Inpatient Management of Status Asthmaticus*

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We examined physician management of patients hospitalized for status asthmaticus at a university hospital. A retrospective review of consecutive admissions for status asthmaticus covering a 13-month period yielded 130 charts for review. We found that practice patterns with respect to documentation of severity of illness, medications, and treatment were then collected for each day of hospital admission. We asked two specific questions:

1. Did physicians document the severity of the attack and its response to therapy using findings on physical exam and objective indices of airflow obstruction? The specific physical findings noted on chart review were wheeze, accessory muscle use, pulsum paradoxus, and diaphoresis. Objective tests reviewed were peak flows and spirometry.

2. What treatments were used? We looked at the medications patients were taking at the time they presented to the emergency department, those prescribed during hospitalization, and those prescribed at the time of discharge. We paid special attention to the use of corticosteroids (systemic and inhaled).

The method of Feinstein et al. for retrospective chart review was followed. Non-paired Student's t-testing was used to compare findings between groups.

RESULTS

The 130 admissions for status asthmaticus involved 98 patients, 17 of whom were admitted more than once during the study period; those 17 accounted for a total of 49 admissions. Seventy-four of the 98 patients were women and 24 were men. The mean age was 42.6 years (range, 19 to 67).

In 120 (92 percent) of the 130 admissions, the patient had previously been diagnosed as having asthma. In nine cases (7 percent), asthma was a new diagnosis. There was no mention of previous diagnosis in one patient. In 98 cases (75 percent), the patient had been previously hospitalized for asthma; in 13 (10 percent), there had been no prior hospitalization for asthma; and in 19 cases (15 percent), there was no mention of past hospitalization. The duration of the current attack prior to seeking medical care was noted in 98 percent of patients and not available for only three patients; mean duration was 3.9 days, with all but one patient falling into a range of hours to 14 days. One patient stated that he had symptoms for 50 days prior to presentation.

Each day of hospitalization was reviewed, with the day of presentation called day 0. On day 0, wheezing was commented on in 100 percent of cases and was present in 125 (96 percent) and absent in 5 (4 percent).

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Accessory muscle use was mentioned in 84 cases on day 0 (no mention in 46), and was present in 53 (41 percent) and absent in 31 (24 percent). Pulsus paradoxus was present in 5 cases (4 percent), absent in 29 (22 percent), and not mentioned in 96 cases (74 percent). Diaphoresis was present in 13 cases (10 percent), absent in 12 (9 percent), and not mentioned in 105 (81 percent). On the day of discharge, the only physical finding to receive comment in any chart was wheezing, which was present in 52 cases (40 percent), absent in 44 cases (34 percent), and not noted in the remaining 34 (26 percent).

Peak flow was first measured in 72 cases (55 percent) on day 0, was measured in an additional 17 cases (13 percent) after day 0, and was never measured in 41 cases. The mean peak flow on day 0 was 177 L/min, with a range of 40 to 430. In only 45 cases (35 percent) was more than one measurement of peak flow obtained during hospitalization. No patient had spirometry on day 0. Spirometry was obtained at some time during the course of hospitalization in only 28 cases (22 percent). Only one patient had sequential spirometric studies.

Medications at the time of presentation included inhaled sympathomimetics in 108 cases (83 percent), oral theophylline in 86 (66 percent), inhaled corticosteroids in 12 (9 percent), and oral corticosteroids in 20 (15 percent). One patient was using inhaled cromolyn.

Inhaled beta-agonists were given initially and during the remainder of hospitalization in 126 cases (96 percent). Systemic corticosteroids were started in 112 cases (86 percent) on day 0 and later during hospitalization in seven more cases (5 percent). In 15 cases (9 percent), steroids were not given at any time during the hospital course. Intravenous theophylline was given at time of admission in 96 cases (74 percent), and oral theophylline in an additional 16 (12 percent).

Discharge medications included inhaled beta-agonists in 115 (89 percent), oral theophylline in 105 (81 percent), oral steroids in 92 (75 percent), inhaled steroids in 17 (13 percent), and cromolyn in 5 cases (4 percent).

