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Abstract

Asthma is the most common chronic condition affecting children and a prominent chief complaint in pediatric emergency departments (ED). We aimed to determine parental preference between short- and long-term courses of oral corticosteroids for use in children with mild to moderate asthma presenting to our pediatric ED with acute asthma exacerbations. We surveyed parents of asthmatic children who presented to our pediatric ED from August 2011 to April 2012. Questions characterized each patient's asthma severity, assessed parental preference among systemic steroid and inhaled medication delivery options for acute asthma management, and inquired about compliance, medication costs, and intention to follow up. The majority of our parents prefer the use of 1 to 2 days of steroids to 5 days for acute asthma exacerbations in the ED. Thus, dexamethasone is an attractive alternative to prednisone/prednisolone and should be considered in the management of acute asthma exacerbations in the ED.

Keywords

asthma, steroids, dexamethasone, prednisone, parental preference

Introduction

Asthma is the most common chronic condition affecting children. It affects more than 10% of American children and is a prevalent chief complaint in pediatric emergency departments (EDs).¹ The National Heart, Lung, and Blood Institute's 2007 Guidelines for the management of acute asthma exacerbations recommend the use of systemic steroids for those patients who fail to respond promptly or completely to short-acting β -agonist therapy.² Systemic steroids have been shown to reduce airway inflammation, decrease rates of hospitalization, and decrease the number of repeat visits to the ED.³⁻⁶ A 5-day burst of oral prednisone/prednisolone is the most commonly prescribed systemic steroid regimen.^{4-5,7} However, several recent studies have shown that a 2-day course of dexamethasone has efficacy comparable to a 5-day course of prednisone/prednisolone for acute asthma management.^{3,6,8,9}

Because of the prolonged course of therapy and potential unpleasant side effects, compliance with oral systemic steroids after ED discharge is often a challenge

for patients and families, particularly in the pediatric population.¹⁰ Dexamethasone is an attractive alternative to prednisone/prednisolone because it has a significantly longer half-life, thus requiring fewer doses to achieve similar results. Previous studies have examined both 1- and 2-dose regimens of dexamethasone and compared them to a 5-day course of prednisone/prednisolone, and these have shown similar efficacy with regard to symptom resolution, relapse rate to the ED, and hospitalization rates.^{6,8,9,11} In a recent decision-tree cost-effectiveness analysis conducted by our group, use of 2 days of oral dexamethasone yielded a predicted cost savings of \$3500 to \$7000 per 100 patients as compared with

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5 days of oral prednisone/prednisolone in the ED management of pediatric acute asthma exacerbations.¹²

The purpose of this study was to determine if parents of asthmatic children, aged 1 to 17 years, with previous use of systemic steroids for an asthma exacerbation, have a preference between short and long courses of oral corticosteroids for the management of acute asthma exacerbations in the ED. Because of decreased dosing frequency with comparable efficacy, we hypothesized that parents would prefer a short course of oral steroids, such as a 1- or 2-day course of dexamethasone, to a long course of steroids, such as a 5-day course of prednisone/prednisolone, particularly in milder cases of asthma with fewer ED visits and hospitalizations. If we are able to show that parents prefer a short course of steroids, we will have eliminated 1 possible barrier to physicians prescribing dexamethasone in mild to moderate asthma exacerbations in the ED.

Materials and Methods

This is a survey study with 12 questions. There were 4 “yes/no” questions, 7 multiple choice questions, and 1 open-ended question (see Figure 1 for full survey questions). In general, survey questions aimed to characterize each patient’s asthma severity, assess parental preference in systemic steroid dosing options (ie, 1-2 days vs 5 days), determine parental preference among inhaled medication delivery options, and evaluate controller compliance and medication costs.

To our knowledge, there were no previously developed validated instruments; thus, our survey questions were developed by the authors specifically for this study and have not been validated in previous studies. The survey development process included focus groups with local pediatric emergency medicine faculty and pediatric residents, followed by cognitive laboratory interviews conducted by the investigating team. The survey was then pilot tested among the pediatric emergency medicine division at our institution followed by a joint debriefing. The final version of the survey reflects feedback from the piloting sessions.

To maintain a simplistic vocabulary for parental comprehension, the specific drug names for steroids were not used in our questions. Instead, a brief description of both dexamethasone and prednisone/prednisolone was provided in substitute for the specific drug names, and the emphasis was on preferred duration of course of therapy (Figure 1). Surveys were conducted after medical care was initiated; therefore, study results did not affect management in the ED.

The surveys were administered to parents of previously diagnosed asthmatic children who presented to our urban pediatric ED (annual census of approximately

20 000) with an acute asthma exacerbation from August 2011 to April 2012. The surveys were conducted if the patient was between the ages of 1 and 17 years and had previously received systemic steroids for an asthma exacerbation. All surveys were verbally administered in person by a study team member.

