ORIGINAL RESEARCH

The Frequency of Re-evaluation or Peak Flow Meter Documentation in Acute Asthma Exacerbations in the Emergency Department: Are We Treating in Accordance with NIH/NAEPP Guidelines?

Danner Hodgson, MD
Scott E. Rudkin, MD, MBA, RDMS
Jennifer A. Oman, MD
Jason Fisher, MD

Department of Emergency Medicine
University of California, Irvine Medical Center

Correspondence:
Scott E. Rudkin, MD, MBA, RDMS
Dept. of Emergency Medicine, UCIMC
101 The City Drive, Route 128
Orange, CA 92868
(714) 456-5239; Fax (714) 456-5390
srudkin@uci.edu

ABSTRACT

Objectives: To evaluate the frequency of peak expiratory flow rate (PEFR) measurement and clinical re-evaluation in the management of ED asthmatic patients. Methods: This was a retrospective chart review examining consecutive asthma patients who presented to the University of California Irvine ED between September 1, 2003 and December 31, 2003. Patients were excluded if they had a diagnosis of COPD, lung cancer, pneumonia, congestive heart failure, alpha 1 anti-trypsin deficiency or were under 5 years of age. Data collected included patient demographics, pulse oximetry reading(s), ED treatments rendered, and frequencies of PEFR measurement (pre and post therapy), of clinical re-evaluations in the ED, and of ED return visits. Results: Of the 122 ED visits from 111 patients, 11 (10%) patients returned during the 4 month study period, with 5 patients (4.5%) returning in less than 72 hours. Seven (6.0%) patients had PEFR done both pre and post treatment and 24 (20%) had one or more PEFR performed either before or after treatment. Only 61 (50%) of the visits had a documented clinical re-evaluation prior to disposition. Conclusions: Despite their documented role in asthma treatment algorithms, PEFR was performed infrequently and clinical re-evaluation was documented in only half of cases. Recommended algorithms for asthma management were not commonly followed in this academic ED.

INTRODUCTION

Asthma exacerbation is a common chronic illness and frequent reason for presentation to the Emergency Department (ED). In 2001 the National Health Interview Survey found that 31.3 million respondents were at one time given a diagnosis of asthma while 12 million respondents had suffered an asthma attack in the previous year.[1-2] The same survey showed 1.8 million visits to the ED in 2000, with a total of 4,487 asthma related deaths over the same 1 year period.[1] To aid in asthma management, a series of algorithms were created using pulmonary function testing as a diagnostic adjunct to determine treatment course, patient disposition, and outcome prediction.[3-6] The National Asthma Education and Prevention Program (NAEPP) Expert Panel Report 2 proposed one such algorithm which recommends use of objective values of pulmonary function—peak expiratory flow rate (PEFR) or forced expiratory volume in one second (FEV_1).

The importance of objectively measuring the degree of airway obstruction during an acute asthma attack is a recurring theme in the asthma literature. It has been shown that patients' subjective evaluation of asthma severity and provider physical assessment of the degree of airway obstruction are suboptimal in determining actual impairment.[7-10] Although FEV_1 is more sensitive for judging asthma severity, PEFR is more readily available in many ED settings and correlates well with spirometry.[11-13] While the data supporting the use of pulmonary function testing in the ED is well established, emergency physicians (EP) often make decisions regarding disposition and treatment based solely on subjective complaint, repeat

physical examination, or pulse oximetry.

Peak flow values are expressed as a percentage based on the patients sex, height, and age. Patients may know their prior best value which can serve as a new baseline comparison for calculating a percentage of best prior PEFR. A limiting factor in PEFR is patient effort. It has been shown that children old enough to follow directions should be able to comply.

Although survey studies have been undertaken to assess NAEPP adherence, there is no prior study evaluating the frequency of PEFR testing in an ED setting.[14-16] Our goal is to evaluate how frequently PEFR, repeat physical examination, subjective complaint, and pulse oximetry are used to estimate the degree of obstruction during an asthma exacerbation.

METHODS

We conducted a retrospective chart review on consecutive asthma patients (based on ICD-9 codes) presenting to the University of California Irvine ED from September 1, 2003 until December 31, 2003. This study was classified as Institutional Review Board exempt status. All patients under the age of 5 years were arbitrarily excluded from the study due to potential inability to accurately perform PEFR. If the patient had an alternative diagnosis such as COPD, lung cancer, pneumonia, congestive heart failure, alpha 1 antitrypsin deficiency, the chart was excluded. Once identified, the charts were reviewed by a single non-blinded reviewer. The patient's sex, age, frequency of repeat evaluations, PEFR pre and post treatment, repeat pulse oximetry, and repeat visit rates were recorded. Ages were reported as means ± standard deviations. All other statistics were descriptive.

RESULTS

We collected data from 122 consecutive visits for asthma from 111 patients. There were relatively equal numbers of males and females and the mean age was 27.8 ± 16.4 years. Eleven (10%) patients returned during this 4 month period, with five (4.5%) returning in less than 72 hours. See Table 1.

