. The use of structured forms and a brief educational programme on asthma guidelines to physicians and nursing staff, has been shown to improve the management of acute asthma [18–20].

A further factor may be the transfer of competence and responsibilities in assessment and objective control of therapy to nurses. As reported in an earlier study some areas of improvement or lack of improvement tend to be physician time dependent [15].

Our main study limitations relate to the difficulties of retrospective data collection in the first observation period. Not all data could be found in the charts. Another limitation with our protocol was that only variables specified on the sheet were documented regularly, whereas other important symptoms or features of examination and medical history that were not specified on the sheet could

have been regarded as less important and therefore might not be documented.

For the future it would be of interest to study whether such programmes improve the outcome, for example the recurrence rate to the ED and for how long the improvement lasts.

In summary, we have evaluated the use of a simple standardized assessment- and treatment protocol jointly with education of the staff. Physicians and nurses showed better compliance with guidelines resulting in an improvement in the management of patients with acute asthma in the emergency department.

Correspondence:
Dr. med. Claudia Steurer-Stey
Medical Policlinic
University Hospital Zürich
Rämistrasse 100
CH-8091 Zürich
Switzerland
E-Mail: claudia.stey@usz.ch

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Asthma assessment sheet
Patient:

PEF = Peak expiratory flow (liter / minute)

age: _____ years

hight: _____ cm

PEF predicted: _____ l/min
PEF initial: _____ l/min
PEF at discharge: _____ l/min

- ! Assess severity objectively
- ! Give oxygen when O_2 sat. is below 92%
- ! Start short-acting beta-agonist by inhalation and titrate therapy
- ! Give systemic corticosteroids
- ! Assess response to therapy objectively under treatment and before discharge

Therapy:

Inhalation: salbutamol ± ipratropiumbromide _____

Frequency: (at least 3–4 times in first hour) _____   Date: _____

systemic corticosteroids: p.o. _____ mg   Ultracorten H i.v. _____

other therapies:

time	blood pressure	pulse rate	breathing rate	temp.	PEF l/min	SpO$_2$ %	O$_2$ l	therapy / comments

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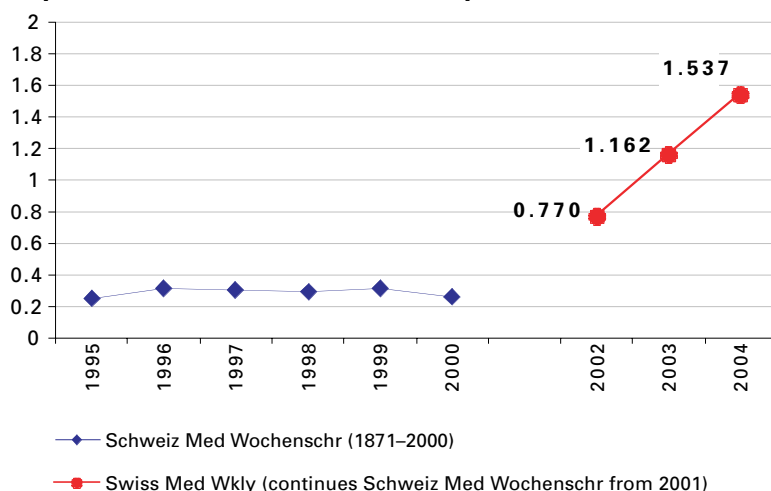- No page charges and attractive colour offprints at no extra cost

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