We calculated response frequencies for all survey questions and used χ^2 tests to determine if there was any association between survey responses and our primary outcome variable—namely, steroid preference. Additionally, in our secondary analysis, we used χ^2 tests to determine if there was an association between survey responses and preferred inhaled medication delivery method. All analyses were performed using SAS 9.3 (SAS Institute, Cary, NC).

The survey was reviewed and approved by the Medical University of South Carolina’s institutional review board, and parents had the right to refuse participation in our study.

Results

A total of 100 surveys were completed in the Medical University of South Carolina’s Pediatric ED from August 2011 to April 2012. The mean age of patients at presentation was 6.52 ± 4.3 years, with a median age of 5 years; 58% were aged 1 to 6 years, 26% were aged 7 to 11 years, and 16% were aged 12 to 17 years. Bivariate analysis revealed no statistically significant association between age of the child and parental preference for duration of systemic steroid use during the child’s next asthma exacerbation ($P = .22$).

Nearly half (49%) of our patients had 1 or fewer ED visits for an acute asthma exacerbation in the past 12 months, and 59% of our patients had never been admitted to the hospital for their asthma. However, 12% of our patients had at least 1 pediatric intensive care unit stay in their lifetime for an asthma exacerbation. Bivariate analysis revealed no statistically significant association between hospital admission and parental preference for duration of systemic steroid use during the child’s next asthma exacerbation ($P = .43$).

Approximately half of our patients have a daily controller medication (51%) for their asthma. Of those patients with a controller, 48% of parents said that their child never missed 1 dose in a given week, whereas 38% missed 1 dose a week, and 14% missed more than 1 dose a week. Bivariate analysis revealed no statistically significant association between missed controller doses per week and parental preference for duration of systemic steroid use during the child’s next asthma exacerbation ($P = .27$).

When asked about their preference of a systemic steroid, 95% of parents surveyed were interested in trying a short course of oral corticosteroids for a further asthma exacerbation. However, when asked which duration of

1. How old is your child? ____
2. Not counting this time, how many times in the last 12 months has your child visited any Emergency Room for an asthma attack?
 - a. None
 - b. One
 - c. 2-5
 - d. 6-10
 - e. More than 10
3. How many times EVER has your child been admitted overnight to the hospital for his/her asthma?
 - a. None
 - b. One
 - c. 2-5
 - d. 6-10
 - e. More than 10
4. How many times EVER has your child been admitted to the ICU for his/her asthma?
 - a. None
 - b. One
 - c. Two
 - d. 3 or more
5. We usually give steroids to take by mouth for 5 days during an asthma attack. If we could give 1-2 doses of a different kind of steroid in the Emergency Room that worked as well as the 5 day steroids, would you be interested in trying it?
 - a. Yes
 - b. No
6. Does your child have a daily medicine for his/her asthma?
 - a. Yes
 - b. No
7. It is often hard to remember to take medicines every day, how often does he/she miss a dose in a given week?
 - a. Never misses a dose
 - b. Misses 1-2 doses
 - c. Misses >2 doses
8. We often treat asthma attacks with a medicine called albuterol. This medicine comes in a pump/hand inhaler form, as well as by a nebulizer machine with a mask. Do you prefer to administer this medicine by handheld pump or machine?
 - a. Pump
 - b. Nebulizer Machine
 - c. Doesn't Matter
9. Do you have to pay for your child's prescription medications?
 - a. Yes
 - b. No
10. How much do you typically have to pay for each medicine?
 - a. \$10 or less
 - b. \$11-20
 - c. More than \$20
 - d. Unsure
11. Next time your child has an asthma attack would you prefer for him/her to get the 1-2 day steroids or the 5-day Steroids?
 - a. 1-2 day steroids
 - b. 5-day steroids
12. Do you plan on following-up with your child's regular asthma doctor after this Emergency Room visit?
 - a. Yes
 - b. No

Figure 1. MUSC pediatric ED asthma parental preference survey

Abbreviations: MUSC, Medical University of South Carolina; ED, emergency department.

steroid course they would prefer their child get for their next asthma exacerbation, 88% preferred 1 to 2 doses to a 5-day regimen. With a subtle difference in wording, this question was repeated to measure internal consistency of responses.

Parents were also asked if they have a preference in method of albuterol administration to their child during an acute asthma exacerbation; 51% of our parents favored administration by metered dose inhaler, 38% by nebulizer, and 17% had no preference in administration method. Bivariate analysis revealed no statistically significant association between parental preference for method of albuterol administration and parental preference for duration of systemic steroid use during the child's next asthma exacerbation ($P = .84$).

Our survey revealed that 30% of our patients' parents pay for their child's asthma medications, with approximately 47% of those parents paying more than \$20 per medication. Whether or not parents pay for their child's asthma medications and the cost of each medication were also not statistically significant in bivariate analyses ($P = .27$ and $.38$, respectively). Finally, 100% of our

parents reported that they planned to follow up with their child's pediatrician following their ED visit.