	Number	Percentage
Number of return patients	11	10%
Number returning < 72 hours	5	4.5%
Males	57	51.4%
Females	54	48.6%
Mean age in years	27.8 ± 16.4	

Table 1. Demographics (n=111 patients).

	Number	Percentage
Number re-evaluations or PEFR pre or post treatment	73	60%
Number of re-evaluations	61	50%
Number of PEFR pre or post treatment	24	20%
Number of PEFR pre and post treatment	7	6%
Number repeat Sp O_2 documentation documented	60	50%

PEFR=Peak Expiratory Flow Rate, SpO_2=Pulse Oximetry

Table 2. Frequencies of PEFR or re-evaluation (n = 122).

	Number	Percentage
Drug	Visits treated	% Treated
Albuterol	122	100%
Ipratropium	99	81%
Steroids	87	71%
Epinephrine	1	0.8%
Montelukast	1	0.8%
Terbutaline	1	0.8%

Table 3. Treatments rendered.

Only 7 (6%) patients had a documented PEFR both pre and post treatment as proposed by the algorithms. Only 24 (20%) had either a PEFR done prior to treatment or subsequent to treatment. Overall, 61 (50%) of he visits had a documented re-evaluation which was either subjective per the patient, or based on physician physical examination. See Table 2.

All patients received albuterol, 81% of patients received ipratropium, and 71% were given corticosteroids. One patient each was treated with montelukast, epinephrine, and terbutaline respectively. See Table 3.

None of the return visit patients had documented pre and post treatment PEFR as suggested by various algorithms. Only two of five patients had a single peak flow done in the ED. Of the 5 who returned to the ED in less than 72 hours, only 1 received steroids in the ED. Two did not receive a prescription for steroids,

	Number	Percentage
Re-exam or PEFR	3/5	60%
Re-evaluation alone	2/5	40%
PEFR pre and post treatment	0/5	0
PEFR pre or post treatment	1/5	20%
No steroids given in ED	4/5	80%
No steroid prescription given in ED	2/3	67%
Prescription not filled	2/3	67%
Prescription filled	1/3	33%

PEFR=Peak Expiratory Flow Rate

Table 4. Treatments rendered to patients returning in less than 72 hours.

and two of the three patients who received a prescription lost it in less than 24 hours. See Table 4.

DISCUSSION

To our knowledge, there are no studies to date evaluating the frequency of re-evaluation or PEFR in the ED management of acute asthma exacerbation. Despite the prominent role of pulmonary function tests in various algorithms such as the NAEPP, in our academic ED these recommendations from algorithms were rarely followed. In our study, pre and post treatment PEFR was recorded in only 6.0% of cases. Additionally, PEFR was documented either pre or post treatment in only 20% of cases. It has been shown that subjective improvement and physical examination are unreliable predictors of asthma severity.[7-10] Nevertheless, in our ED repeat physical examination was routinely used as the sole gauge of asthma severity. In 40% of the cases there was no documented repeat PEFR or repeat physical exam. Although this 40% may represent a group with less severe asthma, a failure to adhere to NAEPP guidelines could be interpreted as not meeting the standard of ED care should a poor outcome occur.[17]

Of the patients returning to the ED within 72 hours of initial presentation, 4/5 (80%) had not received steroids during the initial visit, and 2/5 (40%) had not received a prescription for steroids. Previous studies have shown relapse rates of greater than 25% when patients were not treated with steroids.[18] NAEPP guidelines currently recommend a short course of steroids for patients being discharged from the ED.[4] Additionally, the literature supports early administration of steroids to prevent both relapses and hospitalizations.[19-22] Despite the NAEPP guidelines and numerous studies showing the efficacy of steroids, these guidelines were infrequently followed, offering another area of potential for ED care improvement.

LIMITATIONS

Because the study was a retrospective chart review, it was difficult to determine whether those cases lacking documentation had in fact been the cases in which re-evaluation and PEFR had not occurred. However, it is the authors' observations that the majority of the cases lacking documentation had in fact not undergone re-evaluation or PEFR. Additionally, the results apply, whether the issue is adherence to accepted asthma treatment algorithms or inappropriate documentation of tests performed.

Another potential for error lies in the manner in which the charts were retrieved and in which the data was extracted. We analyzed data from charts under the ICD-9 code for asthma exacerbation and subsequent treatment. Subsets of patients may have been missed due to simple miscoding errors made any time before the charts were stored.

Due to our small sample size (122 patients), the re-visit rate of 11 patients was small and the re-visit rate under 72 hours (5 patients) was even smaller. It is pre-mature to draw many conclusions from this subset of the population until larger populations can be evaluated despite our similar rate of return-visit when compared with other studies.[23-25]

Our study was also limited by the occasional difficulty of obtaining a pre treatment PEFR. Nurses sometimes initiated albuterol and ipratropium in the triage setting making it impossible to obtain the pre treatment values. This could potentially be improved by adopting a nursing asthma protocol in triage. Additionally, patients presenting in extremis are unlikely to undergo pre-therapy PEFR and represent another subset of the asthma population in which this adjunct is difficult to evaluate.