A follow-up plan was mentioned in the patient chart for 108 admissions (83 percent), and there was no mention of follow-up planning for the remaining 22 (17 percent).

The mean length of stay for all 130 cases was 5.47 days, with a range of 1 to 18 days (Fig 1). The mean length of stay for those patients treated with corticosteroids during admission (5.38 days) was not statistically different from that of patients who were never treated with steroids (6.0 days).

We looked briefly at the subset of cases admitted more than once during the study period (17 cases, 38 percent of admissions). Approximately one third (31 percent) of them never received peak flows or spirometric evaluation during any of their admissions.

**Discussion**

Asthma is a common disease. It affects approximately 10 million people in the United States alone. Because of its reversibility, physicians can have a major impact upon the implications of the disease.

The rising mortality from asthma has been noted since the late 1970s and has caused much dismay in the medical community. How can mortality increase when we have more knowledge, more ostensibly effective treatments, and good access to medical care? Is it a function of physician treatment, of patient compliance (not seeking medical care or not following advice), or has some genetic or environmental factor led to a more severe type of asthma than was experienced 20 years ago? We have tried to gain some insight by looking at one aspect of asthma, i.e., how patients hospitalized with a diagnosis of status asthmaticus are being treated.

We would suggest that appropriate care for patients hospitalized with status asthmaticus (and most diseases) consists of the following steps:

- **Step 1** Accurate assessment of severity of illness.
- **Step 2** Use of appropriate therapy during admission and discharge with an appropriate regimen.
- **Step 3** Documentation of efficacy of therapy.

We would like to review each of these steps with respect to our population.

**Step 1**

The severity of illness in asthma is primarily a product of the severity of airflow obstruction. Although

**Duration of Hospitalization**

![Figure 1. Duration of hospitalization for patients in the study group.](http://journal.publications.chestnet.org/pdffile.ashx?url=/data/journals/chest/21658/)

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wheezing denotes airflow obstruction, wheeze is probably the least reliable indicator of severity of attack; the presence of wheeze cannot be used to accurately assess degree of airflow obstruction,19 and the absence of wheeze does not rule out significant airflow obstruction.20 On the other hand, accessory muscle use, pulsat paradoxicus, diaphoresis, and the inability to lie flat, when present in an asthmatic, all appear to correlate with severe airflow obstruction (FEV₁ < 40 percent of predicted).21-25 The two direct measurements of airway function most often used to assess the severity of airflow obstruction in asthma are measurement of peak flow and spirometry. Both more effectively assess the severity of an attack than the clinical findings noted above.5,10,20,29-34 Peak flow can be measured quickly and inexpensively and has been shown to be an effective clinical tool. Spirometry is more difficult to obtain, but it is the gold standard for measurement of airflow obstruction; when the two are compared directly, peak flows have been shown to have more intertrial variability than spirometry, and often to underestimate the degree of airflow obstruction documented by spirometry.35,36

When we look at our study population, we conclude that the objective documentations of the severity of asthma attacks at the time of admission were poor. The only physical finding to be documented routinely was wheezing. When we look at objective airflow measurements, the peak flow was measured upon presentation in only 55 percent of patients. No patient had documentation with spirometry on day 0.

Step 2

Some principles of treatment of asthma are well-documented. First, systemic steroids are extremely effective in the treatment of status asthmaticus. When used early enough, they can help to prevent hospital admissions for asthma, and they are a mainstay of inpatient treatment of status asthmatics. (Their efficacy has been known for years, and the more recent literature deals with timing, dosage, and route of admission.12,14,27,30) Second, inhaled steroids can decrease airway hyperresponsiveness, and when used over an extended period, can have a major effect upon severity of symptoms.29,30

The contributions of theophylline to the treatment of asthma has been controversial, with most analysis and meta-analysis suggesting that they are of limited benefit if beta-agonists are being used with maximal efficacy.21,28 There are, however, theoretic reasons why theophylline should add to efficacy of treatment,29 and some recent data support their use in acute asthma.25