We found no statistically significant association between any of the survey responses and preference for a particular method of albuterol administration.

Discussion

Our results demonstrate that the majority of our parents prefer the use of 1 to 2 days of an oral corticosteroid to a 5-day course for the management of acute asthma exacerbations in the ED for their child. Approximately 95% of parents surveyed were interested in trying the short course rather than a long course at a future visit. If parental preference is incorporated into the decision of which systemic steroid to use for the management of acute asthma exacerbations, ED prescribers should not be hesitant to prescribe oral dexamethasone.

Several studies have examined the efficacy of 1- and 2-dose dexamethasone regimens as compared with longer courses of prednisone/prednisolone. In 2000, Gries et al¹¹ showed that a single intramuscular (IM) injection of

dexamethasone acetate was as effective in lowering the clinical asthma score in children as a 5-day course of oral prednisone. Shortly afterward, Qureshi et al⁶ also demonstrated that 2 days of dexamethasone was equivalent to 5 days of prednisone with respect to ED relapse rates and symptom presence 10 days after treatment in children. In 2006, Altamimi et al³ compared a single dose of oral dexamethasone to a 5-day course of prednisone and revealed similarity between the groups with respect to days needed to return to baseline, albeit not statistically significant. Also, in a pediatric population, Greenberg et al¹³ found no difference in 10-day relapse rates between randomized groups receiving either 2 doses of dexamethasone or 5 doses of prednisone. Most recently, Kravitz et al⁹ published a randomized controlled trial of adults with asthma that showed similar efficacy between a 2-day course of dexamethasone and a 5-day course of prednisone with regard to the number of days required to return to normal activity.

Hendeles⁷ reviewed the available systemic steroids for use in acute asthma in children and concluded that the most important factor to consider when selecting a systemic steroid in children is whether the child will be able to swallow and retain the doses of medication. In the aforementioned efficacy study by Gries et al,¹¹ 17% of the children who received prednisone refused more than 75% of their prednisone doses, and another 24% missed 30% to 50% of the doses despite their parents' best efforts. Additionally, 70% of parents in the dexamethasone and prednisone groups preferred to give IM dexamethasone to treat their child's next asthma exacerbation. Similarly, Isa et al¹⁴ evaluated parental preference for 3 prednisolone preparations based on route of administration, taste, and volume required. After tasting 2 prednisolone suspensions, nearly half of the parents preferred IM administration of prednisolone to the oral syrups. Parents initially preferred the smaller amount of oral medication, but after tasting the syrups, they preferred the better tasting one despite volume size.

Our group recently conducted a decision-tree cost-effectiveness analysis to compare oral dexamethasone and oral prednisone/prednisolone in the ED management of pediatric acute asthma exacerbations. Using estimates from published studies for rates of prescription filling, compliance, and steroid efficacy, the predicted total cost savings per 100 patients for the dexamethasone compared with the prednisone arm was \$3500 or \$7000 depending on whether the second dose of dexamethasone was prescribed or dispensed in the ED.¹²

Despite the comparable efficacy, improved compliance as a result of less frequent dosing, and potential for cost savings, the use of dexamethasone in acute asthma exacerbations in the ED continues to be

low. To our knowledge, the barriers to prescribing dexamethasone in the ED have yet to be elucidated. We speculate that physicians may be unfamiliar with dexamethasone's comparable efficacy and thus hesitant to prescribe it.

Limitations to our study include the lack of a previously validated survey to assess parental preference, the small population size that was surveyed, and failure to directly assess the reason for a parent's preference in steroid choice. In order to not disrupt workflow in our ED, the surveys were designed to be brief. As a result, the breadth of our results is somewhat limited. Surveys were only administered by study team members who had variable schedules in the ED, contributing to the small population size. A larger sample size and more normal distribution of ages may have elucidated more characteristics that contributed to parental preference in systemic steroid choice. Additionally, because of the variability in patient age, we were unable to acquire patient input and evaluate the impact of taste on steroid preference. Furthermore, the survey questions were developed specifically for this study; therefore, they were not validated, and reliability was not tested. The internal consistency of the survey was satisfactory based on answers to questions 5 and 11 having similar response rates of 95% and 88%, respectively.

Conclusions

The majority of our parents prefer the use of 1 to 2 days of oral steroids to a 5-day course of steroids for the management of acute asthma exacerbations in the ED for their child. We believe that this relates to the less cumbersome dosing regimen and improved compliance. Given the comparable efficacy, potential for cost savings, and parental preference for a shorter course of steroids, we believe that dexamethasone is an attractive alternative to oral prednisone/prednisolone, and there should be fewer barriers for its use in the management of acute asthma exacerbations in the ED. Additionally, ED physicians should consider asking parents about their preference regarding the systemic steroid to be used in their child's treatment plan in order to best improve compliance.

Declaration of Conflicting Interests

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