CONCLUSIONS

Despite numerous treatment algorithms and asthma scores based on objective measures of pulmonary function in acute asthma, in an academic ED setting these algorithms were rarely followed. Over-reliance on both physical exam and pulse oximetry, while under-utilizing the objective measures such as PEFR is counter to various asthma treatment guidelines such as the NAEPP EPR-2. Attempts should be made to increase the frequency of PEFR/FEV_1 use as dictated by the current standards of care in EM. Additionally, early administration of steroids is a cornerstone of asthma therapy and should be considered more frequently in the ED to prevent relapse.

REFERENCES

1. CDC. *Asthma Prevalence, Health Care Use and Mortality, NHIS*. 2001-2002, U.S. Department of Health and Human Services.

2. Mannino DM, H.D., Akinbami, LJ, et al. Surveillance for Asthma—United States. Mor*bidity and Mortality Weekly Report* 2002;**51**(SS01):1-13.

3. Phanareth, K., et al. A proposal for a practical treatment guideline designed for the initial two-hours of the management of patients with acute severe asthma and COPD using the principles of evidence-based medicine. ***http://www.phanareth.dk/Guidelines/guidelines.htm***. *Respir Med* 2002;**96**(9):659-71.

4. (NAEPP)., N.A.E.P.P. Expert Panel Report 2:Guidelines for the diagnosis and management of asthma. *National Institutes of Health Publication* 1997.

5. Report, N.W.W. Global strategy for asthma management and prevention, in Report available ***http://www.ginasthma.com***. revised 2002.

6. Rodrigo G, R.C. A new index for early prediction of hospitalization in patients with acute asthma. *American Journal of Emergency Medicine* 1997;**15**(1):8-13.

7. Shim CS, W.M. Evaluation of the severity of Asthma:Patients vs. Physicians. *The american Journal of Medicine* 1980;**93**:11-13.

8. Emerman, C.L., T.W. Lukens, and D. Effron. Physician estimation of FEV_1 in acute exacerbation of COPD. *Chest* 1994;**105**(6):1709-12.

9. Emerman, C.L. and R.K. Cydulka. Effect of pulmonary function testing on the management of acute asthma. *Arch Intern Med* 1995;**155**(20):2225-8.

10. Liam, C.K., et al. Relationship between symptoms and objective measures of airway obstruction in asthmatic patients. *Asian Pac J Allergy Immunol* 2001;**19**(2):79-83.

11. Hansen, E.F., et al. Peak flow as predictor of overall mortality in asthma and chronic obstructive pulmonary disease. *Am J Respir Crit Care Med* 2001;**163**(3 Pt 1):690-3.

12. Nowak, R.M., et al. Comparison of peak expiratory flow and FEV_1 admission criteria for acute bronchial asthma. *Ann Emerg Med* 1982;**11**(2):64-9.

13. Adams, B.K. and R.K. Cydulka. Asthma evaluation and management. *Emerg Med Clin North Am* 2003;**21**(2):315-30.

14. Grunfeld, A., et al. Management of acute asthma in Canada: an assessment of emergency physician behaviour. *J Emerg Med* 1997;**15**(4):547-56.

15. Emerman, C.L., R.K. Cydulka, and E. Skobeloff. Survey of asthma practice among emergency physicians. *Chest* 1996;**109**(3):708-12.

16. Mahabee-Gittens, E.M., et al. Are pediatric ED physicians blowing off peak expiratory flows? *Am J Emerg Med* 2000;**18**(3):352-3.

17. *District of Columbia v. Wilson*, in *Atlantic 2d*. 1998, District of Columbia Court of Appeals. p. 591.

18. Kelsen, S.G., et al. Emergency room assessment and treatment of patients with acute asthma. Adequacy of the conventional approach. *Am J Med* 1978;**64**(4):622-8.

19. McNamara, R.M. and J.M. Rubin. Intramuscular methylprednisolone acetate for the prevention of relapse in acute asthma. *Ann Emerg Med* 1993;**22**(12):1829-35.

20. Rowe, B.H., et al. Corticosteroids for preventing relapse following acute exacerbations of asthma. *Cochrane Database Syst Rev* 2001;(1):CD000195.

21. Chapman, K.R., et al. Effect of a short course of prednisone in the prevention of early relapse after the emergency room treatment of acute asthma. *N Engl J Med* 1991;**324**(12):788-94.

22. Littenberg, B. and E.H. Gluck. A controlled trial of methylprednisolone in the emergency treatment of acute asthma. *N Engl J Med* 1986;**314**(3):150-2.

23. Emerman, C.L. Relapse following treatment of acute asthma in the emergency department. *J Asthma* 2000;**37**(8):701-8.

24. Camargo, C. Management of acute asthma in US emergency departments: The Multicenter Asthma Research Collaboration. *American Journal of Respiratory & Critical Care Medicine* 1998:**157**.

25. Rowe, B.H., et al. Early emergency department treatment of acute asthma with systemic corticosteroids. *Cochrane Database Syst Rev* 2004(2).