When we look at the study population, we find that treatment patterns appear to fall short of the current state of knowledge. First, systemic steroids were underused in our population. Only 15 percent of patients with diagnosis of status asthmaticus severe enough for admission were receiving systemic steroids at the time of admission. Steroids were not given at the time of admission in 15 percent of patients and were never used for 9 percent of admissions. The patients who never received steroids had a mean length of stay of 6.25 days, and thus, did not appear to represent a group of patients with such minimal disease that steroid therapy was not warranted. We note that theophyllines continue to play a major role in physicians’ approach to status asthmaticus despite their uncertain efficacy. In contrast, inhaled steroids were used infrequently and, we believe, suboptimally, especially in outpatient regimens. Inhaled steroids were part of the prehospital regimen in only 9 percent of cases despite the fact that in 75 percent of cases, there was a history of previous admission for status asthmaticus. Inhaled corticosteroids were prescribed at discharge only 13 percent of the time, a minimal increase over prediagnosis usage. It is true that many patients were receiving oral corticosteroids at the time of discharge, but we would posit that inhaled steroids should have been part of the maintenance regimen of the vast majority of the patients and that teaching and institution of inhaled steroid therapy should have occurred during admission.

Step 3

Documentation of the efficacy of therapy is an appropriate adjunct to any intervention. The clinical assessment by the physician is often less accurate than the subjective report by the patient,34 but even these subjective reports can be misleading; some patients can be asymptomatic when the FEV₁ is less than 50 percent of predicted.5,10,20,29 The use of peak flow rate or spirometry or both will identify the patient with residual airflow obstruction and give grounds for individualization of discharge therapy; the patient with residual obstruction is a candidate for continued systemic steroids, whereas the patient with normal function on discharge can often be managed with a regimen including only inhaled corticosteroids.6,30

When we look at our study population, we find that documentation of efficacy of therapy was minimal. Only 35 percent of cases had peak flows measured more than once over the course of hospitalization to objectively document the effect of therapy. When we look at patients who had initial peak flows on day 0 against which subsequent flows could be gauged, the figure drops to 26 percent. When we look at spirometry, only 22 percent of patients had spirometric testing and only one had sequential spirometric studies to document response to therapy. As mentioned, the patient's subjective reports and the presence or absence of wheezing appear to have been the only consistently reported “measures” of airflow obstruc-
tion at the time of discharge. Even so, wheezing was present in 44 cases (34 percent) at the time of discharge, a surprisingly high number if physical exam was to be the criterion for presence or absence of airflow obstruction.

When the subset of our patients with more than one admission during the study interval was examined separately, we found that 31 percent of them never received peak flows or spirometry during any of their admissions. This high risk group, therefore, seemed to receive no more attention than did the average case.

Our study suggests that the current management of patients hospitalized with asthma does not reflect the current state of knowledge about optimal approach to the disease. Severity of illness and response to therapy were underevaluated, and the use of steroid therapy both in inpatients and at the time of discharge seemed to fall short of optimal usage as defined in the literature.25,26

These data complement data available from another recent study of patients hospitalized for asthma.26 In a study of variations in interhospital approach to asthma, Daley et al26 demonstrated significant variations in approach between hospitals but a uniform lack of consistency in obtaining objective documentation of degree of airflow obstruction. Their data were reported differently, but systemic corticosteroids appear not to have been used in a significant subset of their patients, as was the case with ours. They did not comment upon discharge medications.

We have gathered some data to suggest that predmission treatment and postdischarge management were suboptimal, but the focus of our study was the actual time spent in the hospital. The striking finding in our study is that for that period over which physicians have almost complete control, the time of hospitalization, practice patterns appear to have fallen short of the current state of knowledge. Dyspnea is the presenting symptom and wheezing a frequent finding in patients admitted with status asthmaticus, but the airflow obstruction is the principal pathophysiologic abnormality. We feel that optimal management of status asthmaticus should include documentation of degree of airflow obstruction, the early use of systemic steroids, and documentation of reversal of airflow obstruction. Inhaled corticosteroids are then indicated to help maintain airway patency and to help prevent future deterioration. Our final message appears to need continual reinforcement:17-20 physicians are the conduits of care, and better physician education needs to be a cornerstone of our effort to stem the morbidity and mortality of this eminently treatable disease.

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